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Development of a Supportive Tool for Participatory Learning Space Design

Fatema Qaed

PhD

2015

Development of a Supportive Tool for Participatory Learning Space Design

Fatema Qaed

A thesis submitted in partial fulfilment of
the requirements of the Northumbria
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ABSTRACT

All learning occurs within a space, whether this space is physical or virtual, but we have limited knowledge of how learning and teaching relate to it, particularly after a learning space's users engage and adapt with it. A learning space is seen as a third teacher, but there is limited guidance for teachers on how to adapt designed elements of learning spaces. Therefore, this research aimed to empower teachers' use of learning space without directly involving designers. It did so by sharing redesign opportunities for learning spaces that facilitate learning and teaching. There were three phases to this research: 1) *Contextual review* using literature review and observation; 2) *Understanding learning space use and potential* by investigating classroom space through student drawings, social network data, semi structured interviews, classroom photographs, and teachers' planning books; and 3) *Tool and Exemplar development* of a supportive tool formed from structured sets of cards for guidance and inspiration.

The first phase revealed a gap between what is written about learning in physical spaces and how these are designed. The second phase studied a range of current teachers' practices to address this gap, and indicated that although teachers are aware of the importance of physical space, they do not always know how to adapt it to facilitate learning. The results also revealed learning space design elements which designers are unaware of, extending the initial framework from the first phase such. Findings from these studies supported design of a tool (third stage) to empower teachers' use of space to support different learning and teaching approaches. Evaluation showed that the tool can improve teachers' awareness of learning space design elements, and enable them to adapt space to support different teaching and learning approaches. Thus research helps both initial learning space designs by architects, as well as subsequent redesign by teachers through development of a practical tool.

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DECLARATION

Declare that the work contained in this thesis has not been submitted for any other award and that it is all my own work. I also confirm that this work fully acknowledges opinions, ideas and contributions from the work of others.

Name: Fatema Qaed

Signature:

Date:



Development of a Supportive Tool for Participatory
Learning Space Design

CHAPTER 1: INTRODUCTION

“We shape our buildings, and afterwards our buildings shape us
(Ratti, 2004).”

CHAPTER 1: INTRODUCTION

1.1 The Background to the Study

All learning occurs within a virtual or physical space whether this space is outside or inside a classroom. This space will have an impact on learning, either this is positive (where it facilitates, adds value and encourages different learning and teaching approaches) or negative (where it prevents a range of approaches and forces teachers to adapt to it). In some learning spaces, teachers must change their teaching strategy and learning approach because the space obstructs familiar methods. Clearly, the way that teachers and pupils use a learning space is strongly affected by the way it has been designed. A well-known aphorism by Winston Churchill goes: “We shape our buildings, and afterwards our buildings shape us” (Ratti, 2004). However, “there remains a surprising lack of underlying analysis about what is changing in learning and teaching practices and about what role architecture has in this process” (Boys, 2011). Although the institutional learning space is the most important space after home, its design has not been changed for centuries (Odaci et al., 2011). As John Dewey said in 1916: “If we teach today’s students as we taught yesterday’s, we rob them of tomorrow” suggesting also that if we continue to teach today’s students in the same types of learning spaces that we taught them in days gone by, we fail to provide them with the necessary learning to build a successful future. Many researchers agreed that traditional learning spaces must change (Keep, 2002, Stevenson, 2007, Butin, 2000). There are significant public investments in designing new learning spaces in order to meet the needs of 21st century learners; these significant investments have opened up interesting questions related to the way we design and think about learning space.

According to Barret and Zhang (2009b) “When a new building is completed and is handed over to the teachers, the school can only be a ‘finished beginning’ in which adaptations will occur.” The learning spaces that architects design are unfinished stories, the “finished beginning” of a narrative that will be written by users who are going to inhabit, change and adapt to the space. However, current literature of learning space does not look at what happens to the learning space after users begin to engage with it, or how the users change and use the space to facilitate their teaching and learning approaches, or how the meaning of designed learning space changes through occupation by users. Much current literature focuses on the quality of physical conditions, rather than how space is perceived, used, and changed (Wardlaw, 2011). As a result, many learning spaces do not

work as their architects' intended and need to be redesigned. Looking at and reflecting upon such *finished stories* can help architects to improve learning space design, better understand the relationships between architectural design and learning and teaching activities, and rethink their design during the planning process, *before* the space is built. There is little research on how teachers and pupils use, change and occupy built space over time, and how it impacts upon their teaching and learning approaches. And there are many quantitative controlled studies focused on post-occupancy evaluation, yet these take little account of the complexities of teaching and learning, or the actual experience of living and working in a learning space (Comber et al., 2006). The current literature's emphasis seems to be on the importance of designing and using learning space from a 'third teacher' perspective, which aims to present a three dimensional curriculum which speaks to pupils by sending unspoken messages facilitated by space design. However, this literature does not explain *how* those aims might be achieved. In addition, these texts claim that the space shapes the learner and that the learners in turn influence their space (Lippman, 2010), yet it is not clearly explained how these mutually shape each other, in part because there have been few studies on the impact of learning space architecture on educational practice (Odaci et al., 2011). Further, Temple (2007) asserts that thinking about how spaces meet the needs of teaching and learning is generally not clear in most learning space design, and also lacks understanding how a non-ideal space could be used for new learning approaches (Montgomery, 2008).

1.2 Research Focus

There is a gap between theoretical knowledge of learning space design and its practice. Researchers who write about learning space do not explain how published knowledge informs design practice. Similarly, the architect-designers of learning space do not explain how the theoretical knowledge of learning informs their practice. We lack explanations of how users, space context and objects in space operate, or how relationships are built between them. Many researchers note the importance of engaging space design with learning theories (Boys, 2011, Dudek, 2008, Harrison and Hutton, 2013), yet they do not explain *how* such theories can be engaged with space design. Many research studies discuss the effect of learning space design elements on pupils' outcomes and achievements, yet they do not necessarily relate these impacts to the way learning spaces should be designed. Most studies have not been followed through to the level of design practice where designers and architects translate ideas into design elements.

Designers and architects could apply such findings to the design of the physical learning space in ways that facilitate teaching and learning, enabling architects to add value to learning space design elements. Furthermore, some literature claims that the use design elements in learning space is a powerful teaching instrument (Prashnig, 2004b, Martin, 2002b), where it can work as a ‘silent curriculum’ that complements and increases engagement (Taylor, 2005b). Rather than a neutral space where teachers and students gather to learn, it can be key to users’ learning quality and learning experience (Caine, 2008), helping to create a meaningful educational experience (Heiss, 2004). However, the question is: how can design elements of learning space achieve these claims? It is the answer to this ‘how’ question that is missing. How do users use the learning space to obtain benefits and how do architects design the learning space elements to offer benefits to users? This is where the journey of this research begins.

1.3 Aims

This research has two main aims which are:

1. To propose approaches and opportunities to rethink learning space design (classroom space specifically), in order to facilitate and support learning.
2. To empower teachers to change and use their current learning space, to support and facilitate different teaching and learning approaches.

1.4 Research Questions

Through this research, the researcher aims to answer three main questions:

1. What are learning design space elements?
2. How does learning space architecture shape users’ practice and, in turn, how do users adapt with the designed learning space?
3. How can we empower teachers to redesign, use and shape space to support different teaching and learning methods?

1.5 Scope of the Research

This research seeks to contribute to, and bring into closer relationship, the theoretical and practical knowledge of learning space design. Additionally, the research presents different approaches to architects’ rethinking of learning space design in relation to

theoretical knowledge. Additionally, this research constructs and contributes a framework that brings together the disparate factors that shape learning space and which aid better understanding, and designing, of learning spaces. Finally, this research presents a designed tool that empowers teachers to shape, use and change their available learning space to facilitate different approaches to teaching and learning using available resources.

1.6 Thesis Outline

This research is divided into six chapters and structured into three phases, and each phase is presented in a chapter. The next chapter is the next chapter is *Contextual Review* and it present the first phase of this research. This chapter reviews relevant literature related to this research. This chapter seeks to understand learning space problems' background and discusses which problems need to be solved. The third chapter which is *Methodology* chapter discusses the methodology that was developed for research three phases and begins by discussing research philosophy, research methodology and research strategy. It then presents research methods of each phase, which are: observation, interview, document analysis, photo analysis and drawing analysis. It then goes on to explain how these methods are analysed and finally, it discusses and validity of this research. The Fourth chapter presents the second phase of research which is, *Understanding Learning Space Use and Potential*. Chapter Five, *Tool Exemplar and development*, presents the third phase of this research. It is about designing and developing a tool that designs a practical solution which. The tool aims to propose opportunities to rethink classroom space design and empower teachers in order to facilitate and support learning and influence innovative teaching practices. Firstly, this chapter presents rethinking learning space design elements then it discusses the design development of the tool, then it discusses the tool evaluation. The last chapter concludes the thesis.

Table 1: Thesis Outline

| Chapter | Phase |
|--------------------------------|---|
| Chapter 1: <i>Introduction</i> | Research Outline Explaining phases |
| Chapter 2: Contextual Review | Phase One: Contextual Review |
| Chapter 3: Methodology | Research Methodology Explaining phases methods |

| | |
|---|---|
| Chapter 4: Understanding Learning space use and potential | Phase Two: Understanding Learning space use and potential |
| Chapter 5: Tool exemplar and development | Phase Three Tool exemplar and development |
| Chapter 6: conclusion | Phase discussions |

1.7 Research Phases

This research is planned as three overlapping phases. The first two phases mostly address the problem space, where problems are understood, framed and refined. Phase three the solution space, where a design solution is developed and evaluated. However, it is important to mention that these phases do not form a linear process, but instead overlap and interact. The first phase guides methodology choice and method design for the second phase, but both phases one and two also informed and inspired the design solution:

1.7.1 Phase One: Contextual Review

This phase is reported in chapter two and aims to understand the current learning space literature to find gaps and frame problems. This phase achieved this by aiming to:

- understand the current literature by reviewing the meaning of learning space; looking at the relationship between learning and space; comprehending users of learning space, and identifying learning space design elements.
- highlight gaps and frame literature problems via constructing a theoretical framework of learning space design elements, criticising the learning space literature, linking theoretical knowledge with visuals, and finally by identifying literature gaps. In this phase, researcher used observation in schools in Bahrain to develop perceptions of learning space design after it is built and adopted by users, which supports reflection on, and helps to understand, what was found in the literature review.

1.7.1.1 Connections between phase one and phase two:

- The results of phase one showed that current literature on learning space explains each part of this space (users, design elements, and learning) without explaining connections and interactions between them. Therefore, the second research phase was designed to understand connections between these three parts and how they interact.
- Observation during phase one showed that users' adaptation of space changes the design story of space, knowledge that is currently missing in literature. This missing knowledge was sourced from internet searches for visual examples, because few researchers explain what happens to space after users occupy it.
- Users are the ones who connect space with its purpose after occupying it. In addition, users build relationships with space design elements and learn by interacting with space. Therefore, the second phase explored user behaviours, for example: how they interact with space through learning and teaching.
- Based on gaps found during the contextual review, the methods and methodology for the second phase were chosen: for example teachers' interview questions were designed to address phase one gaps.

1.7.2 Phase Two: Understanding learning space use and potential

This phase is presented in chapter four. Phase one has framed problems and highlighted gaps, Phase two fieldwork methods aimed to fill gaps and refine understandings of problems. However, as phase one showed that users' understanding of space has not been researched, hence it was important to understand learning space problems from their point of view in the second phase. The findings of this phase filled first phase gaps, refined its problems and highlighted more problems. Phase two achieved this by:

- filling first phase gaps, as reported in four sections: (1) Comprehend Changes in Classroom Space, (2) Create Understanding of Classroom Space, (3) Classroom

Space Design Elements and (4) The Relationship between Design and Teaching Strategy.

- Refining understandings of problems. Phase one findings emphasised the importance of teacher's use of space, but did not explain to teachers how to use learning space. Further, the second phase showed that teachers are aware of the importance of using space, but they not know how to use it. Therefore, "how to empower teachers' use of space to facilitate teaching and learning" remained a gap in current knowledge.
- users highlighting problems that the researcher was not aware of in the first phase (Section 4.5)

1.7.2.1 Connections between phase one, two and three

- The result from second phase confirmed the first phase conclusion that teachers are not making the best use of learning spaces. They are aware of the importance of space use, but they do not know how to use it.
- Therefore, "how to empower teachers' use of space to facilitate teaching and learning" remain a gap in knowledge from phase one and two without an answer. Consequently, the third phase planned to empower teachers' use of space.
- Phase one emphasises the importance of teachers' use of space, while phase two findings showed that teachers are aware of the importance of using space but they do not know how to use. However, both phases one and two do not explain how to empower teachers' use of space.
- Although both phases one and two showed design opportunities for solutions, they were not in the form that could be used by teachers.
- Both phases one and two raised the concept of using classroom as a tool. However, these phases do not explain how to design space as a tool. Phase 3 developed a toolbox to support the use of learning spaces as tools.

- The empowerment of teachers through the toolbox developed in Phase 3 was built upon theoretical knowledge found in phase one and users' finding in phase two. The tool box was designed as several sets of cards. Each set empowers teachers' use of space by responding to theoretical knowledge found in first phase and/or solving problems the users reported in the phase two.

1.7.3 Phase Three: Tool Exemplar and Development

This phase is presented in chapter five. The focus of this research is not only on understanding learning space users and learning space problems from their point of view, but to find practical solutions. Phase one and phase two emphasise the importance of teachers' use of learning space to facilitate teaching and learning without explaining how teachers use space. Therefore, this phase aimed to design a solution that empowers teachers to use space. In designing the solution process, the researcher was inspired by design opportunities from both earlier phases. The empowerment of teachers was built upon theoretical knowledge from phase one, and from user findings from phase two. Phase 3 began by reflecting on what had been found in previous phases to rethink current learning space and to suggest design solutions for architects. After that, this phase took action to empower teachers' use of learning spaces by designing a toolbox. Although phase one and two discovered the concept of using a learning space as a tool, neither phase explained how to design space as a tool. Therefore, the toolbox's main strategy did not come from phase one and two, but from the Convivial Tool concept (Section 5.2.3.1).

1.7.4 Problem Development Through Phases

Phase one showed that the current literature explains each part of learning space separately (these parts are learning, users, and design elements). Nevertheless, without explaining the relationship as connections and interactions between these three parts, the meaning and understanding of learning space remain unclear. Therefore, phase two aimed to understand the connection between these three parts and how they interact in response to gaps found in phase one. However, because users in learning space are the one who connect learning and design elements by using and interacting with space, phase two planned to understand users and how they occupy space. After phase two, a better understanding of learning space and the relationship between its parts was achieved. However, this understanding of learning space was not in a form that can be used and applied by teachers, which means the findings of phase two do not empower teachers'

use of space. Hence this problem from phase one and two remained without a solution. Therefore, the third research phase planned to solve this problem.

“When the practitioner tries to solve the problem he has set, he seeks both to understand the situation and to change it” (Schön, 1983). In creative design, understandings of the problem and the solution evolve together. Thus for Cross (1999), design is not just about, “Problem solving, but finding the problem and also solving it”. This research thus co-evolves understandings of the problem and solution space. The research problem was not understood fully in the literature (Chapter 2), so the understanding of the problem evolved during field work (Chapter 4) and action research (Chapter 5), alongside the development of a solution (Chapters 4 and 5). A research methodology was selected that supported finding the problem and refining it alongside the development of a solution.

1.8 Research Contribution

This research marks several important contributions. This research:

- Demonstrates multiple values for different visual forms. It reduces the gap between practice and theory, reveals theoretical knowledge beyond the written literature, reveals how users reshape the space, inspires solutions, and in some contexts, it was an element of the solution.
- Builds on users’ perceptions of learning space to answer “how to design” questions, reveals overlooked design element, and exposes new meanings for learning space design.
- Exploits Social networks to support design research practice, with different roles during research: understanding theoretical knowledge in the first phase, understanding users’ adaptation of space in the second phase and finally inspiring and evaluating the tool solution.
- Empowers teachers by suggesting a variety of practical solutions resources through the Classroom Design Recipes Tool. This tool increases teachers’ awareness of space and its design elements to finish architects’ ‘beginning design. Furthermore, applying the tool adds educational value to physical space objects

which empowers teachers to use space as a teaching instrument. This research achieved this convivial toolbox concept, which helped to pack an interior design space in a toolbox.



Development of a Supportive Tool for Participatory
Learning Space Design

CHAPTER 2: CONTEXTUAL REVIEW

*“Spaces are themselves agents for change. Changed spaces will
change practice” (JISC, 2006)*

CHAPTER 2: CONTEXTUAL REVIEW

A contextual review is broader than a standard academic literature review. It can also draw on popular literature and visual sources to explain and explore academic literature about learning and its space design. This proved to be necessary for this research, since during the academic literature review, a gap between research and practice became apparent. Therefore, the researcher searched the accessible popular literature and visual sources to fill this gap. Visuals in this chapter are mostly sourced from teachers' and architects' blogs. Architects' blogs provide rich visuals of their practice, but they do not usually connect it with theoretical research on learning and space. The contextual review provided such connections. Teachers' blog explains the relationship between users and space after architects have finished their work, something that was missing in both architects' blogs and the research literature.

This literature chapter has five sections. The first is **Understanding Learning Space; what is a Learning Space? And why is learning space design important?** Concepts of learning space vary, because architects, estate planners, educators, psychologists, learning technologists, teachers and students do not share a same common language or understanding of this term. Understanding the concept of a 'learning space' is thus a challenge for researchers. This chapter starts by discussing the meaning of learning space and why it is so important

The second section is about **The Relationship between Learning and Space** (*Between Learning and Space, Learning theories, Practical examples and The Shift in Learning in the New Century*). A room's purpose influences its design and as learning is the main purpose of a learning space, it is important to understand the relationship between learning and space. This section begins by discussing the wider purposes of learning space and the different learning theories that have impacted on the way learning spaces have been designed and built for centuries. It also explores different theories on teaching and learning to help designers to understand learning space users' needs and how they respond to the space. This section concludes by discussing ways in which learning theories can inform and be practically translated into designs. Two practical cases have been chosen to exemplify how the design of the classroom is derived from particular educational philosophies, and how learning can be supported by elements integrated into the space design. Finally, in order to understand the problem of current learning space design, "The Shift in Learning in the New Century" section discusses how

current learning space does not embody the new educational requirements of 21st century learners.

The third section is about **Users of learning space** (*users' participation in designing learning spaces, the user's voice and participatory approach projects*). According to the Commission for Architecture and the Built Environment (2010), a successful learning space design is a result of collaboration among designers and learning space users. Hence, today there is a growing movement to involve users in the design of learning spaces. This section discusses how users' participation in designing learning spaces helps them to articulate what they want from the learning space and; through listening to users, designers can better inform learning space design. This section concludes with examples of participatory school design projects in order to show practical examples of how users' have been involved in the design of schools and how their concepts have been translated into design.

The fourth section is about **Design Elements of the Learning Space**, it describes design elements (e.g. colour, air quality and temperature) and considerations of the learning space design. For clarification, the theoretical knowledge of learning space design has been supported with visual illustrations of different learning spaces and space design projects. This section ends with a theoretical framework that has been constructed to integrate Design Elements of the Learning Space, this framework exemplifies the research view of space design elements. Finally, the chapter concludes with the section **Criticising Learning Space Literature** which discusses the problems, gaps and questions identified in the review of the literature.

Before these five main sections, the role of visuals for this research is described.

2.1 The Value of Visuals in This Chapter

It is important to mention that the current theoretical literature of learning space design overlooks learning space design practice. While the literature explains design elements of learning space, it does this without *visually showing* how these elements can be applied and designed in space, and linking theoretical knowledge to practice. On the other hand, existing learning space projects lack descriptive texts or the necessary theoretical knowledge of learning space design, teaching and learning. This clearly exposed a gap that the researcher attempted to address by linking the theoretical literature

review of learning space with examples of practice in order to provide a better, theoretically grounded, but visually enriched, understanding of learning space design. After all, the visual has particular importance for designers. For example: the IDEO design company use visuals to support lateral thinking (Kelley and Littman, 2001); designers use visuals as an integral part of the design studio (Eckert and Stacey, 2000) and make collages or mood boards (Keller, 2005). In this chapter, visualisation was a tool that helped to: reveal the key concepts of the research; understand gaps in current knowledge; a bridge between research and design of learning space; and propose approaches to rethink the design of learning space. Additionally, through a process of visual analysis, new opportunities to rethink and change the current design of learning space were discovered, supporting Corner (1999) who observed that visuals can be agents in uncovering realities that previously could not be seen.

In this chapter, visuals from different design practice fields are used to propose new ways to rethink learning space design. When trying to explain the particular use of a design element, such as colour, without supporting it with visual examples, the explanation remains unclear. For example, colours can be used to define form and manipulate users' behaviour – a concept that many designers embrace (Smith, 2008). Understanding this could be supported with an example of the work of Mexican architect Barragan (Ambasz, 1984). Where colouring architectural planes such as walls, fins and benches to define forms such as defining entrance to (Figure 37). Visual examples support a practical approach to how colours can be designed in space.

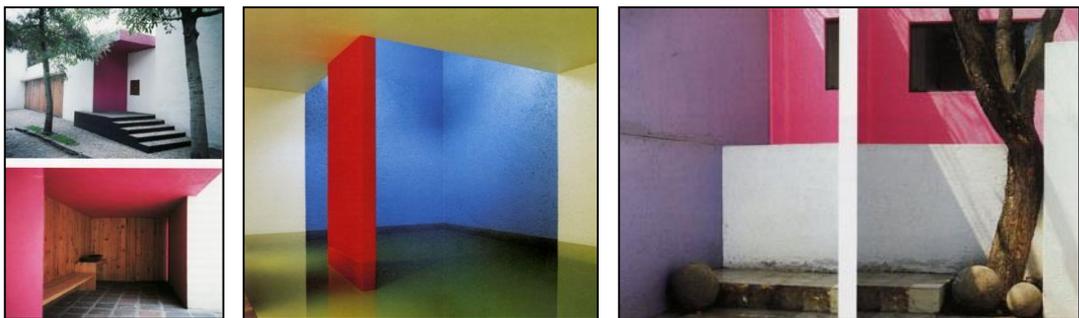


Figure 1: Examples of Barragan's work

Source: (Pauly, 2008).

In another example, Martin (2002a) has determined features of legible and coherent classroom design theoretically as: landmarks, visual access, different floor and ceiling levels, textures, colours, and hallways. Supporting these theoretical features with images from different design practice examples would lead to a better understanding of the

application of this theoretical information. For example, different floor and ceiling which levels can be seen in a children bookstore, have been designed in Beijing by SAKO (Figure 2).



Figure 2: Children Bookstore in Beijing

Source: <http://www.duitang.com/people/mblog/19601070/detail/>

2.2 Understanding Learning Space

2.2.1 What is a learning Space?

What does the term ‘learning space’ mean? The concept of a learning space is challenging because different stakeholders invariably do not share the same understanding of this term. Different researchers from different background have focused on different meanings of learning space. Educators concentrate on defining space in relation to learning as its main purpose. Architects focus more on important physical design elements and space structure. Other researchers focus on environmental control or users’ behaviour. However, the links between these research areas is weak, although they all focus on learning spaces. There is thus no clear single, agreed meaning for “learning space” yet, and a better understanding is needed. To clarify the learning space concept, this research starts by reviewing different meanings of learning space in current literature, as a basis for reaching a position on how this research understands learning space.

2.2.2 Reviewing Current Meanings of Learning Space

Space can be understood as a human relationship rather than as a physical setting or object. Therefore, space can lose its meaning when it is separated from the participants who occupy it, and from the context in which participants and the space are operating (Boys, 2011). Accordingly, a space can be understood by understanding its users and its purpose. In addition a space, whether physical or virtual, can have an important impact on learning (Oblinger, 2006). More than an area for people to gather together in order to learn, space can shape the way people learn and impact on the quality of their learning experience, with good spaces helping to inspire, stimulate and support both students and teachers (Hyslop and Hutton, 2009). A space can be shaped by the wider environment beyond and by the objects within it (Hertzberger, 2000), because learning can happen anywhere (Woolner, 2010). For architects, educators, psychologists, learning technologists, teachers and students, a learning space means more than just a physical space; it also embraces sensory, virtual and social spaces (Poole and Wheal, 2011). Therefore learning space can be conceptualised as a set of relationships among objects, objects and people, and people and people (Martin, 2002). Finally, learning space can be understood as the product of design process that depends on assumptions about different forms of space and learning practices. The meaning of learning space has been extended beyond the physical space to include virtual and conceptual space (Sharples, 2013). However, although learning space can be defined as a relationship (Boys, 2011), this does not describe the nature of how this relationship is formed or developed, as users, the purpose of the space, and/or the objects within a space all interoperate. General claims that space can be understood by understanding its users and its purpose (Oblinger, 2006) do not explain how students and teachers occupy and interact with the space, each other and designed objects. All these ‘how’ questions remain unanswered; yet, without a better understanding of learning space, it is difficult to design a space that can inspire, stimulate and support both students and teachers. However, according to Boys (2011), the meaning of space and what matters about it in relation to learning, remains an unanswered question.

2.2.3 Learning Space in This Research

In this research, the meaning of learning space is a set of relationships among a space’s purpose, users, and design elements. This contextual review analyses the literature on learning space purpose, users and design elements with the aim of linking

these elements together to show their relationships. This is supported by using visuals from stakeholder blogs and other sources. Although the focus in this research is on physical classroom space, virtual space and other spaces within one school space cannot be ignored because learning can happen anywhere (Woolner, 2010), in other spaces such as school playground, library, and garden. The term learning space is used because it has a broader coverage than classroom.

However, although the current literature explains learning spaces' purpose, users and design elements, it does not explain their relationship together. Although it defines learning space as a relationship rather than an object, it does not explain the nature of this relationship and how it is built by users, for example how users occupy space and relate to its design element, a knowledge that is limited in current literature. Therefore, a better understanding of learning space is needed.

2.2.4 Why Learning Space Design Important?

This section explains why the learning space design topic was chosen and its importance. "Education is one of the biggest investments we make in our nation's future" (Jamieson et al., 2006) and therefore, many governments today are investing substantial funds in renovating or building new iconic learning spaces. The UK's £45 billion "Building Schools for the Future" project (BSF) aims to rebuild or renew every secondary school in the UK by 2020 (CABE, 2007, GreatBritain:NationalAuditOffice, 2009, Parnell et al., 2008) with primary schools later added to the programme (DfES, 2006b, DCSF, 2007). Meanwhile, similar projects and programmes are being created in other parts of the world such as in Australia, the USA, Indonesia, the Gulf state of Qatar, and in other countries (Parnell et al., 2008, Nair et al., 2009a). In the UK, one of the most well-known school projects from the "Absolute Return for Kids" (ARK) schools' programme, which aims to build or renovate schools to improve the learning space (Buckley et al., 2004a), is The Evelyn Grace Academy in Brixton, London. Designed by the leading architect, Zaha Hadid, the school is considered to be one of the most outstanding school buildings in the UK (Walker, 2010). This is just one example from an enormous number of projects that aim to build or renovate school environments in order to improve the quality and experience of learning (DfES, 2002, Chiles, 2003a, CABE, 2009, Nair et al., 2009a, Care and Chiles, 2006, Happold, 2001).

However, although schools such as Zaha Hdid school is considered one of the most outstanding school buildings in the UK (Walker, 2010), there is no published research on how this school building enhance users' learning and teaching performance, and if it resulted in satisfied users. Therefore, these schools are breaking ground architecturally but have no associated evidence of having positive effects on users of space. The space, whether physical or virtual, has an impact on pupils' and teachers' learning (Oblinger, 2006). It can bring pupils and teachers together, and encourage them to explore, collaborate and discuss with each other (Oblinger, 2006) or conversely, can communicate to its users "*an unspoken message of silence and disconnectedness*" (Oblinger, 2006). Negatively or positively, the context shapes the learning which takes place in that space (Monahan, 2002). A space can even speak directly to pupils and tell them "*We want you to feel safe, comfortable, challenged, inspired, and proud; we believe in you and your future*" (Young et al., 2003). Design then, cannot be overlooked in attempts to achieve a better quality of learning (Chism, 2006), and designed space is itself is an "*agent for change*" as it impacts positively to bring transformation to teaching and learning practice (JISC, 2006). A large proportion of the existing literature concerning the design of learning spaces is based on higher education design possibilities (Bullard, 2010). There is little research on the design requirements for young children (Wardlaw, 2011), and yet primary school children are typically situated in a single classroom for much of the school day –unlike older children in secondary schools (Dudek, 2008). Meanwhile, research has shown that 9-to 11-year old pupils are more likely to identify a space's physical attributes, such as untidy classrooms and wall colours, than adults (Young et al., 2003). Furthermore, existing research is said to be flawed due to its lack of attention to learning space use and pupils' various responses to its design (Simon et al., 2007). For these reasons, this research focuses on the learning space design for the primary school age group. Classroom space is said to be the most important supporting element in teaching and learning processes (Udin and Rajuddin, 2008).

Barrett and Zhang (2009b) assert that classrooms play the most important role, because classrooms are the core of learning spaces (Hertzberger, 2008). The design of learning spaces, particularly in American education, is structured around the classroom and, in general, these spaces have not been changed for decades (Lippman, 2010). Typically designed by an architect, to accommodate various elements, such as chairs, desks, cupboards, a whiteboard and audio-visual equipment (Udin and Rajuddin, 2008),

it is the space where students and teachers come together to interact and to learn (Strauss, 2002).

2.2.4.1 The Importance of the Learning Space for Pupils

Learning spaces are the most important spaces after the home in the development of pupils (Odaci et al., 2011). They play an important role in pupils' lives and have an impact on their cognitive and behavioural development, as well as on their childhood vulnerability (Ellis, 2005), not least because of the amount of time they spend on average in such spaces (Young et al., 2003), with around six hours a day and over 1000 hours a year spent in classrooms (Ghaziani, 2008). This not only matters because it concerns the education and life chances of these pupils (CABE, 2010); pupils' health, leisure, emotions, achievements, learning outcomes, behaviour, affective state, attendance, well-being and engagement (Odaci et al., 2011, Wardlaw, 2011, Barrett and Zhang, 2009b, Victorian.Institute.of.Teaching, 2011, Brooks, 2011, Higgins et al., 2005, Ghaziani, 2008, Tanner, 2009, Heppell et al., 2004) and the future of society (Odaci et al., 2011). There is a Swedish saying about students having three teachers: other children, the teacher and the educational space (Karmer, 2010). Clearly, the quality of learning space design has a significant impact on pupils' learning and life chances

A number of studies show that there is a strong relationship between the quality and nature of learning space design elements and pupils' learning outcomes (Barrett and Zhang, 2009b, Heppell et al., 2004, Uline and Tschannen-Moran, 2008, Earthman and Lemasters, 1996, Earthman and Lemasters, 1998, Higgins et al., 2005, Lemasters, 1997, Schneider, 2002a, Earthman, 2004a). Poor learning spaces are difficult for teachers to teach and pupils to learn (Barrett and Zhang, 2009b, Heppell et al., 2004, Ghaziani, 2008) whereas a well-designed learning space has motivational impact, for example: natural light can provide a more pleasurable learning experience and space design, encourage pupil collaboration and social interaction (JISC, 2006).

2.2.4.2 The Importance of the Learning Space for Teachers

Teachers use the learning space that was designed by the architect, on a daily basis, and have to deal with it in a way that effects their practice (Horne, 1999). The quality and nature of the learning space affects the quality of teachers' lives, health, safety and educational outcomes (Buckley et al., 2004a);, as well as their attitudes and behaviour

(Uline and Tschannen-Moran, 2008) and performance (Lowe, 1990, Dawson and Parker, 1998, Schneider, 2003, Buckley et al., 2004b). Besides, the social dynamics of the space were also found to affect teachers' satisfaction and behaviour (Anderson, 1982, Brookover et al., 1978, Hoy et al., 1990, Tarter et al., 1995). Additionally, in Hunley and Schaller's (2009) study, a group of teachers suggested that specific learning space design elements did indeed inspire a connection between the learning space and innovative pedagogical practices (Hunley and Schaller, 2009). Therefore, the design of learning spaces does affect teachers' morale, retention and their ability to teach (Buckley et al., 2004a, CABE, 2006). Furthermore, the Victorian Institute of Teaching (2011) asserts that learning space facilities can make additional contributions to teachers' work. Moreover, there is evidence that learning space design can promote more creative approaches to teaching and learning (CABE, 2006) while, conversely, spaces can limit the range of pedagogical practices that teachers feel comfortable using (Hunley and Schaller, 2009). Furthermore, the design of the learning space offers both possibilities and constraints for teachers' activities with students in individual, small group and large group activities (Lippman, 2002a). Therefore, teaching and learning should be able to support and encourage different opportunities for activities for both individuals and groups (Lippman, 2002a).

2.3 The Relationship between Learning and Space

2.3.1 Between Learning and Space

A learning space serves a variety of functions but the most obvious function is learning (Martin, 2002a). Indeed, the interest in learning space design in relation to learning theories and methods is not new. It received special emphasis in the post-1945 national school building programmes where innovative school designs created to allow new educational methods to be applied (Harrison and Hutton, 2013). More recently, while learning considerations should be put at the heart of conversations on learning space planning (Chism, 2006), researchers acknowledge *other* purposes. These relate to the formation of children's personal identity, development of social as well as educational competence (David and Weinstein (1987). Furthermore, the special arrangement and layout of a space used for teaching (Martin, 2002a) can indicate and support a teacher's learning strategy, most readily exemplified by the traditional single focal point at the front of the space which sends a strong message about the learning strategy used (Oblinger, 2006). In post-compulsory education, improvements have been brought about through the

design and development of physical and flexible learning spaces (Boys, 2011). It is important here to involve learning experts in the architectural design of learning spaces to translate between design and educational vocabularies, and provide relevant design solutions (Boys, 2011).

Learning is a complex activity which involves pupils' motivation and the surrounding physical conditions (Lyons, 2001). It should motivate collaboration, support formal practices, offer a personalised, comprehensive and flexible space for changing needs (JISC, 2006). Spaces have a significant impact on activities such as communication, arguing and knowledge creation (Scott-Webber, 2004) and their flexibility can facilitate different and evolving approaches to teaching and learning, and take account of new learning theories and methods (Dudek 2008; Boys, 2011). This demands that the designer have an understanding not only of the value of creating places that are aesthetically pleasing but a knowledge of education that is grounded in a of learning methods (Boys, 2011) in order, to facilitate 'third teacher' support, and; beneficial changes in learning (Lippman, 2010).

2.3.2 Learning Theories

Learning theories have been developed to explain the learning process (Klein and Mowrer, 1989). These theories aid researchers in seeing the 'big picture' by making it possible to view practice and research from a wider perspective (Anderson, 2003). Many researchers note the importance of engaging space design with learning theories (Boys, 2011, Dudek, 2008, Harrison and Hutton, 2013) and merging learning theories with the architects' design of learning space; yet they do not explain how to do that. In addition, Jordan et al. (2008) point out that a knowledge of learning theories allows a researcher to: access the considered experience of others; validate existing practice; employ mind-tools for recognising, analysing and evaluating issues; offer the power to manipulate and develop concepts in a reflective manner; and finally, explore epistemological and pedagogical topics. There are three main learning theories on which other learning theories are based on. These theories are behaviourism, cognitivism and constructivism (Cooper, 1993, Duffy and Jonassen, 1991, Ertmer and Newby, 1993, Anderson and Elloumi, 2003, Buzzetto-More, 2007). Behaviourism and cognitivism are older theories than constructivism. However, cognitivism and constructivism are related to this research and will be used later in tool design content, therefore next these two theories will be explained in details.

2.3.2.1 Cognitivism

Cognitivism is opposite to behaviourism because it concentrates on the mind and on the brain's learning processes (Holmes and Gardner, 2006). Cognitivism includes the study of mental processes, such as sensation, perception, attention, encoding and memory, (Jordan et al., 2008). In addition, several factors influence the development of cognitivist theory (Jordan et al., 2008). These are: improvements in experimental psychology; the move from an interest in external behaviours to internal brain processes; and the development of computers and an interest in artificial intelligence. Cognitivists believe that learning is an internal process which involves memory, reflection, abstraction, motivation (Ally, 2003), attention, perception, learning, problem solving, and thinking (Eysenck and Keane, 2005). Teachers in the cognitive school encourage pupils to develop critical thinking skills (Buzzetto-More, 2007).

This theory does not explain how to design learning space, however, because this theory explains the internal processes of the brain which are involved in making sense of the space, understanding these processes helps designers to design a learning space that supports these processes and motivates pupils' senses and skills like critical thinking, and problem solving. As such design a space might encourages students to think of what is around them in order to motivate their thinking skills.

2.3.2.2 Constructivism

Constructivist theory consists of a broad group of learning theories which describe knowledge acquisition and learning (Jordan et al., 2008). In constructivist theory, knowledge does not exist independently from the learner: knowledge is constructed (Vrasidas, 2004). Additionally, constructivism focuses on what learners do with information to develop knowledge (Jordan et al., 2008). Many educationalists believe that learning moves through behaviourism to a cognitivist, and then to a constructivist approach in the way students act, think, and then create meaning (Cooper, 1993, Duffy and Jonassen, 1991, Ertmer and Newby, 1993). The key principle of constructivism is that students learn best by actively constructing their own learning (Cole, 2009); thus, constructivists see learners as active rather than passive (Ally, 2003, Jordan et al., 2008, Buzzetto-More, 2007). Constructivists argue that knowledge transfers to learners based on the learners' personal interpretations of the world, created through their interaction with the world around them.

Bodomo's (2009) constructivist tenets are based on the views of Bruner, Piaget, Dewey and Vygotsky. For example, he asserts that the learner plays an active role in the learning process (Bruner); learners build their own knowledge through experience and not through 'given' information (Piaget, Bruner); that teachers should assist students as facilitators and support them to discover new knowledge by themselves (Bruner); and that learning is a social activity (Dewey, Vygotsky). In constructivist theory, learners learn better when they depend on themselves and discover things for themselves, instead of being told by a teacher or machine (Lin and Hsieh, 2001). The constructivist theory has significant implications. This theory suggests that learning is best served when it is: firstly, contextual, where students' understanding is important; secondly, active, where students are engaged in learning activities which use analysis, debate and criticism; and finally, social, by supporting activities such as discussions, direct interaction with experts and peers, and team-based projects (Brown, 2005). Based on constructivist learning theory, the following points could be taken into consideration when designing learning spaces:

- **Cooperative learning:** Instructors should encourage cooperative learning in order to facilitate constructivist learning (Johnson and Johnson, 1996, Palloff and Pratt, 1999) through using certain learning activities: for example, small-group discussions, simulation games, project-based work, and collaborative problem-solving activities. Group work helps pupils to achieve their goals (Murphy and Cifuentes, 2001) and develop critical thinking skills through working collaboratively (Romiszowski, 1997).
- **Interactive learning:** Learning should be interactive to allow the development of higher-level learning and social skills, and to help develop personalised meanings (Ally, 2003). This aids students in acquiring new knowledge and skills while they interact with information and the space (Heinich et al., 2002). Furthermore, interaction creates a sense of presence and a sense of community for learners (Murphy and Cifuentes, 2001). Learners interact with the curriculum, other learners and instructors, and the relationship between instructor, learners and the curriculum is important for the learners' learning experience (Garrison, 1999).

There are several schools of thought within the constructivist approach (Cobb, 1994, Prawat and Floden, 1994). The next section presents one of the most prominent learning

theories which have been established from the constructivist learning theory. This is the learning theory of socio-constructivism.

2.3.2.2.1 Socio-constructivism

Socio-constructivism is one of the most prominent of the constructivist paradigms. The main difference of this approach concerns knowledge construction. Social constructivists believe that knowledge is the result of social interaction; however, Cobb (1994) argues that social constructivism cannot be separated from constructivism as a whole. Socio-constructivism assumes there is a third dimension to the interaction between students and their space; this might be other people: other learners or instructors, for example (Holmes and Gardner, 2006). Social constructivism is derived from the work of Vygotsky and Albert Bandura (Jordan et al., 2008). The theory of social constructivism suggests that the learning of humans is based on their interactions with the social and culture environment. The basic concept of this theory is that students learn most effectively by engaging in carefully selected, cooperative, problem-solving activities, under the supervision of instructors (Vygotsky, 1978b). The implications of socio-constructivism for architects and designers include thinking of the whole campus as a learning space rather than emphasising classrooms (Chism, 2006).

2.4 How Can Our Understanding of Learning's Relationship with Space Drive the Design of Space?

The current literature does not show how to design learning space that integrate learning theories with the learning space design. Consequently, it is important to show the architect different visual examples from projects that have successfully translated learning theories, values and strategies into design. The next section exemplifies how different visuals of learning spaces can communicate to architects new and varied ways of understanding and engaging with learning theories, with the aim of improving the way that learning space is designed. Visuals here are used to build a bridge between learning theories research and learning space design, to explain how to design space through the understanding of learning theories.

2.4.1 Cognitivism

Since cognitivism helps to explain how the brain makes sense of space and how it is stimulated, understanding this theory help designers to design learning space that motivates and stimulates pupils' senses. This can be achieved, for example, by designing with colour to stimulate pupils visually or; using rich imagery that encourages students to think and reflect on what they see in the space around them. Figure 3 shows examples of a colourful learning space in Wareham St Mary's Primary school, in which the designer has used a colourful glass shade that is both practical and which visually reflects colour onto the ground, creating a sensory use of space from different materials.



Figure 3: Wareham St Mary's Primary school

Source: <http://www.infinitecanopies.co.uk/canopies-awnings/wareham-st-marys-primary-dorset/#lightbox/2/>

Figure 4 shows another example colourful primary school in London; in this school designers encourage students to make sense of space using different elements, such as the colour of the cushion settings, different groups of open learning spaces with different layouts, flooring patterns, window squares, and sheets hanged from the ceiling.



Figure 4: Colourful Primary School in London

Source: <http://www.behance.net/gallery/Primary-School-London/894497>

Additionally, Figure 5 shows example of rich visuals in Fort Washington Children's Library which can work as rich learning resource to encourage students to think, by sending them unspoken messages through light shade illustration in the ceiling.



Figure 5: Fort Washington Children's Library

Source: <http://www.wear designbureau.com/projects/graphic-design-vs-architecture/>

Another approach is to design a learning space with diverse textured materials to stimulate pupils' touch sense. Figure 6 shows an example of a designed space incorporating wood, leather, stone and grass materials in an office in Italy called Talented Garden.



Figure 6: Talented Garden in Italy

Source: <http://officesnapshots.com/2012/07/18/check-out-the-coworking-space-talent-garden-brescia/>

2.4.2 Constructivism

Constructivism Theory (2.3.2.2) can have a significant impact on the way learning space is designed if this knowledge is supported visually, using examples of how to translate this theory into different design solutions. However, this theory encourages teachers to use cooperative learning through the encouragement of different learning activities, such as: small-group discussions, simulation games, project-based work, and

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collaborative problem-solving activities. Therefore, it is important that the design of learning space facilitates these different learning activities. For example, some teachers have redesigned their classroom space and created different seating groups with different seating shapes. Figure 7-Figure 9 show different examples of teachers' classroom redesign shared in their blogs, in these examples teachers have created different groups of seating and varieties of learning areas that encourage different learning activities using different flooring materials, walls displays and shelves.



Figure 7: Teacher's Classroom redesign

Source: <http://secondgradeparadise.blogspot.co.uk/2013/08/classroom-reveal-teacher-week.html>



Figure 8: Teacher's Classroom Redesign

Source: <http://classroomsimple.blogspot.co.uk/>



Figure 9; Teacher's Classroom Redesign

Source: <http://classroomsimple.blogspot.co.uk/>

Additionally, this theory claims that learning should be interactive (Ally, 2003). An example for designing an interactive learning space can be seen in Udavi Gentillesse School in India where space was designed to allow pupils to interact with walls by giving the opportunity to draw and paint on the walls, (see Figure 10)



Figure 10: Interactive Wall in Udavi Gentillesse School

Source: <http://www.theguardian.com/teacher-network/zurich-school-competition/gallery/innovative-learning-spaces-gallery#/?picture=422976006&index=9>

Designers can include an interactive multi-purpose wall that allows pupils to sit and teachers to store books. These walls communicate to pupils their purpose in an unspoken message. In Stephen Perse School, the wall of a storytelling space has been designed to spell out “STORY”, explicitly but attractively communicating to pupils the space's purpose and inviting them to physically engage through the design of the seating and book shelves. This space is designed by Chadwick Dryer Clarke Architect (Figure 11).



Figure 11: Storytelling Space in Stephen Perse School

Source: <http://www.chadwickdryerclarke.co.uk/>

Even flooring can be interactive, as in the New River View Primary School in Manchester, where teachers have covered The Transformational Learning Hub floor with an A-Z street map to use as a learning tool (Figure 12).



Figure 12: The Learning Hub Floor in New River View School

Source: http://printedspace.com/floors_school_map_floor.aspx

2.5 Practical Examples

The following practical examples are from educators who have had a great impact on the present day thinking about learning and childhood and who inspired the design of schools in their own time; some of this inspiration still endures today. After the establishment of compulsory education in Europe and North America, a number of key educators influenced and inspired school architects in a profound way. For example, John Dewey inspired Frank Lloyd Wright's school designs; Margaret MacMillan in London

talked about the requirements of the working poor; and Friedrich Froebel was the creator of the kindergarten and introduced the value of play in education (Liebschner, 1993). Froebel believed that all students learn by being active; any kind of action generates emotional responses which, in turn, lead to mental considerations and to thinking (Liebschner, 1993). Meanwhile Maria Montessori established the first furniture scaled to the size of young children (Dudek, 2007). Reggio Emilia's teaching methods aim to involve learners in activities using a variety of tools (Lippman, 2010). Additionally, a concept such as the physical environment as the 'third teacher' was first mentioned by Reggio Emilia who viewed space having the ability to guide learning (Lippman, 2010). Furthermore, Montessori asserts that a learning space must be equipped with tools to stimulate learning opportunities. Similarly, today's learning spaces are using tools (for example, technology) to stimulate learning opportunities (Lippman, 2010); these are believed to guide the pupil (Vygotsky, 1978c). In addition, Reggio Emilia and Montessori had explained how learning can be translated into design elements in a space and integrated with the space design, which shows how space design supports different learning approaches. The next sections offer examples which has a direct relation to learning space design: (1) Montessori and (2) John Dewey. Montessori example will be explained next. For John Dewey is see APPENDIX 1.

2.5.1.1 Montessori

Many of Montessori's concepts are so basic to our way of thinking about childhood today that we take them for granted (Mooney, 2013). Even now, Maria Montessori is considered to be one of the world's great educators (Gutek, 2004) and yet when she opened her first school, Casa de Bambini in 1907, which was designed with child-sized furniture and tools, her idea of children working freely was considered radical. Her study concerning young children and their learning needs fundamentally affected the way early educators think about children (Mooney, 2013). Montessori had applied the principle of a child's freedom in the tools and materials she created and in the design of the prepared environment (Gutek, 2004). According to her educational principles, a child's freedom gives him/her the opportunity to select his/her own learning activities (Gutek, 2004). In addition, she designed and developed educational methods and tools to stimulate children's sensory skills, as well as providing a prepared environment for them (Gutek, 2004). The literature of Montessori learning concepts is not supported with visuals on how the prepared environments and its tools can look, however, because Montessori

learning concepts are still used today by different teachers, visual examples of Montessori prepared environments and tools of can be seen, in teachers' blogs. Figure 13 and Figure 14 show examples of Montessori materials and tools.



Figure 13: (Left) Examples of Montessori materials and tools.

Source: (Martha, 2010).

Figure 14: (Right) Examples of Montessori materials and tools.

Source:(Hearts-and-Hands-Montessori, 2007).

These learning tools and materials are integrated with the design of learning space and create interactive walls and floors, and help to explain how learning space works as a ‘third teacher’. Montessori developed teaching and learning tools in order to encourage learners to discover the space they were learning in, through self-directed and co-operative learning activities. This approach was completely innovative at that time (Lippman, 2010). Montessori learning approaches illustrates how to apply the concept of ‘third teacher’ in classroom space design. Figure 15 and Figure 16 show how the Montessori classroom is working as a ‘third teacher’ and 3D curriculum, and how space elements such as walls and floor can be a learning and teaching tool. Furthermore, the idea of the tools designed by Montessori allow teachers with different budgets to facilitate and design different learning spaces to support their teaching and learning approach, concepts used today in different parts of the world because of wide applicability.



Figure 15: Examples of Montessori prepared environments (Montessori classroom).

Source: (Tangient-LLC, 2006).



Figure 16: Montessori prepared environment (Montessori classroom).

Source: (montessori4autism, 2005).

The reason for choosing Montessori specifically is that she is one the first educators who applied and translated the theoretical concepts of learning into design, for example, her child-sized furniture and tools (Gutek, 2004). Additionally, she explained how to design tools and teaching materials, and prepare the learning space to support and facilitate teaching and learning. She shows clear integration between learning and space design in her concept of learning and her explanation of how to design the learning space to support the learning and make students learn from the space, in what she called the ‘prepared environment’ where teachers prepare the learning space design to be part of the learning process through designing tools as a learning resource. This put the classroom at heart of the learning space design.

2.5.2 The Shift in Learning in the New Century

While learning approaches and practices have changed fundamentally from the teacher-centred model of the earlier years of the last century critics complain that today learning spaces are very outdated. Michael Bloomberg, who served as the mayor of New York City, said that current learning in U.S.A “ looks a lot like the U.S auto industry in the 1970s, stuck in a flabby, inefficient, outdated production model” (OWP/P.Architects

et al., 2011). Learning spaces need to express the new educational requirements of 21st century learners (Chism, 2005b, Fisher, 2002, Temple, 2007). With formal classrooms remaining largely unchanged for several centuries, apart from incorporating obvious technical advances, out datedness of learning spaces now threaten to hinder the implementation of flexible learning approaches and theories being introduced into the US's education (Jamieson, 2003) to support 21st century students with their diverse learning styles, preferences and awareness of new technologies (Lonsdale and Hanson, 2010), currently the literature does not inform designers how to meet these needs.

2.6 Users of learning space

2.6.1 Users' Participation in Designing Learning Spaces

Participatory Design involves the user in the design process—an important theme in the existing literature (Jamieson et al., 2000, Morgan, 2000, Radcliffe et al., 2008, Higgins et al., 2005, Fisher, 2005). Participative Design is about designing with people and not just for them (Sanders et al., 2001) and; where 'users' work with designers as partners (Sanders and Stappers, 2008). Participation Design involves activities where users engage in conversation with the designer, answer questions, generate personal account and make visible the ordinary, and engage in conversation (Graham and Rouncefield, 2008), Participative Design also focuses on data collection and "*can be described in terms of a set of analytic and constructive commitments, commitments that can be understood as either moral/political or as methodological*" (Graham and Rouncefield, 2008). Participation aims for designing usable and meaningful technologies (Hagen and Robertson, 2010) in a process whereby the roles of the designer and the researcher blur (Sanders and Rim (2002) and the user becomes a critical component within the design process. Within this process new tools are designed which help users to express themselves and to participate proactively in the design development. However, Participative Design is about people designing *together with designers* to harness the collective and infinitely expanding set of ideas and opportunities for rethinking design problems (Sanders and Rim, 2002).

Successful participative design needs to be concerned with design politics and a participation perspective, as well as methods, tools and techniques (Blomberg and Kensing, 1998). This process takes into consideration validity, generalisation and ethics, while often using props as a method to encourage participation (Graham and Rouncefield,

2008). More recent design literature recommends using a Participatory Design process to design learning spaces because this will improve teachers' practices and, in turn, will benefit students' learning (Temple, 2007, Higgins et al., 2005, DEECD, 2009, Fisher, 2002). Typically, there is a separation between those who design learning spaces and the teachers and pupils who use this space (McGregor, 2004b), with the architect considered to be the creator while the teacher was seen as its housekeeper, arranging it and provisioning it (Loughlin and Suina, 1982a). Thus, learning spaces have traditionally been designed by architects and designers, not by teachers. Further, designers and architects usually mirror contemporary architectural styles and do not overly concern themselves with educational ideas, which has led to the widespread reproduction of the industrial model of classrooms (Wardlaw, 2011). So while physical design of learning spaces has largely been seen as the responsibility of non-academic personnel, teachers were asked with improving teaching practices, to inspire pupils' learning (Jamieson, 2003). However, there are some exceptions such as Emilio, Montessori and Dewey who all influenced the design of the classroom deriving ideas from particular educational philosophies (Jamieson et al., 2000, Abassi, 2009, Ceppi and Zini, 1998). The design of new learning spaces, and/or the renovation of existing classrooms and other formal and informal spaces, have a direct impact on pupils' learning experience; teachers should be involved (Jamieson, 2003). Pupils seldom able to influence school buildings design (Ghaziani, 2008). Today however, there is a growing movement to involve users (McGregor, 2004b) and architects-designers now are working with teachers, the community and pupils to design new or renovate old learning spaces (Jones, 1981). The benefits of participating with users are: to make sense of what users want from education (McGregor, 2004b) and to gain effective insights into users' needs (Jones, 1981). Furthermore, to involve users in design aspects can give them a measure of control over the learning space and over their own learning (JISC, 2006). Lippincott's study (2009) found that new spaces did not result in changes being made to pedagogical practices or to pupils' learning if the teachers and students were not involved in the design of the learning space (Wardlaw, 2011).

So, involving users and understanding their needs enables researchers and designers to gain insights into the relationship between the learning space and learning, as well as to understand more about the subtle interplay of factors that hinder or enhance students' performance (Flutter, 2006). And while several international studies have involved teachers and students in the design process (Ghaziani, 2008, Burke and Grosvenor, 2003)

there are still only limited details that have been recorded about these approaches (Parnell et al., 2008).

A trend towards participatory decision-making is mirrored in the research literature concerning learning space, with closer attention now being paid to listening to teachers and students (Thomson et al., 2009). However, the future of learning spaces demands that architects and designers participate with students and teachers at the very beginning of the design process in order to interpret both evolving learning trends and everyday interactions with space, products and systems that facilitate learning (Heppell et al., 2004). Users need to be available ‘as good clients’ who have the ability to understand the role of effective design and its impact on improving quality; they also need to recognise barriers to design and be able to avoid the common pitfalls. Visiting and looking at previous design space projects has been noted as helping to inspire clients when embarking on their own projects (CABE, 2006).

2.6.2 The User’s Voice

Hattie’s (2009) study about school size has shown that interaction between teachers and students is one of the greatest predictors of learning outcomes (Bowen et al., 2008, Alton-Lee, 2003).

2.6.2.1 Teachers

A teacher can arrange a learning space as an active inspiration for the learning experience of his/her pupils during the teaching and learning process (Loughlin and Suina, 1982a). Since teachers use what architects design and provide, they inherit learning spaces and have to deal with and adapt in such a way that permits their teaching to take place. Its design can hinder a teacher’s approach (Horne, 1999).

The input teachers can add to design can be critical (Temple, 2007, Higgins et al., 2005, Sanoff, 1995) because of their attitudes and behaviours affect the way they use the space, and therefore students’ learning outcomes. Hence, a lack of teacher involvement lead to negative learning spaces (Temple, 2007, Fisher, 2002, Wolff, 2003). In creating a flexible space, it is predicted that teachers will increase and refine their repertoire of teaching methods (Radcliffe et al., 2008). One of constraints to pedagogical innovation is the limitations in the power to make changes (Margaret C. Lohman, 2000). Additionally, an effective integration between a learning space and pedagogical and programmatic

innovation needs to pay attention to teachers' learning and engagement (Hunley and Schaller, 2009).

2.6.2.2 Pupils

Pupils' participation usually focuses on their ability to be involved in decision-making processes (Clark, 2010). Gordon Wells (1986) uses the term 'meaning making' in studying young children's language development (Clark, 2010). Considering children as meaning-makers is a social constructivist view of learning where learners are seen as playing a dynamic role in constructing knowledge in a social context (Vygotsky, 1978b, Rogoff, 2003). There has been limited research on pupil's view of their own world and what meanings they attach to the physical spaces they inhabit (Clark and Statham, 2005). However, because pupils' participation is an important element in learning communities (Clark, 2010), there is a growth of interest today in the students' voice and educational research has increasingly focused on listening to what young learners say about the conditions they experience in schools and classrooms (Flutter and Rudduck, 2004). Such studies have enabled researchers and practitioners to gain insights into the relationship between learning space design and learning itself, as well as to understand more about the subtle interplay of factors that impede or enhance student performance (Flutter, 2006).

Pupils' voices are now considered as a powerful focus with regard to learning (McGregor, 2005) because pupils know a great deal about their school environment; therefore their voices could serve as valuable sources of information that should be explored by designers and architects. Hence, it is important to discover pupils' needs and their own ways of seeing, as well as the spaces that are required to support their activities and aesthetic preferences (Ghaziani, 2008). According to Fraser (1998), students are in a good position to evaluate their classrooms because they have experienced many different learning spaces and spend enough time in such spaces to form accurate impressions. Besides, even if students' everyday behaviour is inconsistent, they often project a reliable image of the long-standing attributes of classroom space (Fraser, 1998). Additionally, pupils' voices are also important in creating a better and more sustainable learning space; they are most effective in inspiring designers and architects with new ideas, analysing, criticising and highlighting problems with their learning spaces, and suggesting ways of improving them (Care and Chiles, 2006). In addition, in some projects, it is possible to involve pupils in constructing things which can give pupils a significant potential for improving their own educational experience. Care and Chiles (2006) found that involving

pupils in designing and constructing full-size models or real objects had a great impact on the way pupils responded to their learning space.

Recent literature has provided rich resources with regard to participative learning space design. For example, these include books, such as *“The School I’d Like”* (Children and Young People’s Reflections on an Education for the 21st Century) by Catherine Burke and Ian Grosvenor; *“The School Works Toolkit, Joined-up Design for Schools”* by the Sorrell Foundation; *“Looking from the Inside Out”* by the Arts Council; CABE (Commission for Architecture and the Built Environment); *“The Young Design Program, Fielding Nair International Schools”* – Design Patterns for 21st Century Schools; *“The Third Teacher”* which is a collaboration book project between WOP/P architects, VS Furniture and Bruce Mau Design, and *“Transforming Children’s Spaces”*; these provide a number of different approaches to improve learning space design through participation with users (i.e. both teachers and students). Furthermore, the book, *“Primary Ideas”* tries to be more direct about how the design of learning spaces can be improved by looking at ideas which have been created by teachers and schools. This book contains information and ideas without architectural input; it expresses the wealth of creative ideas that already exist in schools (Care and Chiles, 2006).

2.6.3 Participatory Approach Projects

Three projects have been selected because of their clearly participative methods that have been recorded with users, users’ comments about the projects, and the design success the school project has achieved. The Erika Mann Elementary School is explained in the next section while for economies of space two further examples (New Dalry Primary School and Colmonell Primary School) are outlined in APPENDIX 2.

The architects of this project encouraged pupils aged from 9-13 years to participate in creating collages of imaginary landscapes during a workshop entitled ‘The Path through the Garden of the Future’ (Dudek, 2008). Through the collage art produced in this workshop, pupils were given the opportunity to offer an expression of the future design of their school. The ‘Baupiloten’ was inspired by pupils’ drawings, visions and wishes; it was an attempt to interpret moods and atmospheric effects and to define them in collages and 3D models (Dudek, 2008). After this, the results were turned into prototypes which pupils were finally invited to examine and re-evaluate. Figure 17 and Figure 18 show some

of the different ways pupils participated in the project. Furthermore, parents and teachers were also actively involved in the school design process.



Figure 17: (Right): Children choosing their favourite designs submitted by the Baupiloten.

Figure 18: (Left): Children's collage workshop.

Source: (Dudek, 2008).

The students chose to create a playful and communicative design, 'World of the Silver Dragon', for their school design (Dudek, 2008). As visitors enter the school, they are welcomed by a small exhibition of the pupils' 'World of the Silver Dragon' art work. The ground floor and one of the stairwells are designed as a gallery to display children's current work. *"The further you go into the school building the more strongly you feel the spirit of the Silver Dragon: a spirit which changes, resonates, glows and shimmers"* (Dudek, 2008).

Figure 19 and Figure 21 show different images of the design of the different floors, Figure 19 shows hallways which have been designed with flexible verities of learning areas, and architects designs that stimulate students through the use of different lighting sources, natural and artificial, colours, and elements from nature.



Figure 19: Hallways design in The Erika Mann Elementary School.

Source: (Chami, 2008a).



Figure 20: Different floor designs in The Erika Mann Elementary School.

Source: (Ward, 2009).

The redesigning of this school has been carried out with the participation of pupils during the design process; this captured their imagination to such an extent that they were able to sense and describe the presence of the dragon (Dudek, 2008).

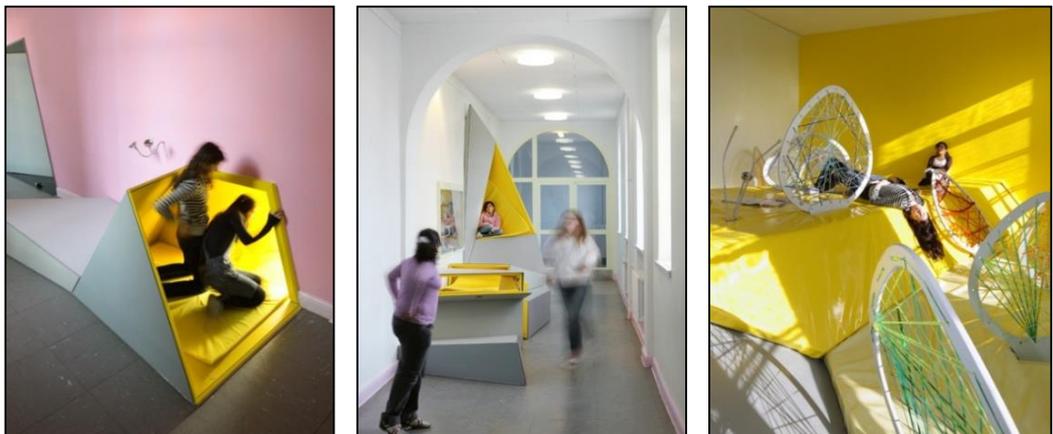


Figure 21: Different floor designs in The Erika Mann Elementary School.

Source: (Ward, 2009).

Participation between designers, teachers and students has produced various good examples of learning space projects. Since, participatory design makes users an integral part of the design process at the early front end (Sanders et al., 2001) these examples stop being designed after designers finished their work. The space was given over to teachers, who then could start redesigning and adapting the learning space to best facilitate their teaching methods. However, Participatory Design is an ongoing process as users' needs and experiences change over time (Sanders and Rim, 2002). Change is often enforced through the continuous changes in teaching and learning methods and institutional processes. Participatory Design should be able to help elicit the hidden message and unspoken data between what people say they want of space, what they do and make with/in the space, in relation to observations of how they currently design and adapt their space. Revealing these hidden messages, in the way teachers and students move, use, interact and redesign the space and comparing this with what they say they want from space design helps to explain to designers how the design can be improved and developed to facilitate teaching and learning. Participatory Design is not a linear process, but a constant intersection of changing perspectives (Sanders and Rim, 2002).

2.7 Design Elements of the Learning Space

The next section describes design considerations of learning spaces. It is important to mention here that many research studies discuss the effect of learning space design elements on pupils' achievements but they do not necessarily relate these impacts to the way learning spaces should be designed. Most of these studies have not been followed through to the level of practice where architects translate ideas into design elements. However, a few research studies, such as that of Barrett and Zhang (2009b), have related these elements to the way a learning space designed. Current literature on design elements of learning space rarely support the theoretical description of these design elements with visual images from practice that can better clarify some design elements such as colours. Furthermore, most of the current literature review covers the technical side of the design elements and don't explain how to use it to support different teaching approaches. Therefore, this chapter been supported with visual examples.

2.7.1 Environmental Impacts

Temple (2007) and Higgins et al. (2005) mention several environmental elements that impact on pupils' learning. These include temperature, noise, ventilation, lighting and air

quality (Higgins et al., 2005, Keep, 2002, Earthman, 2004a, Sundstrom, 1987, McNamara and Waugh, 1993, Weinstein, 1979b). Generally, although these environmental impacts are considered to be basic, they are the optimal conditions in which pupils and teachers perform (Wardlaw, 2011), and impacts good health and hygiene, and mental and emotional well-being to ensure their productivity and learning (Hille, 2011). However, most of the current studies about the design elements of learning space focus on the environmental design elements (Bosch, 2006).

2.7.1.1 Temperature, Indoor Air Quality (IAQ) and Ventilation

According to Earthman (2004a), temperature and air quality are the most important design elements that affect pupils' achievements in a learning space. These elements showed strong consistent effect on learning (Odaci et al., 2011). Temperature and air quality have a demonstrable impact on student learning outcomes (Cash, 1996, Earthman, 2004b, Hines, 1996, Lanham, 1999).

1. Temperature

Teachers who won State Teachers of the Year award emphasised their ability to control the space temperature as central to both teachers' and pupils' performance (Lowe, 1990). Thermal comfort clearly affects both teaching quality and student achievement (Lackney, 1999), and that as temperature increases and pupils report greater discomfort, their performance and achievement deteriorates as attention spans decreases (King and Marans., 1979). In fact, excessive temperatures has been linked to stress in pupils (Young et al., 2003). Thermal comfort in a space is achieved by maintaining temperature, humidity, air movement and users' activities within a certain range (Szokolay, 2003). A new building design should not just aim to achieve thermal comfort, but also to make efficient use of heating, by using heat from warmer environments such as IT centres (JISC, 2006). Barrett and Zhang (2009b) claim that there are three space design options in particular that influence thermal performance: orientation, space layout and windows. Fundamentally, the orientation of the space determines at what time and for how long an amount of solar heat is received. For instance, there is stronger and more intense sunlight and heat in spaces which are orientated towards the West than those towards the East (Barrett and Zhang, 2009b). Space shape and layout impact heavily on heat gains and losses because the heat exchange between the outside and the envelope is directly proportional to the surface area (Barrett and Zhang, 2009b). Windows play an essential

role in the thermal environment of a building. The larger the window size, the more the solar gain and the greater the heat loss (Barrett and Zhang, 2009b, Ward, 2004). Young et al. (2003) found that solar heating through glass is a major contributor to overheated learning spaces. In addition to window size, the arrangement of the windows and other openings provide the architectural character of the main space (Barrett and Zhang, 2009b).

2. Indoor Air Quality (IAQ) and Ventilation

There is a growing body of research linking learning achievement, and pupils' performance and productivity to the indoor air quality of the space (Schneider, 2002a, EPA, 2010). This research show that poor indoor air quality (IAQ) is a common problem even in new schools (Hani et al., 2011) and is a cause of discomfort (Barrett and Zhang, 2009b) leading to health problems, such as asthma, one of the leading causes of school absenteeism (Centers.for.Disease.Control.and.Prevention, 2009). Additionally, poor IAQ is a factor in 'sick building syndrome' which, in turn, increases pupil absenteeism, reduces pupils' performance (EPA, 2000, Kennedy, 2001, Leach, 1997, Smedje and Norback., 1999, Rosen and Richardson., 1999, Barrett and Zhang, 2009b), and discourages their engagement (Hunley and Schaller, 2009, Barrett and Zhang, 2009b). Meanwhile, improved indoor air quality has been shown to increase productivity and improves mental performance (SFRB, 2008). One study showed that pupils in classrooms with higher outdoor air ventilation rates scored 14% to 15% higher in standardised tests than pupils in classrooms with lower outdoor air ventilation (Shaughnessy et al., 2006). Good ventilation then increases pupils' test scores, and reduces the airborne transmission of infection (Myhrvold et al., 1996, Mendell, 1993, Seppänen et al., 1999, Apte et al., 2000, Shendell et al., 2004). According to Barrett and Zhang (2009b), there are two learning space design practical options related to indoor air quality (IAQ) and ventilation: (A) Orientation and (B) Windows.

A. Orientation:

This option concerns the prevailing wind, which can be either wanted or unwanted. As much wind as possible can either be received or diverted through design.

B. Windows:

A window is a “breach in the enclosing skin of the building, providing an opening for the flows – inward and outward – of heat, light sound, view and air ventilation” (Barrett and Zhang, 2009b). Wind pressures are positive (push) on the windward side of the building and/or negative (suck) on the leeward side; this motivates good cross-ventilation in spaces with windows and/or doors on opposite sides. However, this should be controlled carefully in order to avoid too much air movement on windy days. Usually, windows are used to provide passive ventilation; thus, windows should be designed carefully to allow for different weather conditions. In an ideal learning space design, windows should have ventilation options which include a number of types. Figure 22 shows ventilation options for varying conditions:

1. **Small size window at a high-level:** This type of window allows a small amount of ventilation in high winds. Figure 23 shows how can small windows at a high level be designed to allow ventilation.
2. **Trickle ventilators in cold weather seasons:** This type of window is appropriate for high winds and when other windows are shut for security.
3. **Large size windows for summer seasons:** This type of window constitutes the main central windows in a space.
4. **Small size windows at bench height:** This type of window is used for all-round ventilation; users may need close them in very windy conditions to prevent papers flying.

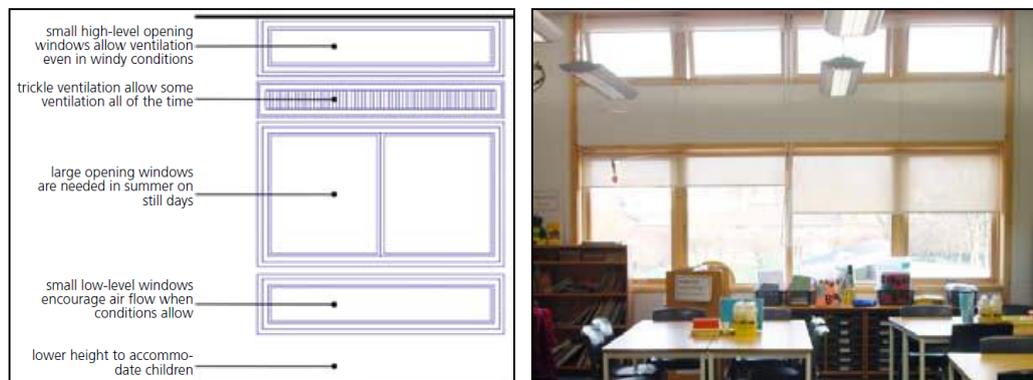


Figure 22: (Left): Ventilation options for varying conditions;

Source: (Barrett and Zhang, 2009b).

Figure 23: (Right): Small windows at a high level, allowing ventilation;

Source: (Barrett and Zhang, 2009b).

2.7.1.2 Light

Lighting ranks next in the order of criteria which influence student outcomes, with daylight offering the most positive effect (HeschongMahoneGroup, 1999). The lighting of learning spaces plays a critical role in pupils' performance (Phillips, 1997, Buckley et al., 2004a, Dunn et al., 1985), their productivity, health and as a financial return on investment (Boyce et al., 2003). Boyce et al. (2003), in explaining how lighting can impact on users' performance, note that there are three ways in which lighting conditions can influence users' individual performance. These ways are: (1) The visual system where capabilities in this system are determined by the lighting conditions; (2) The circadian system, which is influenced by light; (3) The perceptual system, as messages delivered by this system are influenced by many factors, lighting being one. Jago and Tanner (1999) offer the results of seventeen studies carried out from the mid- 1930s to 1997 which show that adequate lighting improves pupils' test scores, decreases off task behaviour, and plays a significant role in pupils' achievement. Learning space light is about the sensation of daylight which provides visual comfort and facilitates visual performance (Barrett and Zhang, 2009b); furthermore, using daylight as a primary light source is an essential component of sustainable buildings because it is expected to minimise the use of electricity (Boyce et al., 2003). Sources of daylight in learning spaces could be windows, skylights, borrowed light and reflected light (Tanner, 2009).

Kingsland Primary School offers an example of a classroom that was designed to allow an adequate amount of daylight (Architecture-and-Design-Scotland, 2010b). Figure 24 and Figure 25 show different ways of designing windows to provide daylight; Figure 24 large windows run along one wall of the classroom to provide daylight, while in Figure 24 the windows also operate as doors, which provide daylight as well as physical access to the playground outside.



Figure 24: (Left): Daylight in Kingsland Primary School classroom.

Source: (Architecture-and-Design-Scotland, 2010b).

Figure 25: (Right): Daylight in Kingsland Primary School classroom.

Source: (GRAHAM, 2010).

However, daylight offers a more positive effect on student outcomes than other forms of lighting, potentially due to its biological effects on the human body (HeschongMahoneGroup, 1999, Wurtman, 1975, Uline and Tschannen-Moran, 2008). Natural light helps in creating a sense of physical and mental comfort inside the learning space, so its benefits seem to be more than just being an aid to sight (Barrett and Zhang, 2009b). Furthermore, according to Gee (2006) and Boyce et al. (2003), lighting design can be an element in changing pupils' levels of stimulation and mood, and changes in pupils' moods affect their judgement and behaviour (Boyce et al., 2003). There has been shown to be some stability in mood for the same lighting conditions (Boyce et al., 2003) and therefore there has lately been renewed interest in increasing natural daylight in learning spaces (Schneider, 2002a). Good daylight design is important for learning spaces from a quantitative point of view, for the performance of certain visual tasks and, from a qualitative point of view, it provides a necessary and pleasantly luminous environment (Barrett and Zhang, 2009b). However, it is important to mention that, although daylight is clearly preferred over other types of lighting as a source of illumination, users will give up daylight when it is linked to visual or thermal discomfort or a loss of privacy (Boyce et al., 2003). According to Barrett and Zhang (2009b), the essential requirements for effective day lighting are: an adequate amount of light, a satisfactory distribution of light components and absence of glare. In its report "A Guide to 21st Century Learning Space Design", JISC (2006) claims that new building materials can produce spaces which are both self-regulating and which allow natural light to pass through. Natural light can be maximised using transparent membranes and atria style double height windows in

corridors. These are distinguishing features of several new learning spaces and can create an inspirational ambiance.

A design needs to consider the number of windows and their size and shape: for example, there could be one small window, a few small windows, large windows on two sides (see Figure 26;(Heschong et al., 2002b) and other glazed areas such as skylights (see Figure 27; (Heschong et al., 2002b).



Figure 26: (Left): Large windows on two sides.

Source: (Heschong et al., 2002b).

Figure 27: (Right): Sky light.

Source:(Heschong et al., 2002b).

A successful example of using a skylight to bring natural light into a space is at Kingsland Primary School where skylights were used to bring light into corridors. Figure 28 shows a skylight in Kingsland Primary School corridors (Architecture-and-Design-Scotland, 2010b). However, Daylight will be more uniformly distributed in a room with more than one window compared with a room with a single window, Figure 29 shows this daylight concept.



Figure 28 (left): Skylight in Kingsland Primary School corridors, source: (Architecture-and-Design-Scotland, 2010b)

Figure 29 on the (right): Daylight Concept, source: (Barrett and Zhang, 2009b)

One example of the excellent use of daylight is at the Ben Franklin Elementary School. This school has used the building as an important modulating device, integral to the perception of space. Figure 30 shows the Ben Franklin Elementary School classroom and activity area with its large area of glazing while Figure 31 shows the clerestory windows for diffusing daylight in the library area of the Ben Franklin Elementary School.



Figure 30 (Left): Classroom with large glazing area, source: (Barrett and Zhang, 2009b).

Figure 31 (Right): Clerestory windows to diffuse daylight in the library, source: (Barrett and Zhang, 2009b).

Most of the literature explains lighting in learning spaces in terms of its purpose, some studies provide extensive technical information about lighting while there is limited literature about lighting as a decorative element. The concept of lighting as a decorative as well as a functional design element is not new. Figure 32 shows examples of lighting in the “Tree of Dreams” project (Chami, 2008b) in which the Die Baupiloten architect “concentrates on bringing daylight into the inner core of the building, which is called the atrium. Depending on the seasonal position of the sun each season has its own dedicated set of reflective steel panels, the so-called “leaves” conducting the sunlight deep into the building” (Chami, 2008b).

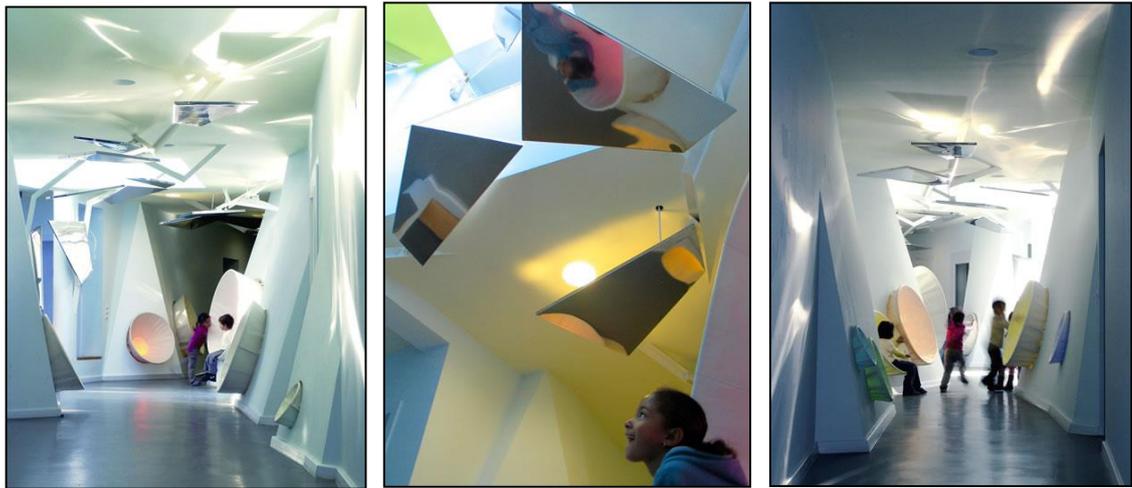


Figure 32: “Tree of Dreams” project lighting

Source: (Chami, 2008b).

2.7.1.3 Sound

Sound in learning spaces is about creating appropriate conditions for listening to sound that is wanted and eliminating unwanted sound (noise) (Barrett and Zhang, 2009b). Studies on sound have shown that this has an impact on pupils’ learning (Cash, 1996, Earthman, 2004b, Hines, 1996, Lanham, 1999). Good acoustics are fundamental to pupils’ academic performance (Schneider, 2002a, Buckley et al., 2004a) and higher achievement is linked to learning spaces with less noise (Schneider, 2002a), not least as: *“Sound experiences trigger emotions and activate numerous areas of the brain”* (Dudek, 2008). Additionally, sound is strongly connected with the autonomic nerve system which affects blood pressure and the respiratory rate (Dudek, 2008). Sound such as chronic noise exposure has been found by a number of studies to hinder cognitive functioning and impair reading skills, as well as to give rise to deficiencies in pre-reading skills (Haines et al., 2001, Evans and Maxwell, 1997, Maxwell and Evans, 2000, Higgins et al., 2005). In addition, high noise levels increase students’ dissatisfaction with their learning space and excessive noise causes stress in pupils (Schneider, 2002a, Fisher, 2000b, Crandell et al., 1995, Nabelek and Nabelek., 1994, ASLHA, 1995, Crandell, 1991, Crandell and Bess., 1986, Evans and Maxwell., 1999). Moreover, noise levels have an important impact on teachers as well, according to Lackney (1999), teachers believe that excess noise impairs academic performance. Barrett and Zhang (2009b) claim that sound control over the acoustics in a room offer good quality conditions for the production and reception of desirable sounds. The two principal aspects which determine the sound environment of a building are the quality of auditory perception and, noise control. Addressing these

two aspects improves communication, working and learning efficiency (Barrett and Zhang, 2009b). Barrett and Zhang (2009b) mention three design options in particular that influence sound inside a space. They are: location, layout and the room. With location for instance, the learning space should be sited away from busy roads. With layout, sensitive spaces should be carefully separated from intruding noise which is coming from outdoors and from within the building. Special measures can be taken to enclose noise which is produced, by using, for example, buffer zones, heavyweight walls and/or floating floors. For instance, spaces such as storerooms, toilets and corridors can act as buffer zones in order to provide acoustic separation between classrooms. Figure 33 shows how toilets and a corridor act as noise buffers in the Confirmatory school. From school feedback, staff and pupils were found to be satisfied with the noise control.

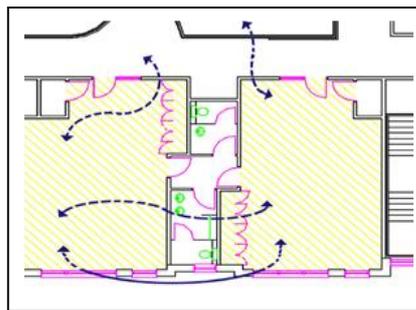


Figure 33: Using toilets and corridor as noise buffers in Confirmatory School.

Source: (Barrett and Zhang, 2009b).

And finally, regarding the room: “*sound-absorbent surfaces can be used in order to change the sound characteristic of the space*” (Barrett and Zhang, 2009b). Although some reverberation within a space helps to distribute speech, longer reverberation times lower speech intelligibility (Butin and Jefferson, 2010) and absorbent materials are widely used, for example on classroom ceilings, to reduce reverberation and the annoying impact of sound (Lackney, 2002). Similarly, room-shape determines how sound is diffused within a space: “*Concave surfaces concentrate the sound while convex surfaces diffuse it. Narrow angles, niches and rooms linked by openings because so-called sound accumulations, which may produce unpleasant delayed reverberation*” (Dudek, 2008). If a built classroom has a problem with reverberation, some immediate and useful solutions can be found, including introducing sound-absorbing porous materials such as heavy curtains and soft chairs (Barrett and Zhang, 2009b).

2.7.2 Aesthetics

“Aesthetics is defined as the philosophy that deals with beauty and with human judgments concerning beauty” (H.Perkins and Brown, 1999) and concerns “beauty” in every variety of aesthetic experience (Stace, 1929). Environmental aesthetics can be defined broadly as the interaction between the user and the environment in relation to beauty (H.Perkins and Brown, 1999). In learning spaces, a ‘different aesthetics’ should be considered, which is concerned with attractive, clean and orderly spaces (Schneider, 2002a, Sanoff, 2001a). “The aesthetic features of a school can foster a strong sense of belonging that, in turn, can generate an enthusiasm for learning” according to Jarman et al. (2004). Clearly the impression of the space is a reflection of the place’s ‘personality’, and a positive impression suggests friendly pupils and teachers (Tanner, 2000). In addition, improved aesthetics, such as decoration and the design and presentation of furniture and carpeting were associated with increased student scores (Cash, 1993, Earthman, 2004b, Hines, 1996, Lanham, 1999). One example of improved aesthetics in learning space design is the Family Service Primary School in Berlin, where the waiting areas and office rooms were converted into open learning space, where vivid paintings replaced those of beige and grey, and where playful, multipurpose and colourful furniture was added (see Figure 34).



Figure 34: Family Service Primary School

Source: <http://www.baupiloten.com/>

In a very recent study, the SKG Project proposed aesthetic principles that included symmetry, harmony, simplicity and fitness for purpose (Souter, 2010), incorporating CAFEBAR design principles (Souter et al., 2009). These principles are shown in some new learning space designs in several ways: for instance, in high-quality, café style furnishings and floor materials; and in the inclusion of an outdoor ‘learning terrace’, as in the FBEL Learning Commons, which includes fixed seating and a bench space. These

qualities are vital because there is evidence which suggests that students view aesthetically pleasing spaces as institutional interest in their experience (Souter, 2010) and reflects on students' perceptions of interest in their learning (Riddle and Souter, 2012). However, nowadays, instead of being purely functional, spaces that pupils want to go to, need to be created, similar to the way cafés attract people (Bunting, 2004). Learning space design should include 'friendly and agreeable' entrance areas, with particular attention being paid to the colour used (Fisher, 2000a, McGregor, 2004a). An example of café style learning space is shown in Lewis' Girls Comprehensive School, where different flooring materials, fixed seating, a bench space and colourful furniture are provided (see Figure 35). Other examples of high-quality, café style furnishings materials can be found APPENDIX 3.



Figure 35: Lewis' Girls Comprehensive School

Source: <http://www.bofeducation.co.uk/project/88#>

Learning spaces should be regarded as a product which needs to be well designed for its users. It is important, according to Patrick Jordan (1999), that designers should not just look at problems, but should also think of things that give pleasure, noting product aesthetics as a factor that should be considered while designing. Jordan discusses pleasure in relation to physio, achieved through physical sensations; socio pleasure, created through communication and time together; psycho pleasure, accomplished through achievements and challenges and IDEO pleasure, gained through product aesthetics.

One of the most important aesthetic features in learning spaces is legibility, because a legible space is easy to comprehend aesthetically (Martin, 2002a). Legibility and coherence can be produced by using different forms, pathways, visual access and patterns (Trancik and Evans, 1995), and can be organised into intelligible patterns through shapes and forms (Martin, 2002a). Legible classrooms function well, both physically and socially (Martin, 2002a) and bear influence over teachers' and students' orientation in the space, easing their movement through it. Features which support a legible and coherent

classroom are: landmarks, visual access, and hallways, textures, colours and different floor and ceiling levels (Martin, 2002a). Figure 36 shows a children bookstore, designed in Beijing by SAKO. In which differing levels of floor and ceilings add legibility and make coherent the intended functions of reading corners and book shelves.



Figure 36: Children Bookstore in Beijing

Source: <http://www.duitang.com/people/mblog/19601070/detail/>

2.7.3 Level of Stimulation

Achieving an appropriate level of stimulation in a learning space is about both focused attention and peripheral perception (Barrett and Zhang, 2009b). It is the extent to which the learning space delivers an adequate quality and quantity of visual, auditory and tactile stimulation (Evans, 2006, Schneider, 2002a, Heschong et al., 2002a, King and Marans., 1979, Evans and Maxwell, 1997, Olds, 2001). Friedrich Froebel, the teacher who introduced to the world the value of play in education, believed that stimulation is the first step towards creativity (Liebschner, 1993). Designing different levels of stimulation in a space can increase users' engagement with that space and work as a 'silent curriculum' (Taylor, 2005b). In addition, combining pleasantness with different levels of stimulation yields either excitement or relaxation (Barrett and Zhang, 2009b). Caine (2008) claims that some of the 12 brain/mind learning principles recommend direct connections between stimulation, learning and physical space (Caine, 2008). When a learning space provides an appropriate level of stimulation for a given situation, the brain and mind will react positively, affecting mood, mental clarity and energy levels (Barrett and Zhang, 2009b). For example, a white, rectangular, antiseptic space with overhead lights and bland floor tiles will create a certain behaviour for the occupants of this space

(Chism, 2005a). Human beings yearn for colourful spaces, and natural and interesting room shapes (Chism, 2005a). Mystery stimulates students' minds and senses, inviting discovery, so considering the potential of hallways and pathways may offer unexpected learning spaces for group work and individuals (Gee, 2006). Furthermore, multisensory experiences stimulate users to use learning spaces; visual, auditory, kinesthetic and tactile experiences all manipulate memory and the intake of information (Prashnig, 2004b). While the majority of research focuses only on visual stimulation (Heerwagen, 2008) different modalities of stimulation increase mental awareness and help students to understand information and ideas which learning spaces provide (Miller, 2004).

However, few learning space designers consider that certain learning experiences may be attached to a specific space, sound, or smell which provide cues that can help the brain build memory and process information, since what humans learn is associated with where they learn it (Gee, 2006). Sensory stimulation is a critical part of people's responses to buildings. One study has shown that people valued the daylight because they liked the variability in light and colour over the day and across the seasons (Heerwagen, 2008). In learning space design, four parameters seem to stand out with regard to occupants' sensations and perceptions of a space: complexity, colour, texture, and nature.

2.7.3.1 Complexity:

According to Barrett and Zhang (2009b), "*Complexity refers to visual richness, which can be related to the number of noticeably different elements in a scene (diversity) without negative content such as clutter and disorder. This often needs to be balanced with a degree of order (unity) in order to provide clarity and familiarity.*" Generally, theories suggest that diversity and novelty produce complexity which, in turn, influences stimulation and preference. Results from building studies show that people's excitement and interest increases with increases in diversity; people prefer moderate levels of diversity (Barrett and Zhang, 2009b). Additionally, there is an agreement among researchers that complexity catches an observer's attention and stimulates arousal which makes him/her try to make sense of it. Hence, space design that provides order and linked features should evoke pleasurable responses; this pleasure could be heightened through a combination of order, diversity or typicality (Sonnenfeld, 1966, Canter and Thorne, 1972, Kaplan et al., 1976, Brower, 1988). Diversity can provide visual choices in terms of shape, form and colour. The regular box is not the only format designers should use as adjusting the space geometry can balance hard and soft forms, create both asymmetrical

and symmetrical patterns, offering visual richness and tangible interest (Barrett and Zhang, 2009b).

2.7.3.2 Colour:

According to Smith, colours are: “*An interplay between lighting, materials and texture; to influence the perception of form; to operate spatially; to have ‘personality’ or character; and to evoke associations for the viewer, how the environment appears and is experienced as a text involves colour*” (Smith, 2008). The interaction of colour in three dimensional spaces such as buildings and interiors has an impact on aspects such as space, volume, scale, atmosphere, and narrative; these aspects are important for the space’s occupants (Smith, 2008). A great deal of research has studied the impact of colour on the built environment and occupants’ perceptions of it (Swirnoff, 2003, Mahnke, 1996, Gaines and Curry, 2011). However, although the nature of colour and its relationship with the human environment are both well researched, it is posited that both areas need to be integrated in order to comprehend the active role that colour plays in the relationship between a person and his/her surrounding environment (Smith, 2008).

Colour is a powerful design element which can create profound psychological and physiological responses (Gaines and Curry, 2011) and researchers have revealed relationships among colour preferences, emotions and academic performance in pupils (Boyatzis and Varghese, 1993, Imhof, 2004, Karp and Karp, 2001, O’Connor et al., 1990, Terwogt and Hoeksma, 2001, Wilkins, 2003). According to Read et al. (1999), colour has an impact on pupils’ cooperative behaviour while the colours on classroom walls affect productivity and accuracy (Engelbrecht, 2003, Birren, 1997). In addition, researchers have found that when colour is transmitted through the human eye, the brain releases a hormone that affects human moods, energy levels (Engelbrecht, 2003), human perceptions, their sense of space and their wellbeing (Dalke et al., 2006). Colour can also create uncomfortable conditions such as glare (Vionet and Chevreur, 2001).

As mentioned before, colours can be used to define a space’s form and manipulate its users (Smith, 2008), architects such as Barragan (Ambasz, 1984) demonstrates this concept. For example by colouring architectural planes such as walls, fins and floor Barragan define forms to look as an entrance or setting bench, Figure 37 shows examples of Barragan’s work.

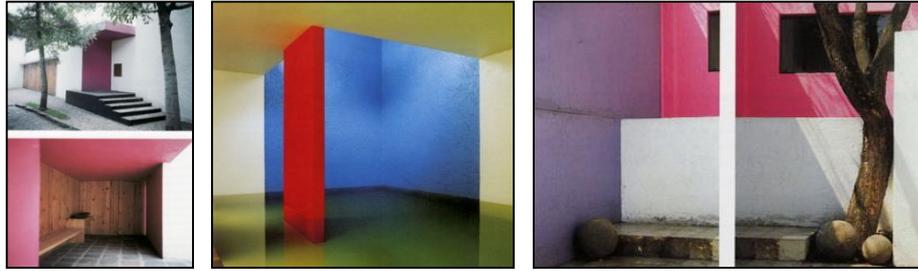


Figure 37: Examples of Barragan's work. Source: (Pauly, 2008).

Other examples include the work of Holl (Ojeda and McCown, 2004), Foster (Koolhaas et al., 2001), and Piano (Abbey, 2006) who have also used colour to express the structure of buildings which, in turn, has an impact on the way observers read the building's exterior form. Another example for defining spaces by colours is a temporary exhibition named "living for tomorrow" in Bangkok designed by Bangkok-based design firm. As in Figure 38 shown, in this exhibition the colours are used to define space functions in one open space.



Figure 38: Defining Space by Colour in Living for Tomorrow Exhibition

Source: <http://www.designboom.com/design/apostrophys-colorizes-living-for-tomorrow-exhibit-in-bangkok-02-21-2014/>

Balancing research into colour with occupants' personal interpretations of colours becomes the designer's task when colour choices are made for a space (Engelbrecht, 2003). While choosing the colours of learning spaces for elementary grades, designers should consider that pupils prefer a warm, bright scheme which compliments elementary pupils' naturally extrovert nature (Mahnke, 1996, Gaines and Curry, 2011). Figure 39 shows an example of learning space for elementary grade students at East Kilbride School in UK. A warm, bright colour scheme complements the tendencies of young people of this age and thus reduces tension, nervousness and anxiety; such colours could be light salmon; soft, warm yellow; pale yellow-orange; coral and peach. Colours which are of the opposite temperature should also be presented as accents (Barrett and Zhang, 2009b).



Figure 39: Elementary grade learning space at East Kilbride School, Source: (Barrett and Zhang, 2009b).

Other studies suggest that, in order to avoid eye fatigue, relieve the visual monotony of a learning space and stimulate pupils' brains, the end wall colour of the learning space should be of a medium hue with the remaining walls of a neutral shade: for example, oyster white, sandstone or beige (Engelbrecht, 2003). Moreover, colours in such spaces can aid important environment elements and way-finding (Engelbrecht, 2003). This is more important for primary school pupils who have begun to distinguish and match colours as it can create a design which emphasises that a child is a unique person who can be stimulated (Engelbrecht, 2003). It is possible to use a wider range of colours in corridors and hallways (Barrett and Zhang, 2009b, Mahnke, 1996) and a designer's choice of colour schemes for corridors and hallways should give a school a distinctive personality and attract students (Mahnke, 1996).

Engelbrecht (2003) claims that a functional colour scheme should be able to support a building's purpose and the tasks it was built for; it should also avoid both over stimulation and under-stimulation, creating instead positive emotional and physiological impacts. An exciting example of using rainbow colours as a stimulating design element is Ecole Maternelle Pajol kindergarten in Paris (Ward, 2009). The Parisian architect of this project kept the building's 1940s bricks and most of its structure while using rainbow colours to create a colourful and stimulating learning space (the-Cool-Hunter, 2012). Figure 40- Figure 42 show examples of the Ecole Maternelle Pajol kindergarten in Paris. Figure 40 shows the kindergarten exterior and how the rainbow colour as a design element was used to stimulate students to interior space through creating colourful patterns on the flooring and on the school exterior elevation.



Figure 40: Ecole Maternelle Pajol Exterior. Source: (the-Cool-Hunter, 2012).

Figure 41 shows how the rainbow colours were designed to create a variety of exciting patterns in the hallways, outdoors and staircase area. In addition, the designer of this school has used colours to identify different space elements such as staircase flooring, hallways' wall and playground flooring.

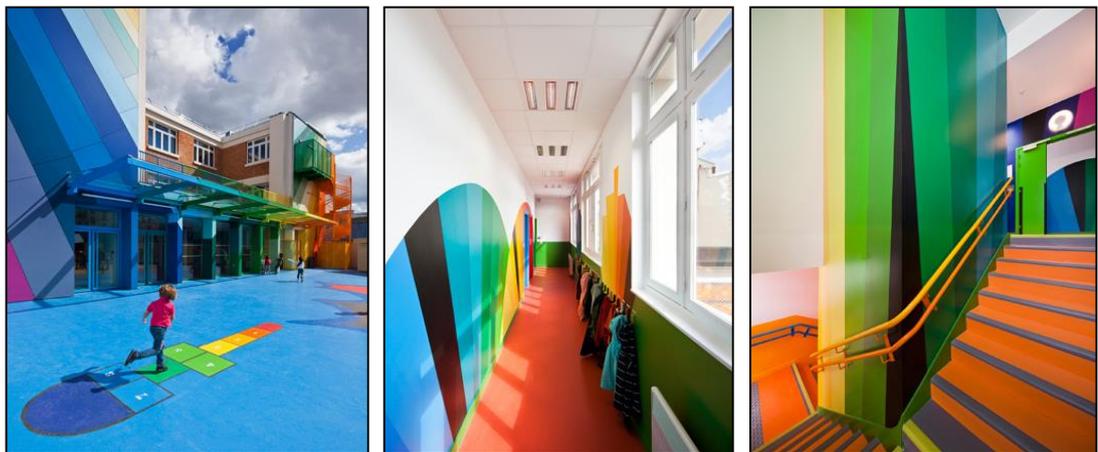


Figure 41: Ecole Maternelle Pajol hallways, outdoor playground and staircase. Source: (the-Cool-Hunter, 2012).

Figure 42 shows how the variety of rainbow colours were used to design a simulative classroom, for example yellow and red was applied in the flooring, yellow and green used for the tables and chairs and blue for the curtains. This example shows an interesting use of colours, where colours are used to create a simulative connection between exterior space and interior learning spaces.



Figure 42: Ecole Maternelle Pajol kindergarten classrooms

Source: (the-Cool-Hunter, 2012).

To conclude, colour remains the focus of the most optimistic claims about its effect on morale and efficiency (Sundstrom, 1987). Some researchers claim that the best choice of colours depends on the age of the children concerned (Engelbrecht, 2003, Gaines and Curry, 2011). However, a good deal of research findings regarding colour is conflicting and debatable (Higgins et al., 2005). However, although it is known that colours do have an impact on the physical space, little is known about the way in which people are affected by colour and how it creates form and light in the space (Smith, 2008). In fact, the literature provides very limited information on how to design stimulating learning spaces using colours. Additionally, although colour can be a very useful, cheap and flexible design tool how to design space using colours is rarely mentioned in literature.

2.7.3.3 Texture

Texture concerns the prominence and characteristics of materials. Along with colour, texture is considered as one of the primary abstract elements of design (Barrett and Zhang, 2009b). Texture plays a fundamental role in space design and has been used by architects to breathe life into buildings, to create a unique experience for the senses of occupants, to express the true quality of materials (Lehman, 2009). Texture can also shape interior space by combining different types of texture, so hard and soft textures can help animate the experience of users with regard to interior and exterior landscapes, For example, Figure 43 shows Kensington International Kindergarten in Thailand, where architects have used different textures material such as soft grey tiles, rough natural grass and real road texture to define different spaces on flooring. Additionally, texture as a design element in this space brought outside space features such as road and garden inside, making users feel connected to the exterior.



Figure 43; Kensington International Kindergarten

Source: <http://www.archdaily.com/383780/kensington-international-kindergarten-plan-architect/>

Such experience can be further supported by complementing aspects of the built environment with natural elements (Barrett and Zhang, 2009b). Such as the grass and trees as shown in Kensington International Kindergarten example in Figure 43. Moreover, texture can stimulate occupants' touch. By, for example, using texture with lighting to play with architectural shadows, designers can create meaningful effects (Lehman, 2009). Soft textures animate landscapes and enable people to connect what they see with their sense of touch, because texture, like colour, offers unity and diversity in the surface of forms. Texture can be manipulated in scale from coarse to fine and can be used in juxtaposition, or in gradients from rough to smooth, from a branch of red flowers to a piece of green glazing, for example (Dee, 2001). An interesting example a design space using different variation of texture from rough to smooth in Kindergarten room is done by The Avenue Children's Centre and Kindergarten. They have designed a playing space in the kindergarten using different natural textures elements such as: rough grass rug, soft long plant leaves, wooden arches openings and soft texture fabric as a ceiling. These varieties of texture as shown in Figure 44 were used to encourage children to explore the wildlife world in playing space.



Figure 44: The Avenue Children's Centre and Kindergarten (wildlife space)

Source: <https://www.facebook.com/photo.php?fbid=507636042668951&set=a.462036807228875.1073741832.101831836582709&type=1&theater>

2.7.3.4 Nature:

There is a long history of nature inspiring the designs of humans (Rudd et al., 2008). Humans' preference over built prospects has amassed reliable empirical studies which support this concept. The environmental psychologist, Judith Heerwagen, mentions that recently a great deal of research shows that spaces that connect people to nature are more supportive of human emotional well-being and mental performance than spaces that do not connect people to nature (Miller, 2009). Additionally, Grant Hildebrand, in his book "Origins of Architectural Pleasure", claims that the manipulation and integration of naturalistic features is a hallmark of several buildings of enduring appeal (Hildebrand, 1999). Nature stimulates human beings continually because of its ever-changing elements and because people respond to nature positively through their subconscious (Gee, 2006). Besides, learning spaces which stimulate nature produce a sense of security and pleasure (Nair and Fielding, 2005). Spaces with nature and adequate degrees of complexity were preferred more than spaces lacking these features (Scott, 1992). Friedrich Froebel, the creator of the kindergarten, believed that, in order to produce a meaningful education, we should start with nature as it is life that educates. Our relationship with natural things, such as the trees, flowers and animals around us, guides us to think reflectively (Liebschner, 1993) because nature itself provides objects for observation and collecting: things like insects, stones, pets, the cultivation of a piece of ground, a garden and fruit trees, for example (Liebschner, 1993). Making contact with nature, plants and animals can improve cognitive development, inspire imaginative play and stimulate empathy (Barrett and Zhang, 2009b). An interesting example of school design which reflects these aspects is the "Green School". The "Green School" is located at the Kul-Kul Campus in

Bali, Indonesia. One of the iconic structures of this school campus is a bamboo bridge which spans the river shown in Figure 45. The owner of this school tried to connect learning with creativity and environmental responsibility using nature as a design element (Ward, 2009). Figure 46 show the “Green School” campus.

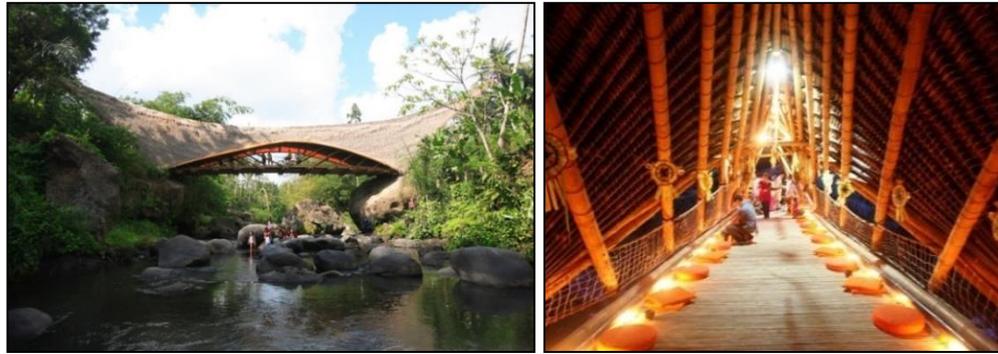


Figure 45: The Bamboo Bridge in “Green School”

Source: (Ward, 2009)



Figure 46: The “Green School” Campus.

Source: (Ward, 2009).

In a “Green School”, natural elements are designed to be design and teaching tool because in one hand, natural elements like stone, wood, water, sky and trees are creating the wall, ceiling, flooring and furniture of the learning space. On the other hands teachers are using these natural elements as a teaching recourse, because in this school when students are learning about water or trees, they are not only reading about them they are continually interacting and touching these elements as shown in Figure 45 and Figure 46. A Canadian study showed that children spoke more with each other and for longer periods of time when they encountered worms or bugs (Herrington. S et al., 2006). Additionally, another study showed that water as a natural element, and particularly moving water, enhances scenic quality and people’s level of excitement (Winkel et al., 1970). Humans are psychologically adapted to and prefer environmental features that characterise the African savannah. According to this theory, a pleasurable environment

for humans is one that contains key features of the savannah, which are (Orians, 1980, Heerwagen and Orians, 1993):

- A large variety of plants, flowers and animals,
- Clustered trees with spreading shelters for refuge, Google offices in Tokyo in Figure 47 shows a design example for using this feature of clustering plants and creating shelters for small group working spaces using wooden settings on artificial grass flooring.



Figure 47: Google offices in Tokyo

Source: <http://gurucareers.com/googles-tokyo-office/>

- Open grassland to provide easy movement and clear views to the distance,
- Changes in topography for strategic surveillance to aid long-distance movements,
- Scattered bodies of water, this feature could be reflected in design in different ways, for example it can be drawn on flooring carpet as in Figure 48 in Google office flooring. Or water bodies can be an aquarium as in Figure 49 on Google office walls.



Figure 48 in the left: Water Elements in Google office flooring

Source: <http://www.fubiz.net/2009/12/30/google-office/>

Figure 49 in the right: Aquarium on Google Office Walls

Source: <http://www.fubiz.net/2009/12/30/google-office/>

- A large sky with a wide, sunny field of view to help visual access in all directions,

These key features could be used by designers when planning for learning space design. An example of using nature as a design element can be seen in the architecture of the Erika Mann Elementary School Figure 50, where plants grow under violet light in the hall way (Dudek, 2008). From Looking at previous examples for using nature as a design elements in space (Figure 45-Figure 50), natural elements brings to gather other design elements such as texture and colour.



Figure 50: Growing plants under violet light in the Erika Mann School.

Source: (Chami, 2008a).

2.7.4 Flexibility

Flexibility is the ability to change a space (Wardlaw, 2011); it concerns the potential for multiple usage of a space and a design which is able to adapt when changes occur (Souter et al., 2010, Barrett and Zhang, 2009b). The flow of different activities in a space over the course of time is usually achieved by flexibility (Lippman, 2002b), (Riddle and Souter, 2012). In Erika Mann School, tall, wide corridors were designed to provide a number of functions by including custom-made furniture, the architecture creates places for individual and small group activities to take place, as well as imaginative play (Chiles, 2007) (Figure 32).



Figure 51: Flexible corridors in the Erika Mann Elementary School, source: (Chiles, 2007)

Another example of a flexibly designed classroom is in Kingsland Primary School; here, the school designers created a flexible learning space incorporating a moveable wall allow two smaller classrooms to become one large one (Architecture-and-Design-Scotland, 2010b) (See Figure 52).



Figure 52: Flexible classroom design in Kingsland Primary School.

Source: (Architecture-and-Design-Scotland, 2010b).

Additionally, flexible spaces enable the use of different approaches of teaching and learning (Boys, 2011). Such spaces should be multifunctional to move easily from

traditional space arrangements to group working or independent activities (Chism, 2006). An example of a school designed to be a flexible, multifunctional learning space is Vittra-school Brotorp in Stockholm which was designed by Rosan Bosch. Rosan Bosch created a multifunctional learning space with a flexible interior space designed to support different learning situations (Bosch, 2012a). For instance, he equipped the school with flexible learning spaces, such as gathering places and small niches for concentration (Bosch, 2012a). In addition, teachers were given the opportunity to deliver information to large groups; after this, students could work individually or in smaller groups in the adapted interior space (Bosch, 2012a). Figure 53 shows flexible table design which could be arranged differently and flexible boxes that can be used for storing, displaying, seating and playing.



Figure 53: Flexible tables and boxes in Vittra-school. Source: (Bosch, 2012a)

Figure 54 shows flexible and multifunctional learning areas which can be used for learning and playing. Figure 55 show a variety of learning spaces free of walls, allow students to use different learning approaches such as group work, reading from books or use of computers. Additionally, this flexible design aims to allow teachers to apply varieties of teaching and learning strategies such as cooperative learning, learning by playing, learning by acting and brainstorming.



Figure 54: Flexible and multifunctional learning spaces in Vittra-school, Source: (Bosch, 2012a).



Figure 55: Flexible Varieties of Learning Spaces Free Of Walls Source: (Bosch, 2012a)

According to Chism (2006) It is better to design spaces which are capable of quick reconfiguration to support diverse kinds of activity. Spaces often need to change their usage over time and a good design enables this change to be achieved easily (Locker and Olsnen, 2003, Locker, 2007) because learning space requirements may vary throughout the school day or year to year, particularly with changes in the demographics and needs of pupils (Wardlaw, 2011). Learning spaces also need flexibility to adapt with changes in pedagogical goals and educational programmes in order to accommodate both current and evolving pedagogies (JISC, 2006). A flexible, multi-use space with an open plan can accommodate and support a rich diversity of learning activities and purposes (Schneider, 2002b, Martin, 2002a, Weinstein and Mignano, 1997, Gump, 1987, Loughlin and Suina, 1982a, Richardson, 1970). Thus, if each teacher uses a different teaching style, and every student has his/her own learning style, it is important that designers create a flexible space that adapts to specific functions and groups.

Flexible space should allow: “The continual reorganization of the class into various sizes and numbers of small learning groups. This means space must be as free as possible of permanent obstructions” (Dyck, 1994), an example of a permanent obstructions is fixed tables that could not be rearranged, which prevent teachers arrangement changes required by their teaching strategy. However, no investigation was carried out to know whether this flexible space was connected to improvements in learning outcomes (Wardlaw, 2011). Additionally, flexible spaces provide users with the opportunity to arrange and re-arrange the semi-fixed furnishings, display boards, bookcases, desks, tables and chairs, within the space in order to support individual, one-to-one, small group, and large group activities (Lippman, 2002b). Flexible spaces should be able to adapt to as many learning space activities as possible, without the need for time-consuming reconfiguration (Riddle and Souter, 2012).

Design elements which make flexible spaces create a sense of comfort and an active school life experience. When pupils can move easily within and beyond their individual classrooms, they are likely to engage more actively with learning activities and with each other (Uline and Tschannen-Moran, 2008). However, Barrett and Zhang (2009b) argue that, in order to define an appropriate school design, classrooms generally play the most significant role because classrooms are the core space of a school and the main body of school buildings. To maximise the flexibility of classroom space, there are several beneficial features for designers to take into consideration when designing classroom spaces. These are: (1) Classroom Size, (2) Open Plan and Cellular Classrooms, (3) Classroom Layout, and (4) Furniture.

2.7.4.1 Classroom Size:

The physical dimensions of a classroom, such as scale, size and shape, have an important effects on users' behaviour and attitudes yet these are usually overlooked in discussions concerning classroom space (Rivlin and Weinstein, 1984, David and Weinstein, 1987). According to Lackney (1994), classroom size is actually the student/teacher ratio, which is independent of the size of the classroom. Additionally, Graue et al. (2007) in the USA found that the number of teachers in classroom space and class size were linked. However, the scale, size and shape of the room are rigid features of classroom's physical space which directly affects its flexibility and, as noted previously, the way classroom users perceive these features will reflect on their behaviour and attitudes (Martin, 2002a). Moreover, the arrangement of furniture can influence classroom users' perceptions of a room's size and scale (Heimstra and McFarling, 1978), for example Figure 56 Figure 57 are taken from a teacher's blog (Tenstall's Teaching Tidbits) where she relocates storing areas and attached them to the wall, leaving the space in-between empty for different furniture layouts, and giving the perception of a more classroom space. Furthermore, pupils in a larger classroom produce a richer array of interactions by improving the quality of interactions among teachers, students and the classroom space (Martin, 2002a).



Figure 56: Teachers' Classroom Arrangements Changes Its Size Perception

Source: <http://www.tunstallsteachingtidbits.com/2012/08/classroom-tour-2012-2013.html>



Figure 57: Teacher's classroom layout changes its size perception

Source: <http://www.tunstallsteachingtidbits.com/2012/08/classroom-tour-2012-2013.html>

A more up-to-date study of classroom size carried out by Blatchford et al. (Blatchford et al., 2003) considered the most recent and complete UK analysis of the educational significance of differences in classroom size. Covering around 10,000 children in the UK and the results showed that classroom size had a clear impact on children's achievement, because classrooms with a smaller number of students enhance the quality of interaction between students each other, and with their teacher. Therefore, an important point which is directly related to classroom size is crowding. However, classroom size becomes a more problematic issue, particularly in open learning spaces, because multi-modal approaches to pedagogy are required (for example, learning as individuals, in small groups, or in large groups) (Wardlaw, 2011). Crowding in classroom space is explained in APPENDIX 4.

2.7.4.2 Open Plan and Cellular Classrooms:

For any type and form of classroom space, it is important to determine the proposed activities which are going to take place and provide well-defined areas which offer

resources that can be shared by pupils (Barrett and Zhang, 2009b). On the one hand, the majority of today's contemporary school buildings comprise traditional, closed, cellular structures; they provide basic teaching spaces or classrooms that are usually used for teaching groups of between 14 and 30 pupils (Barrett and Zhang, 2009b). On the other hand, open-plan classrooms are intended to offer better opportunities for pupils to explore the learning space (Barrett and Zhang, 2009b), because its free from walls with a visual access to different spaces within one open learning space. The most important aim of the open-plan classroom pedagogy is flexibility and adaptability; this helps schools to respond easily to changes in delivering teaching and learning (Barrett and Zhang, 2009b). Figure 58 shows an example of an open-plan classroom in Birchwood Grove CP School. A study in Manchester showed that the most important components of an open-plan system are: large classrooms, matching educational theory and details of the physical layout (Barrett and Zhang, 2009b), Figure 58 shows a design example of open-plan classroom in Birchwood Grove CP School.



Figure 58: Open-plan classroom in Birchwood Grove CP School.

Source: (Thornton-EME-Group, 2010).

2.7.4.3 Classroom Primarily Layout

Classroom layout is about the amount of space a child needs in order to take part in different activities, such as reading, writing, working or listening. Many studies have found that flexible classroom arrangements, layouts and clearly defined pathways have an impact on student achievement (Tanner and Lackney, 2006), because flexible classroom space allows variation in terms of use, layouts and arrangements (Heppell et al., 2004). Moreover, the way these spaces are organised can tell pupils much about adult expectations (McGregor, 2004b) therefore it is important that learning space layouts should have the same focus as learning and curriculum developments (Chism, 2006). For example, a combination of individual and group furniture arrangements for pupils and

teachers can help to nurture an orderly and serious academic atmosphere (Uline and Tschannen-Moran, 2008). The arrangement and layout of objects in the space can manipulate interactions in settings and classrooms (David, 1975) while observations of classrooms have shown that recognised activities form patterns in seating arrangements (which teachers were often not aware of) that can affect pupils' behaviour and performance. Other arrangements and layouts in the space can communicate a symbolic meaning of what is expected to happen (Martin, 2002a), as well as communicate prospects for behaviour that are reinforced by institutional strategies (David and Weinstein, 1987). For example, turning furniture around or re-routing traffic can change patterns of behaviour in a classroom (Loughlin and Suina, 1982a). Higgins et al. (2005) suggested that *“less attentive and less successful pupils are particularly affected by the desk arrangement, with their on-task behaviour increasing very significantly when seated in rows instead of tables”* (Higgins et al., 2005). Furthermore, classroom arrangement and furniture layout may influence social interactions both among pupils and between pupils and teacher (Gifford, 1987); this can be considered as a factor in implementing learning goals (Gump, 1987, Proshansky and Wolfe, 1975). For example, placing chairs in a circle, instead of in rows, makes it clear that discussion and interaction are involved (Gump, 1987). Proshansky and Wolfe (1975) argue that effective classroom space layout and arrangement can also facilitate the learning process; equally, the unplanned arrangement of a space can result in unexpected interference, and may even serve to instigate conflicts.

It is important to mention that from searching different learning space design projects and observing classrooms in the fieldwork, usually a classroom is designed by architects as an empty box with chairs, tables and white board and its layout and arrangements is left for teachers. There are some examples of classroom layouts arranged by teachers (shared in their blogs), that are arranged according to teachers' teaching methods and learning strategies. Figure 59 shows an example of a teachers' classroom layout shows teachers' teaching strategies, for example: the table and chairs arrangements support the use of cooperative teaching strategy, and the map on the carpet supports teacher use of flooring as teaching tool.



Figure 59: Teacher's Layout of classroom space

Source: <http://teachinginroom6.blogspot.co.uk/>

Another example for classroom layout is home-school classroom in Figure 60. This classroom is arranged with different activities and the flooring covered with different colourful circle mat where students chose a mat to work on. As Figure 60 clarifies this classroom is arranged to different areas depending on teachers' teaching activities, such as reading books, artworks and playing with toys.



Figure 60: Home-School Classroom Layout. Source: <http://www.buzzfeed.com/>

Another example for classroom layout arrangements is seen in Montessori classrooms because her educational strategy integrates the design of classroom space with the teaching tools. As Montessori explains what she calls 'prepared environment' where teacher prepare the classroom space design to be part of the learning process through designing tools as a teaching resource. This put the classroom space in the heart of the learning space design, while it is usually overlooked by designers. Figure 61 shows example of Montessori classroom arrangement and its tools.



Figure 61: Montessori Classroom

Source: <http://thebrilliantchild.blogspot.co.uk/>

However, teachers sometimes do not understand that certain behaviours may occur in the classroom because of the way it has been arranged (Proshansky and Wolfe, 1975). Therefore, it is really important that teachers are aware of how to plan their classroom traffic, and arrange the furniture, patterns and space layout because this will influence pupils' behaviour whether teachers plan it or not (Martin, 2002a). Integrating such layout and arrangement within the educational setting will affect pupils' performance (Martin, 2005). Circulation, traffic and pathways are one of the important design elements which teachers and designers should take into consideration when planning classroom arrangements and layout because teachers may define different spaces within the classroom by planning traffic patterns and rearranging objects such as furniture. Thus, furniture may be functional in defining working areas and pathways (Martin, 2002b). Additionally, circulation patterns and pathways around different classroom activities encourage students to look around while fluid traffic produces a means of better communication (Moore and Lackney, 1995, Loughlin and Suina, 1982a). However, space in a room carries a silent message to pupils while movement and shifts in distance between people is an important aspect of the communication process (Duncanson, 2003, Hall, 1959).

Rivlin and Rothenberg (1976), by studying furniture distribution and activities in school classrooms throughout the school year, found that classroom layouts remained quite stable over the course of the year. This means that, although teachers were free to make layout changes and rearrange classroom space, they did not make these changes during the year; this point was confirmed by Horne's (1999) research. Therefore, researchers assert that teachers need a solid knowledge of their pupils in order to implement an effective seating arrangement in the space. Classroom furniture arrangements and layouts are important because, when pupils enter a classroom, they pick up messages its layout and arrangement: For instance the teacher's desk in relationship to

the pupils' tables, chairs and display area (Lippman, 2002b). These arrangements influence the learning space socially and physically; hence, they influence learning (Lippman, 2002b). Seating can be arranged in different ways, the seating arrangement can consist of individual desks or as a space organised for a specific activity (i.e. open-plan classrooms). Additionally, there may be an 'action zone' where the interaction and connection between teachers and pupils increases; this is usually at the front and down the middle of the classroom (Higgins et al., 2005, Weinstein, 1979a). Others might favour a U-shape seating arrangement to overcome the fact that usually, when arranging students in groups, group size and placement can be dictated more by furniture arrangement than by pedagogy (Higgins et al., 2005, McNamara and Waugh, 1993).

In conclusion, there is no "one-size-fits-all" classroom model or solution because different teaching strategies require different seating arrangements. Therefore, it is important for schools to have a clear vision in order to design classroom facilities which can accommodate different teaching strategies (Higgins et al., 2005, Stevenson, 2007).

2.7.4.4 Furniture

Furniture plays a very important role in enabling a learning space to be flexible (JISC, 2006). Selecting furniture, such as chairs, should attract the same kind of attention to learning as selecting textbooks or making decisions about the building (Chism, 2006). An example of a school designed with flexible furniture is Colmonell Primary School. Here, the furniture and settings have been designed in a flexible way that allows pupils of different ages and sizes to take part in different activities. For example, there are spaces where worktops drop down so that children are able to sit or kneel; there are bay windows in the classrooms where pupils can sit and read (Architecture-and-Design-Scotland, 2011); and flexible tables and settings allow users to create different table and seating arrangements. Figure 62 shows tables and settings in Colmonell Primary School.



Figure 62: Tables and settings in Colmonell Primary School. Source: (Thornton-EME-Group, 2011).

2.7.5 Variety

As humans mature, their brains shape a personal set of connections between their basic needs and the world's complex features; these personal values lead to individual responses to space (Barrett and Zhang, 2009b). Therefore, the best chance for success comes from offering some variety of choices which respond to a variety of individual responses (Barrett and Zhang, 2009b). *"Variety of learning venues promotes a greater variety of learning activities within the school"* so diverse kinds of learning space, such as formal and informal, public and private, specialised and generalised, appeal to this individuality, as do diverse classrooms, activity spaces, outdoor learning spaces and hallways which are designed as multiuse activity zones (Hille, 2011). Because people experience an environment in different ways, variety is the best opportunity for success in terms of space design (Gee, 2006). Because there is no one perfect classroom design, it is important to provide a variety of spaces and activities within a classroom space to support student-teacher relationships (Lippman, 2002b, Lippman, 2003). Franklin (2008) asserts that contemporary learning space design can encourage pupils to participate in diverse activities as they obtain knowledge by themselves. An example of a successful case is the campus-based childcare facility in the University of California. Figure 63 shows this example. It includes a large sized classroom space that is divided into a variety of activity zones, including areas for wet play, art, reading and manipulative play. Reflecting the variety of activities, there is also variety in the floor levels, in materials, colours and patterns of play (Barrett and Zhang, 2009b).



Figure 63: Interior of the main activity area of University of California childcare. Source: (<http://www.spacesforchildren.com/>).

Another award-winning example is Colmonell Primary School. The architect of this school has used soft furnishing, and different flooring materials and lighting to create a variety of areas, such as a library area. According to Architecture-and-Design-Scotland (2011) having a variety of different sub-spaces within one space, helps teachers to deal with a number of students doing different things at the same time (Architecture-and-Design-Scotland, 2011). Figure 64 shows the variety of different sub-spaces within one space.



Figure 64: Variety of spaces in one space in Colmonell School. Source: (Thornton-EME-Group, 2011).

However, it is important to mention that usually architects explain variety in seating groups, materials and colours. Architects also need to think of variety of learning tools which facilitate a variety of learning activities, as was mentioned in the pedagogies of Emilia and Montessori: “*In terms of innovation, the 21st century learning ideals are not so different from Reggio Emilia and Montessori pedagogies. Both aspired to engage learners in activities with a variety of tools*” (Lippman, 2010).

2.7.5.1 Variety of Learning Groups

Learning spaces need to create a balance between the human need for social and individual working spaces by providing a variety of learning spaces (Gee, 2006). Because learning happens in both private and lively social settings, learners need both interactive and individual spaces (Gee, 2006). For instance, designing a variety of learning groups and spaces can improve pupils' achievement (Barrett and Zhang, 2009b). Lackney (2002) asserts that it is important to design for a variety of learning groups, such as a family of learners (a group of up to 100), smaller groups of learners (groups of 20), as well as to create a variety of different opening spaces, such as a partially open/partially closed space, and a smaller space, which should be separate yet connected (Lackney, 2002). Suzanne Scott, in a study concerning interior environments, found that spaces which were designed with moderate degrees of variety, and which included a sense of privacy, were preferred to spaces lacking these characteristics (Scott, 1992), at Vittra School Södermalm in Stockholm, the architect of the school Rosan Bosch, created a learning space that gives both students and teachers the chance to choose from a variety of spaces for different types of group, depending on users' needs (Bosch, 2012b) as shown in Figure 65.



Figure 65: Variety of learning groups in Vittra School. Source: (Bosch, 2012b).

This new design supports the pedagogical methods of Vittra School and gives users the opportunity to participate in a variety of learning activities. For example, the colourful cave covered with red upholstery is designed for concentration shown in Figure 66.



Figure 66: The Colourful Cave in Vittra School. Source: (Bosch, 2012b).

In addition, there are tables for group work and soft lounge furniture for informal learning groups (Bosch, 2012b). Figure 67 and Figure 68 show the variety of learning groups in Vittra School Södermalm.



Figure 67: Variety of learning groups in Vittra School. Source : (Bosch, 2012b).



Figure 68: Variety of learning groups in Vittra School. Source: (Bosch, 2012b).

2.7.5.1.1 Social Spaces

Learning is a remarkably social process which works best in a community setting (Gee, 2006, Odaci et al., 2011, JISC, 2006, Bickford and Wright, 2006) and a learning space can be conceptualised as being an interaction between physical and social spaces (Odaci et al., 2011, Victorian.Institute.of.Teaching, 2011) since the relationship between learning and social spaces are located and embedded within the physical space (Lippman, 2002b). Therefore, a learning space is more than its structure; it is the social relationships within the space (Victorian.Institute.of.Teaching, 2011). McGregor (2004a) asserted that a space is ‘made’ by such social aspects. Additionally, John Seely Brown said that, in reality, learning “occurs not as a response to teaching, but rather as a result of a social framework that fosters learning” (JISC, 2006). This is because, although learning involves changes in an individual’s behaviour, the context in which these changes occur is a social space which includes the surrounding people. As a result, it is important to mention that all aspects of learning should support communities (Bickford and Wright, 2006). The claims noted above support the need to create more open spaces to improve teacher-student social interactions and pupils’ learning opportunities

(Victorian.Institute.of.Teaching, 2011). Studies have found that socially configured work spaces have an important impact on students' achievement (Giles and Hargreaves, 2006, Rutter, 1979). Furthermore, a well-designed social space can increase students' motivation and may have an influence on their ability to learn (JISC, 2006). A further study by Blatchford et al. (2006), which was carried out in primary schools, showed that group work for 10-11 year olds led to more active and sustained engagement, increased connectedness and higher order inferential reasoning. Therefore, designing a space for a community of learners should be considered when planning learning spaces (Bickford and Wright, 2006) because strengthening today's learning communities through space design can rebuild tomorrow's communities (Bickford and Wright, 2006).

The interaction between students and teachers underlines the importance of socialisation and personal discussion as important parts of pupils' learning experience, supporting openness and interconnectivity in the learning space. This includes increasing the variety of the planned and non-planned spaces that support intended and spontaneous social interactions within the learning space (Hille, 2011). Therefore, it is important that learning spaces contains adequate areas to support social contact among students (Moore, 1986, Brody and Zimmerman, 1975) and among teachers (Wolff, 2001). Finally, JISC (2006) claims that the "*prevailing pedagogic approach has swung towards active and collaborative learning, but room design and staff skills sets do not always reflect this.*" Moreover, Radcliffe (2009) asserts that, although social learning spaces are one of the most talked about topics by educationalists, it is one of the least understood and studied topics.

2.7.5.2 Variety of Outdoor Learning Spaces

DCSF (2006a) defines learning outside the classroom as: "*The use of places other than the classroom for teaching and learning*" (DfES, 2006a) and providing a variety of positive outdoor learning spaces is one of the design features that affects students' achievement (Tanner and Lackney, 2006), adulthood behaviour, lifestyles and work; these spaces are often where the most memorable learning experiences take place (DfES, 2006a). This is because learning outside the classroom aids pupils in transferring their learning experience to outside the classroom, allowing them to make sense of the world around them by building links between feelings and learning (DfES, 2006a). There is a need to provide a variety of spaces other than the classroom for learning in order to offer pupils a better experience with the outside world. This might include learning away from

the school space, or learning in gardens and local community spaces in order to provide learners with different relationships and experiences (DfES, 2006a, Balls and Burnham, 2008, Rudd et al., 2008).

According to Lackney (2002), designing a variety of outdoor activity areas is a key educational design principle because the design of a learning space should provide a variety of learning experiences which are not available in indoor spaces; for example, these could include nature trails, gardens, pools and other natural learning settings (Lackney, 2002). Additionally, designers need to plan for a variety of outdoor activities, such as reading, listening, gardening and imaginary play. Outdoor spaces should not only be used for burning off energy but should be used as learning tools (Lackney, 2002). Figure 69 shows examples of outdoor activities in St. Paulinus RC Primary School (Playforce, 2012), these outdoor activities enhance students health by encouraging them to play and do different physical activities.



Figure 69: Outdoor learning spaces in St. Paulinus RC School. Source: (Playforce, 2012).

Additionally, Figure 70 shows examples of outdoor spaces in Sinarmas World Academy in Indonesia (fni, 2009), the design of outdoor space here provides a variety of activities such as playing in the pond, playing with sand and allow students to explore outdoor natural landscape. Finally, Figure 71 shows an example of outdoor activities in Friars Primary School (Balls and Burnham, 2008). In this school the outdoor walls are designed to allow students to interact and personalise space by drawing on the walls.



Figure 70: Outdoor spaces in Sinarmas World Academy in Indonesia. Source: (fni, 2009)



Figure 71: Outdoor activities in Friars Primary School. Source: (Balls and Burnham, 2008).

Usually learning spaces is design to support varieties of activities such as (reading, playing, drawing and writing) but all of these activities are designed within school world while the imagination of kids allows them to go outside this world and read, write and play in different worlds. Comparing the design of learning space with some new workspaces design where spaces are designed to offers varieties worlds where users can work, which provides variety of environments other than the usual office working environment and stimulate users to explore, different experiences and work creatively in the space. For example, Google offices allow users to choose their working environment world from a variety of options such as forest environment in (Figure 72), frozen environment in (Figure 73), sea environment in (Figure 74). These examples demonstrates different ways of responding to variety as a design element in the learning space.



Figure 72: Forest Environment in Google Offices.

Source: <http://www.downgraf.com/inspiration/imaginative-google-office-of-zurich/>



Figure 73: Frozen Environment in Google Offices

Source: <http://www.downgraf.com/inspiration/imaginative-google-office-of-zurich/>



Figure 74: Sea Environment in Google Offices

Source: <http://www.downgraf.com/inspiration/imaginative-google-office-of-zurich/>

2.7.6 Personalisation

Throughout the 19th and 20th centuries education was done to people determined by policy makers and educators who created “one size fits all” education system. However today learning has changed, to be personalised to people throughout their lives and their needs (Gibbons, 2005). Personalisation in learning is about building learning experience around the individual’s needs, and it have been strongly influenced by understanding how pupils learn (Gibbons, 2005).

Personalisation can be reflected strongly in space design because, the relationship between space and students’ identity is embedded historically in the principles of environmental psychology (Good and Adams, 2008, Ferrer-Wreder et al., 2008) and today around topics about ideas of personalisation (Wardlaw, 2011). The personalisation of learning is an important new paradigm or model of education (Prakash and Nair, 2003). This refers to individuals’ preferences because of their personal life experiences of spaces; these vary from person to person but such a desire is evident in the way people seek to personalise spaces (Barrett and Zhang, 2009b). Giving students the opportunity to personalise their classroom encourages them to claim the important sense of ownership

and become familiar with their environment; furthermore, the feeling of ownership develops a sense of security which give students confidence (Trancik and Evans, 1995). By personalising classrooms, students learn suitable labels for people and objects; moreover, they learn about relationships through social and physical interactions. These relationships indirectly help students to define themselves, both for themselves and for others (Martin, 2002a). Therefore, it is important that learning space design provides opportunities for pupils to personalise the space, and take ownership and control over it (Johnson, 1990, Overbaugh, 1990). Students should be able to identify clearly with a smaller community and feel a sense of belonging to the learning space (Prakash and Nair, 2003). In Kingston International School, Hong Kong, China, all the outside walls of the classrooms are intended to act as a backdrop to the artistic endeavours of the pupils (Dudek, 2008) and here teachers can personalise the walls using pupils' work. The architects of this school have encouraged the personalisation by giving pupils a specific space to personalise. Indeed, pupils are encouraged to use every surface (Dudek, 2008). Figure 75 shows the walls of Kingston International School which are intended to act as a backdrop pupils' work.



Figure 75: The walls of Kingston School which act as a backdrop pupils' work. Source: (Dudek, 2008).

However, how students can personalise their classroom space and teachers give students opportunities to personalise such space, remain unanswered in the literature.

2.7.7 Technology Support

“Since the early 1900s, technology, beginning with film, then radio, television and video were brought into the learning environment” (Oliver, 2004). Although many older teachers might like to keep the same technology, today's generation of learners expects seamless technology use (Oblinger and Oblinger, 2005) and computer, tablets and smart

boards have been widely introduced into instructional settings (Lippman, 2010). “As technology changes today, smaller devices travel with users, who will expect wireless environments, the capacity to network with other devices and display vehicles, and access to power...learning spaces of the future will need more flexible plug-and-play capabilities” (Chism, 2006). However, according to Weiss (2007), none of the past or present technologies are being fully integrated into learning programmes, as was expected. One of the reasons behind this is the design of the learning space done by architects which does not support the integration of technology (Weiss, 2007, Oliver and Lippman, 2007). Another reason is that today’s information technologies have not been planned around any specific pedagogy but rather are assumed to be integrated into any and all educational settings (Weiss, 2007). Therefore, it is important to ask: “How can the design professional envision a space that includes technology if the advantages and constraints of this tool have not been fully evaluated in relation to the pedagogy of the place?” (Lippman, 2010). Thus, learning spaces should be designed to support the intended technology for learning activities (Lippman, 2010). It is important to mention that: “Although the SMART Board has been introduced, this tool has only replaced the blackboard as the focal point of the room. In addition, this technology – along with the whiteboard – encourages only peripheral engagement, and continues to reinforce a teacher-centred learning environment” (Lippman, 2010).

2.7.8 Constructing a Theoretical Framework

Current design elements are scattered across the literature, with researchers from different disciplines focused on different design elements of learning space. A framework was therefore constructed to gather together these design elements from the literature, so that they can be related to learning spaces. These elements are brought together in one diagram (Figure 76) to make it easier to identify gaps in learning space design and add missing elements. Figure 76 also shows how relationships among these elements are currently missing, despite Learning Space being defined as a relationship.

Additionally, looking at design elements of learning space in the framework, a question was raised: how can we add value to different design learning space design elements, i.e., learning and education value, not only comfort, aesthetics and health values. Figure 76 shows the framework of learning space design elements.

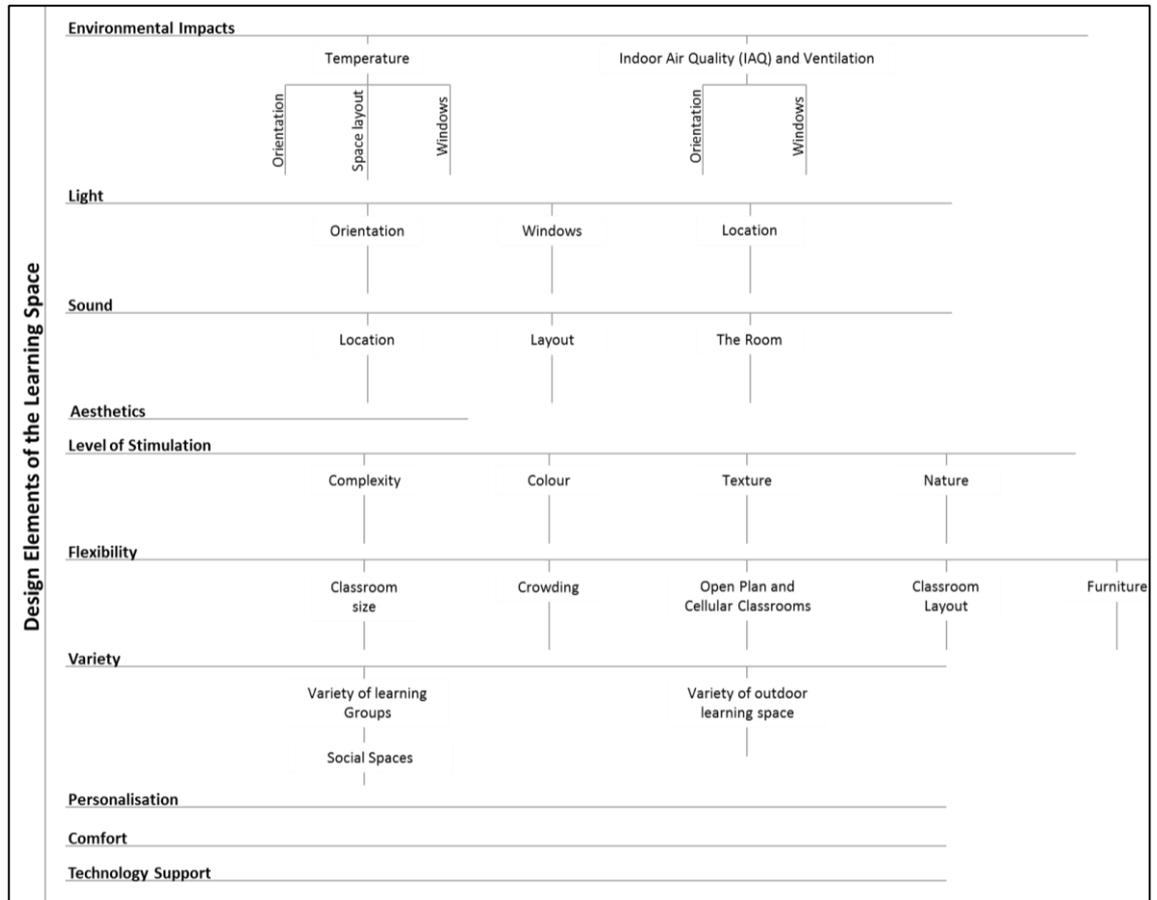


Figure 76: Framework of Learning Space Design Elements

2.8 Criticising Learning Space Literature

Where is design in the literature of learning space design?

2.8.1 First Section: Understanding Learning Space

The literature defines learning space as a relationship, yet it does not explain the nature of this relationship. It suggests that space can be understood as relationship between users and space context in which users and space are operating, yet it does not explain how users, space context and objects in space are operating. The literature does emphasise the importance of the relationship between users and space; nevertheless, it does not explain how this relationship is built between them. For example, how students and teachers occupy the learning space, respond to the objects designed in space and how do they interact with the space around them. Additionally, how could space stimulate and shape its users, how can designers design a space that act as a third teacher, how can designers design the relationship between users and space and how can they design the unspoken message in learning space? All of these how questions remain without answers,

however without this missing knowledge, it is difficult to design a space that can inspire, stimulate and support both students and teachers.

2.8.2 Second Section: The Relationship between Learning and Space

Learning theories have been developed to explain the learning process (Klein and Mowrer, 1989) and how learners learn. These theories aid researchers in seeing the ‘big picture’ by making it possible to view practice and research from a wider perspective (Anderson, 2003). Many researchers note the importance of engaging space design with learning theories (Boys, 2011, Dudek, 2008, Harrison and Hutton, 2013). However, although these theories can help to understand the effect of learning space design on pupils, the current literature on these theories do not show how to design learning space that integrate learning, or how our understanding of learning relationship with space be reflected on the design of space. Consequently, it is important for designers and architects to know how to translate from learning theories to design, in order to support learning through space design. To show designers and architects how to translate understanding of learning to design, theoretical knowledge of learning theories has been linked to different visual examples form practical design projects that can translate learning theories values and strategies into design. Different space design project visuals can communicate different ways of understanding and engaging learning in the design of space.

2.8.3 Third Section: Users of Learning Space

Some participation between designers, teachers and students has produced good examples of learning space projects. However, these examples stopped being designed after designers finished their work and the space was given to teachers. Current literature does not explain how teachers and students respond to classroom after participatory projects finished (Sanoff, 2001b). In reality, teachers and students are redesigning learning spaces after the architect’s work is finished because students become bored and uninterested very easily in this environment (Druin et al., 1999); and because teaching methods vary, changeable this makes it vital to change the design of such spaces. Learning space needs to be studied after architects and designers finish their participation with teachers, since teachers’ adaptation of designed space reveals what architects could have done better during planning. These illuminates’ opportunities for rethinking current learning space design. On one hand, Heiss (2004) claims that: “If educators could

understand the effect “place” has upon learning, much could be done to enhance the quantity of meaningful educational experiences”. But, on the other hand, if architects understood how teachers and students respond, redesign and perceive learning spaces (knowledge which is largely missing in the literature), much could be done to enhance the quality of the educational experience. Martin (2002a) and Sanoff (2001b) emphasise that, although much research assesses learning space itself, studies on how teachers and students perceive such space are lacking (Sanoff, 2001b, Martin, 2002a). Furthermore, Participatory Design should be able to see the hidden message of people’s unspoken latent needs, by responding to real, but unexpressed and unmet needs through unspoken data which usually are missing in people say they want of space, but is apparent from how they adapt space. Additionally, observing the hidden messages in the way space users (teachers and students) move, use and interact with space and comparing it with what they say they want from space design because users’ interaction and adaptation with a space is what makes meaning of space design elements and explains to designers how they can improve the design of learning space in order to help users to improve their way of using and interacting with space to facilitate teaching and learning methods.

In addition, many case studies on participatory design school projects concentrate on the design of school buildings and the facilities they provide. The current literature offers significant knowledge about new facilities that can be added to learning spaces (JISC, 2006, Dittoe, 2006, Boys, 2011, CABE, 2010, Allen et al., 2009, Sorrell and Sorrell, 2005). However, participatory projects includes very limited knowledge about classroom facilities and, in particular, the potential of classrooms is often overlooked (Gee, 2006). The classroom, which after all is considered to be the core element of the entire learning space, is often largely ignored (Strauss, 2002). limited literature exists on classroom preparation that would support teachers in devising strategies best suited to new spatial configurations (Wardlaw, 2011). In addition, teachers and students are using the learning space as a tool to enhance learning outcomes (Care and Chiles, 2006, Fisher, 2008) and, for this reason, teachers and students need to be empowered and supported in designing learning spaces in order to understand how to respond to such spaces. This is because the classroom space can be a powerful teaching instrument at the disposal of the teacher (Prashnig, 2004b, Martin, 2002b) and the physical environment of the classroom can represent the silent curriculum (Prashnig, 2004b), generating a 3D text book (Nair et al., 2009a). This is where designers, teachers and students have to work together in order to improve further learning space design (Care and Chiles, 2006, CABE, 2010). In addition,

when a new building is finished, it is given to the teachers, but learning spaces designed by designers and architects can only be a ‘finished beginning’ in which adaptations will occur (Barrett and Zhang, 2009b). Therefore, a great deal of design work in a classroom space may start after architects have finished their work. However, very little literature moves beyond changing the arrangement of tables and chairs when it comes to talking about what kind of changes teachers can make in a classroom space.

It is obvious that space plays an important role in determining the quantity and quality of users’ engagement, as well as the overall success of the learning experience (Caine, 2008), what is missing is how it does this. Therefore, even though a number of new school designs are today breaking ground architecturally, few consider how pupils learn and respond to learning space. Thus, these schools are simply new old schools (Care and Chiles, 2006). Boys (2011) noted: “There remains a surprising lack of underlying analysis about what is changing in learning and teaching practices and about what role architecture has in this process. What kinds of spaces are we talking about conceptual, physical, virtual, social, and personal? What is the relationship between architectural design and learning, teaching and research activities? What are the different spaces in which learning takes place and how can we judge their relative effectiveness?”

2.8.4 Fourth section: Design Elements of the Learning Space

Until recently, research into design elements of learning space has focused on two main issues: generalisations about the effects of school buildings (Cash, 1996, Branham, 2004) and specific problems such as acoustics and lighting (Luckiesh and Moss, 1940, Siebein et al., 2000, Tanner, 2009). Much of such research focuses on the quality of the conditions, and not learning practices or how the space is used (Wardlaw, 2011). Most of the current studies in the learning space literature reviews studies the effect of lighting, thermal comfort and indoor air quality (Bosch, 2006) but, While arguably part of design, there is no evidence to indicate whether the effect is more on comfort than learning (Lomas and Oblinger, 2005, Heluish, 2009, Nair et al., 2009a). Many research studies discuss the effect of learning space design elements on pupils’ outcomes and achievements but they do not necessarily relate these impacts to the way learning spaces should be designed. Most of these studies have not been followed through to the level of practice where designers and architects translate ideas into design elements: for example, how designers and architects could use the results of these studies while designing the space; or how these studies might be translated into design of the physical learning space,

and how designing learning space can facilitate teaching and learning. Very few studies move beyond this and talk about classroom facilities, resources and tools. Good and Adams (2008) and Rinaldi (2006) (differing from Fisher (Fisher, 2002, Fisher, 2005) and JISC (2006) argue that aesthetics, access to resources and opportunities can work in different ways to accentuate students' learning outcomes. Issues concerning additional resources that may enhance learning spaces are not addressed while furniture, plants, presentation devices and audio systems are resources that are often not factored into costs (Wardlaw, 2011). However, most of current learning space design literatures explain problems and the effects of these problems on learning space users yet do not provide practical solutions for how to respond to these problems. How to design learning space elements in space, how to add learning and teaching value to these elements and how to benefit from these elements in space.

Therefore, the specifications of educational buildings, design guidelines and prototypes of learning space design are very strongly established in the literature (Higgins et al., 2005, Nair et al., 2009a, Barrett and Zhang, 2009a, CABE, 2010), but this leaves little room for real creativity with regard to designing this important space (Nair et al., 2009a, Flutter, 2006). According to Barrett and Zhang (2009b), it is well known that quiet, warm, safe, clean, comfortable and healthy spaces are an important element of effective teaching and learning and yet very little research has examined the complexities lying behind this concept and its connection to the way learning spaces are designed. Furthermore, according to Chiles (2003a), in typical primary classrooms, the curriculum needs are diverse and are heavily dependent on different teaching methods. Moreover, because these teaching methods change, there is a clear need for flexibility in such learning spaces. The current literature offers details about required amounts of light and air quality but does not give the same amount of detail about flexibility, variety and adaptability. Although there is a definite emphasis in the learning space design literature on flexibility and adaptability (Barrett and Zhang, 2009b), there are few detailed explanations with regard to how flexible this space should be, and in what different ways the learning space can be used in order to benefit from its flexibility. Additionally, the literature, while mentioning adaptability as a learning space design element, does not explain how to design an adaptable learning space and how users adapt to what has been designed, because learning space design is not studied after users adapt with the designed space.

Different Researchers have claimed that design elements in learning space is a powerful teaching instrument at the disposal of the teacher (Prashnig, 2004b, Martin, 2002b), where it can work as a ‘silent curriculum’ that complements and increases engagement (Taylor, 2005b). It is not just a space where teachers and students gather to learn, but the key to users’ learning quality and learning experience (Caine, 2008) which can create a meaningful educational experience (Heiss, 2004). Uline and Tschannen-Moran (Uline and Tschannen-Moran, 2008) note that there are important questions around learning space facilities effects remain unanswered, including: How learning space facilities and space design elements affect users who are learning in the learning space and how teachers are using this space to teach. Therefore, there is a need to study qualitatively learning spaces in order to explore how these influence students and teachers. This illustrates the need for more descriptive, qualitative research concerning the relationship between learning spaces and their users. Pallasmaa (2009) claims that designers need more than verbal data and references from literature. When designers work with literature, they make references to conceptual designs, and other pieces of design research, rather than only theoretical work as in the literature review (Pallasmaa, 2009).

2.8.5 Supporting Design and Use for Learning Space

“How” questions are not addressed in the literature; how could *architects* design the learning space elements that will offer these benefits to users; and how could *teachers* use the learning space to obtain these benefits? Therefore, this research aims to help both these who are going to design learning space before building (*architects*) and those who are going to continue designing learning space after space is built (*teachers*).

2.8.5.1 Architects

How do architects design learning space elements that facilitate teaching and learning, how can architects rethink the design of learning space? This was partly answered above by linking theoretical knowledge of learning space design elements with different design projects via visual examples, project visuals suggest different design solutions to respond to learning theories requirements in space.

2.8.5.2 Teachers

The current literature emphasises on the importance of teachers using space to facilitate and support learning, why teachers need to use the design of learning space and

what benefits they can get from space design. The literature explains the reasons for teachers not using learning space, which are their lack of space awareness and not knowing how to use space. However, current literatures do not explain to teachers how to use learning space. Therefore, this research aims to empower teachers to use the design of learning space to facilitate teaching and learning by enhancing their space design awareness, and showing them practical examples of how to use, design and prepare space to facilitate learning and teaching. Furthermore, it is important to ask how teachers can benefit from the above literature review. For example, how teachers design learning space using design elements such as colours, texture and nature. However, most of the literature highlights the effect of these elements on learning space user and the importance of applying them in space, yet it does not explain to users how to use them.

The researcher needed to refine gaps occurs in literature and create a better understanding of learning space design by exploring current learning space design and its users seeking to fill literature gaps and refine its problems, literature gaps:

2.9 Literature Gaps

The researcher needed to address gaps in the literature to create a better understanding of learning spaces and their users, refining and potentially expanding the research problem in the process.

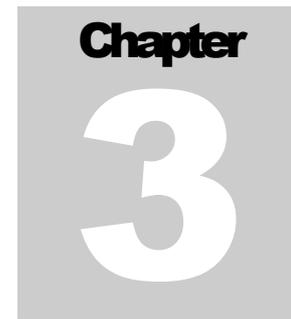
- What happens to learning space design after architects finish their work, how do users occupy and respond to the designed space?
- How can teachers prepare space to engage with their teaching strategies, how do classrooms affect teachers' ability to teach, and how do teachers facilitate space to support different learning methods?
- How does the design of learning space shape its users (teachers and pupils) and stimulate them?
- How can space design empower teachers' use of space to facilitate teaching and learning
- How the relationship between users, learning and space design elements is formed, and how can our understanding of this relationship be reflected in the design of space?
- How space users, learning, and design elements interact with each other.

- How do current learning space designs influence student engagement with learning, and what do students want from space?
- What do we need to design in a classroom to ensure that learning space is effective and what are the learning design space elements, from users' point of view? (answers will be added to the theoretical framework of learning space design elements, and this will refine and expand the problem space for this research)

2.9.1 What Is the Problem, How to Solve It?

The learning space literature reviewed in this contextual review explains each part of this space (learning, users, and design elements) without explaining the connections and interactions between them. This missing gap limits our understanding of learning space, which is still incomplete. Therefore, the next phase of this research is designed to understand the connection between these three parts and how they interact in response to gaps found in this chapter. However, because users in a learning space are the ones who connect learning and designing elements through their use of space, the next phase will be planned to understand users and how they occupy space.

As noted in the introduction design is not just about, “Problem solving, but finding the problem and also solving it” (Cross, 1999) . Since the problem is not understood yet in the literature, the next chapter of this research addresses the methodology used (finding the problem and formulating it) to better scope the problem and create a better understanding of the current problem situation via exploring learning space design and its users through answering questions from the literature review. Additionally, during the next research phase, the researcher will be also seeking ways of solving the problem, and how the current situation could be improved: “When the practitioner tries to solve the problem he has set, he seeks both to understand the situation and to change it (Schön, 1983).”



Development of a Supportive Tool for Participatory
Learning Space Design

CHAPTER 3: METHODOLOGY

This research combines design thinking with qualitative research

“The beauty of qualitative research is that it gives you access to the nitty-gritty reality of everyday life viewed through a new analytic lens
(Silverman, 2005).”

CHAPTER 3: METHODOLOGY

Introduction

This chapter presents the methodology which guided this research. A methodology refers to the choices of methods of data gathering, forms of data analysis in planning and executing a research study (Silverman, 2005) in order to achieve research aims. The aims are: (1) to rethink learning spaces design, in order to facilitate and support learning and teaching practices; and (2) to empower teachers to redesign and use the current learning space to support and facilitate different teaching and learning approaches. Firstly, this chapter describes the methodological strategy adopted for this investigation; the subsequent section describes the research methods considered, including: observation, interview, photographs, document analysis, social networks analysis and drawing analysis. It is explained how these methods were assessed and selected, with some discussion of the anticipated reality and validity of this programme of research. The focus of this research is not only on understanding learning space users and learning space problem from their point of view, but to understand the problem and find a practical solution to solve it, therefore, adopting Interpretivist / Constructivist is not enough for this research. Consequently, constructive (practice-base) design research is used to solve the problem by taking an action where a practical solution is designed. Durling et al (2002) describe practice-based research as “a study where practice is used as an interrogative process”.

3.1 Research Philosophy

It is important to discuss research philosophy and theoretical assumptions because it describes ways of looking at and interpreting social reality (Cohen et al., 2000). Each research philosophy is a set of assumptions and claims as to how the world is perceived, that guides the behaviour of the researcher (Jonker and Pennink, 2010) and underpin research strategy and method choice (Saunders et al., 2009). This research philosophy is a “basic set of beliefs that guides action” (Flowers, 2009). There are two main aspects of research philosophy: **ontology** and **epistemology** (Saunders et al., 2009, Müller, 2003). Ontology studies the nature of reality (Saunders et al., 2009), and describes our assumptions about a particular subject (Flowers, 2009). In this research, ontology is related to the importance of learning space design and its effect on users and learning. As Ruthellen Josselson mentioned “It is not the parts that are significant in human life, but

how the parts are integrated to create a whole (Wertz et al., 2011).” And in this research parts of learning space are well understood separately (learning, users, design elements) but the missing how these parts are integrating and interacting in the whole which is the learning space. The current literature of learning space design calls for in-depth qualitative research to understand the relationship between learning and space (Boddington and Boys, 2012).

Epistemology concerns “What is knowledge and what are the sources and limits of knowledge” (Eriksson and Kovalainen, 2008). Hatch and Cunliffe (2006) summarise epistemology as knowing how you can know. Epistemology has an inter-dependent relationship with ontology. In this research, we need to explain how teachers and architects can apply theoretical knowledge of learning space to space design. Therefore Interpretivist / Constructivist research philosophy is adopted to this research because it understands people from their points of view (Hatch and Cunliffe, 2006) and the meanings and interpretations that they create (Saunders et al., 2007). Additionally Interpretivist / Constructivist helps researcher to understand what people think and feel, as well as how they communicate, verbally and non-verbally (Easterby-Smith et al., 2008). Nevertheless, social reality may change and can have multiple perspectives (Wahyuni, 2012, Hennink et al., 2011), therefore Interpretivist researchers prefer to interact, and to have a dialogue, with the studied participants (Wahyuni, 2012).

3.2 Research Methodology

Identifying research questions is a critical step in research design because questions give direction to the study (Gill and Johnson, 2010), limit the scope of the investigation, and provide a device for evaluating progress and satisfactory completion (Maxwell, 1996). In order to achieve the research’s aims, the research has sought to answer three key questions.

1. What are learning design space elements?
2. How does learning space architecture shape users’ practice and, in turn, how do users adapt with the designed learning space?
3. How can we empower teachers to redesign, use and shape space to support different teaching and learning methods?

In order to achieve this research aims and answers its questions, the research used qualitative methodology because the nature of the learning space design problem was not clear yet and need to be reframe in the Contextual Review. This required exploring the built learning space and a closer observation of the designed space after users have occupied it and relating this to the current literature of learning space design. This phase has raised questions that require interacting with participants and having an in depth dialogue with the teachers and students to comprehend the learning space design problem. Qualitative research classically addresses the “what” and the “how” of the topic matter (Wertz et al., 2011). In order to know what something entails a conceptualization of the matter under investigation as a whole and in its various parts, and how these parts are connected and prepared as a whole, and how the whole is similar to and different from other things (Wertz et al., 2011),

According to Denzin and Lincoln (2011) Qualitative research could be defined as: *“A situated activity that locates the observer in the world, Qualitative research consists of a set of interpretive, material practices that make the world visible. These practices transform the world. They turn the world into a series of representations, including field notes, interviews, conversations, photographs, recording, and memos to the self. At this level, qualitative research involves an interpretive, naturalistic approach to the world. This means that qualitative researchers study things in their natural settings, attempting to make sense of or interpret phenomena in terms of the meaning people bring to them (Denzin and Lincoln, 2011).”*

The aim of all qualitative analysis is not to reproduce reality descriptively, but to add intuition and understanding and to create theory which delivers explanation (Morse and Richards, 2007). Qualitative research seeks to explore and describe what particular users do in their everyday lives, and what their activities and movements mean to them (Denzin and Lincoln, 2011). Qualitative research identifies meaning-relevant kinds of things in people world, kinds of actions and interests by focusing on differences in forms of things which create a difference for meaning (Denzin and Lincoln, 2011). Qualitative research aims to generate understanding from data as the analysis proceeds (Morse and Richards, 2007).

3.3 Research Strategy

Based on the research philosophy, the initial research strategy is planned into three phases: phase one was about identifying and understanding problems background of learning space design and refining problems to solve, phase two is about reframing and understanding the problem from users' point of view and finally phase three designs a solution and take a practical action to solve the problem.

3.3.1 Phase One: Contextual Review

Chapter two aimed to understand the problem background by searching current literature to: understand the meaning of learning space; look at the relationship between learning and space; and identify learning space design elements. Furthermore, it constructed a theoretical framework of learning space design elements, criticising learning space literature, linking theoretical knowledge with visuals as a way of lateral thinking and finally by raising unanswered questions. In this phase researcher helped to understand what were found in the literature review.

The literature defines learning space as a relationship between users and space context in which users and space are operating, yet it does not explain how users, space context and objects in space are operating. Current literature does not explain how teachers and students respond to classroom after finished designing. Observing the hidden messages in the way space users move, use and interact with space and comparing it with what they say they want from space design because users' interaction and adaptation with a space is what makes meaning of space design elements and explains to designers how they can improve the design of learning space in order to help users to improve their way of using and interacting with space to facilitate teaching and learning methods. It is obvious that space plays an important role in determining the quantity and quality of users' engagement, as well as the overall success of the learning experience (Caine, 2008), what is missing is how it does this.

“How” questions are missing in the literature: how could *architects* design the learning space elements that will benefit its users and how could *teachers* use the learning space to obtain these benefits? Therefore, this research aims to help both those who are going to design learning space before building learning space (*architects*) and who are going to continue designing learning space after space is built (*teachers*). However, in

order to achieve the research aims, the researcher need to refine gaps occurs in literature exploring current learning space design and its users seeking. Gaps of literature are:

- What happens to learning space design after architects finish their work, how do users occupy and respond to the designed space?
- How can teachers prepare space to engage with their teaching strategies, how do classrooms affect teachers' ability to teach, and how do teachers facilitate space to support different learning methods?
- How does the design of learning space shape its users (teachers and pupils) and stimulate them?
- How can space design empower teachers' use of space to facilitate teaching and learning
- How the relationship between users, learning and space design elements is formed, and how can our understanding of this relationship be reflected in the design of space?
- How space users, learning, and design elements interact with each other.
- How do current learning space designs influence student engagement with learning, and what do students want from space?
- What do we need to design in a classroom to ensure that learning space is effective and what are the learning design space elements, from users' point of view? (answers will be added to the theoretical framework of learning space design elements, and this will refine and expand the problem space for this research).

These gaps provide an initial problem frame: "In real-world practice, problems do not present themselves to the practitioner as givens. They must be constructed from the materials of problem situations which are puzzling, troubling, and uncertain (Schön, 1983)."

3.3.2 Phase Two: Users' Perception of Learning Space

Answering questions raised in the first phase required understanding users' perception of learning space by working alongside learning space users who make sense of the designed space, give meaning to space objects, and create their own space design realities through the ways they adopt and interact with the designed learning space. Teachers and students experience of learning spaces will be interpreted in the context of the researcher academic experience. To sum up the aim of this phase is:

- **Understanding space users' point of view:** by filling first phase gaps, the research addresses problems of learning space design from users' point of view, and thus extend the learning space design elements framework.
- **Framing the design:** by reflecting on learning space users' perceptions and comparing them to the contextual literature review, the research frames problems and inspires solutions possible.

The aim of this research not only to understand and reframe problems, but to create and assess practical solutions, therefore a third phase was designed to take an action by solving the problem.

3.3.3 Phase Three: Action

This phase began with reflecting on what have been found in the previous two phases in order to form a solution and take action by designing a tool and evaluating it, the process and tool design and development will be explained into details in chapter 5.

3.3.4 Reflection

In this research there was overlap between each phase and another, these overlaps connected with a reflection space. Have, the researcher reflects on what was found and rethink plans for the research. Changes are made and methods for the next phase are designed. After the first phase, a reflection space raised questions and methods were designed for the second phase. Additionally, another reflection space was before going to the third phase, where the findings of the first phase (contextual review) were connected and compared with second phase findings (users' perception of learning space). However, the research findings did not identify a specific solution, but it was a starting point for exploring solutions. Therefore, the researcher planned for final phase in

order to take action by designing a practical solution; however, another hidden reflection space was created while designing a solution. “They exhibit a kind of knowing in practice, most of which is tacit. Indeed practitioners themselves often reveal a capacity for reflection on their intuitive knowing in the midst of action and sometimes use this capacity to cope with the unique, uncertain, and conflicted situations of practice (Schön, 1983).”

3.3.5 Data Purpose

It is important to mention that the research data generated from different methods was used differently in different research phases: The first and second phases collected data helped researcher to understand, identify and reframe problems, inspired the researcher with different design solutions. Finally, in the third phase collected data was a source in the designed solution itself.

3.3.6 Summary

This research strategy can be seen as a layered cake, with data collected used firstly to provide the researcher with the recipe when it helped the researcher to understand and find the problem. Additionally, data provided researcher ingredients in term of design solution inspiration and finally data was part of cooked cake when researcher used collected data as a solution resource. After preparing the cake how it can be eaten, same as this research after understanding the problem and finding solutions how users can apply this solutions and benefit from these solutions. Therefore, as there is a need for a knife, plate and fork in order to eat the cake there was a need for designing a tool that help learning space users benefit and apply these solutions in space.

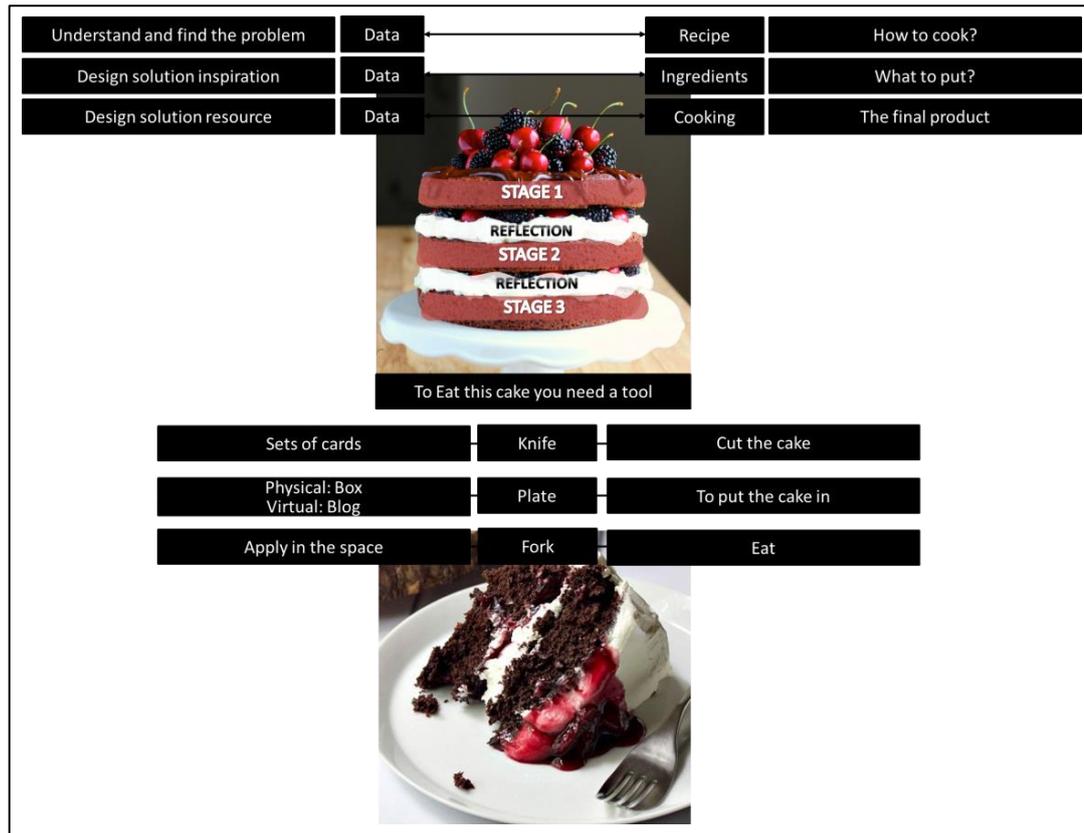


Figure 77: Research Phases Layers

3.4 Research Methods

This research strategy, contextual review and constructive design research have adopted a qualitative research methodology, and in order to achieve research aims and answer its questions, different methods were adopted in the three research phases. Research methods are techniques used to collect research data (Silverman, 2001). This research used multiple methods in collecting data and these methods are observation, interview, photographs, document analysis, drawing analysis and social networks analysis (which consist of document, video, notes and photo analysis). Using multiple methods helps to get at many different aspects of a phenomenon (Silverman, 2005) and these multiple methods are used in order to get diverse aspects of a learning space. Moreover, using multiple methods increases the validity of the result (Silverman, 2005). Next paragraph is explaining the methods used in each phase of the research:

3.4.1 First Phase: Contextual Review

Contextual Review, the first phase of this research, used Literature Review, and Observation. This phase was a critical exploration of the current learning space design, in order to understand and identify the background of this problem. The observation have

helped the researcher reflect on the literature of learning space design and compare what was written about the design of learning space design and what it is currently exist, additionally how the design of this space look like when occupied by users. This reflection and comparison between literature and observation made the researcher rethink the literature, construct a theoretical framework for learning space design elements and link the theoretical knowledge of learning space design literature with the visuals captured during the observation which created a better understanding of the learning space design. Literature review criticism and observation are these phase methods, literature review was explained in chapter two, and next paragraph explains observation. At this phase researcher have observed primary learning spaces and look at how users occupied with the built space, what do architects design in the learning space, how teachers utilise space to support various learning techniques and strategies associated with different teaching styles. Observation findings where reflected on and compared with knowledge obtained from the literature review, this reflection and comparison between literature reviewing and observation creates a dialogue to think about what has been observed in the learning spaces and what has been read about learning spaces, also who designed learning spaces in the literature and who designed the observed spaces.

3.4.1.1 Observation

Observation method is commonly used in social sciences researches (Kothari, 2004). Observation involves looking, recording and listening very carefully (Bernard, 2000). According to O’Leary (2004) Observation is “A systematic method of data collection that relies on a researcher’s ability to gather data through his or her senses”. A key concern for this method is to reduce subjective bias, by observation (Kothari, 2004). Furthermore Kothari (2004) states that this method helps researchers to obtain information about what is currently happening. Furthermore, Fulton Suri argued about how observation could benefit designers, she claims that: “ethnographic-style observation can provide inspiration and grounding for innovation and design. It increases our confidence that ideas will be culturally relevant, respond to real needs and hence be more likely to have the desired social or market impact. But for design and designers there’s much more to observation than that. Successful designers are keenly sensitive to particular aspects of what’s going on around them and these observations inform and inspire their work, often in subtle ways. First hand exposure to people, places, and things seems to be key, but

there is no formulaic method for observation of this very personal kind (Koskinen et al., 2011).”

Therefore, this method was used in this research to observe how users utilize learning spaces; such as how they interact with each other; to understand what is happening in a learning space, and to comprehend the literature review of learning space design. The researcher also planned to observe the learning space design elements which are not mentioned in the literature review to add them to the constructed framework. The findings from this method will reveal factors that influence the learning spaces’ impact on their users and help researcher to compare between the literature and reality of learning space design. The researcher will use both direct and indirect observation, and observation data includes notes from directly watching the learning space and its users; and visual analysis of photographs and sketches of the classroom space.

The reflection and comparison of literature and observation showed gaps that required interacting with space users to fill them during the second phase. However, it is important to mention that at this phase, the research problem was not clear yet, and there were no possible solutions yet.

3.4.2 Second Phase: Users’ Perceptions of their Classrooms

This phase is about exploring users’ experience of using current learning space and their understanding of learning space design. Parts of methods chosen here are built on Sanders position on accessing users’ experience in Participatory Design. Sanders claims that in order to access users’ experience we need to understand **what people do, what people say, and what people make** (Sanders and SonicRim, 2002). Understanding **what people do** could be achieved using observation method (Sanders and SonicRim, 2002). Understanding **what people say** could be achieved using interviews (Sanders and SonicRim, 2002), which will be used in this phase. Finally, understanding **what people make** achieved by analysing what people create from the toolkits provided by researchers (Sanders and SonicRim, 2002). However, in this research understanding **what people make** will be achieved by understanding what people make with the given learning space using what architects have designed in the learning space in term of design elements. Therefore, in this research the given toolkit is learning space with the design elements available in it. Next details of applied methods are explained.

Learning spaces' main users are teachers and students; therefore, this phase is divided into three activities: *teachers' phase*, *students' phase*, *social network phase*. In *Teachers' Phase*, three qualitative methods were triangulated: Semi structured interview, Teachers' classroom photographs and Teachers' planning book. The *Students' Phase* used students' drawings to understand student learning space perception, and explore learning space design through their eyes. Therefore, students were asked to draw 'the classroom of their dreams' and support their drawings with written notes that explain their drawings. In the *Social network phase* different qualitative data were collected and analysed are: photos, videos, users' comments and documents about learning. These were shared by learning space users in different social networks websites such as Facebook, Blogs and Pinterest. We next paragraphs explain the methods used in each activity.

3.4.3 Teachers' Phase

Teachers are key classroom users, who shape, adapt and re-design classroom space after the architects initially designed it. Therefore, the main aim of this phase was to explore classroom space and understand it from the teachers' point of view, answer the questions raised in first phase. Teacher also explained some of what she observed in the first fieldwork. In phase three, the qualitative methods were triangulated involving: Semi structured interview, Photographs and Teachers' planning book (teachers' planning book is a diary of where teachers' write what they do with the learning space and document their everyday learning approach, term of teaching strategy, teaching aids and how they apply these in the classroom). Figure 78 shows triangulation of three qualitative methods in teachers' phase. Participants' teachers were interviewed and asked to support their responses with classroom photographs and pages from their planning book. Figure 79 summarises methods used in Teachers' phase.

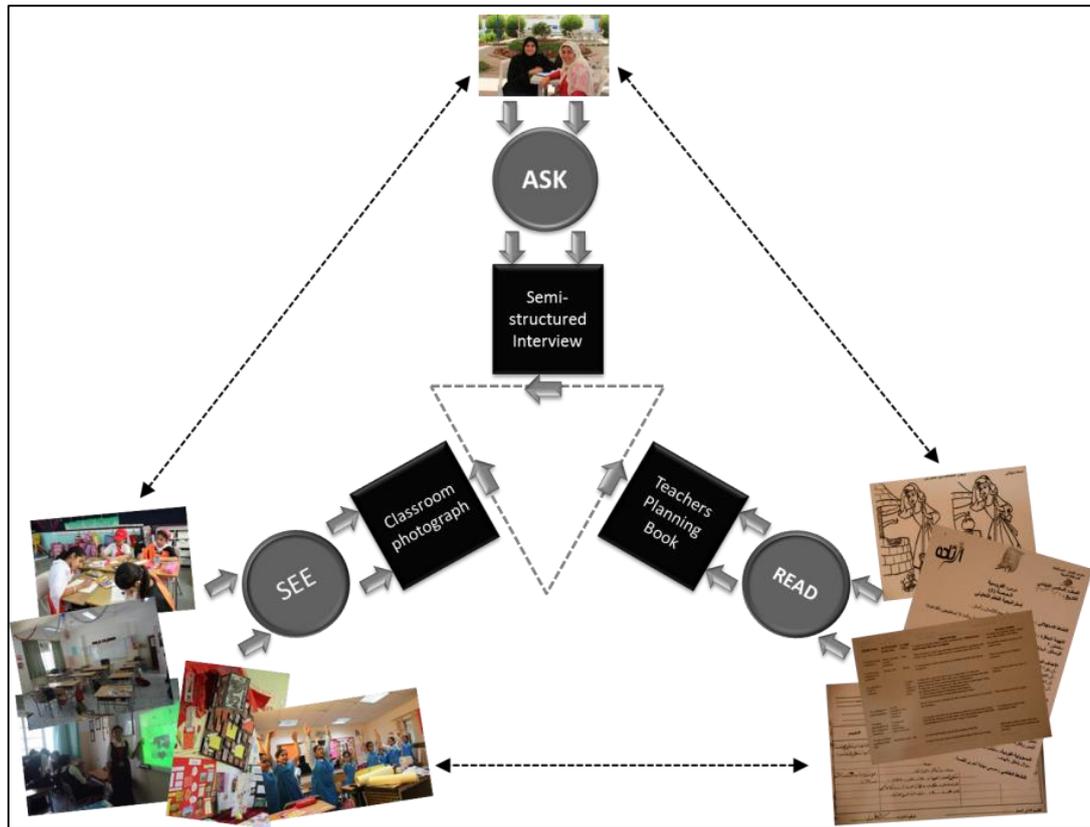


Figure 78: Triangulating Three Qualitative Methods in Teachers' Phase

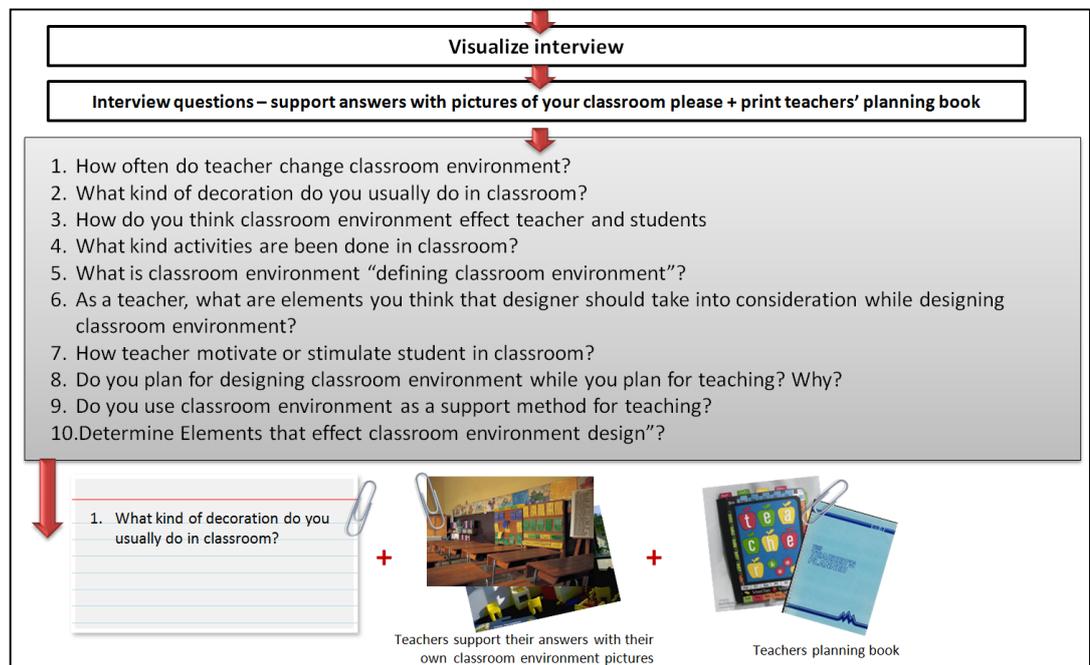


Figure 79: Methods Used in Teachers' Phase Interview

15 teachers from 6 different primary schools in Bahrain teaching 10-13 year-old pupil year-group were engaged in this phase. Of these, 11 were female and 4 male. The length of their teaching experience ranged from 7 to 33 years. More than 400 photographs and

38 pages of teachers' planning books were collected. The aim of this phase was not to create the basis for statistical comparisons across different classroom design elements, which would not be appropriate with such a sample size; rather, the goal of this phase was to build an understanding of classroom space through the teachers' eyes.

3.4.3.1 Interview

An interview is an important discussion between two or more people (Kahn and Cannell, 1957). According to Pole and Lampard (2002), interviewing is the most appropriate method to use when seeking participants' opinions, feelings and attitudes. In addition, the purpose of interviewing is to find out in-depth what is in and on a person's mind and to find out from him/her things that the researcher cannot directly observe (Patton, 1990). In this programme of research, the researcher used semi structured interviewing. Semi structured interviews typically refers "to a context in which the interviewer has a series of questions that are in the general form of an interview schedule, but is able to vary the sequence of questions. The questions are frequently somewhat more general in their frame of reference from that typically found in a structured interview schedule (Bryman, 2008)." Semi structured interviews in this research were used as a method to understand uses of learning space, to explore learning space design possibilities, to understand teachers' competences with classroom space, and study the relationship between teaching strategies and classroom space from the teachers' point of view. In addition, teachers will further inform the researcher about design elements that affect users in classroom space.

3.4.3.2 Photographs

Recently, interest in using visuals such as photos as a qualitative method has increased, in order to explore participants' experiences and create meanings (Frith et al., 2005). Visuals can be a way of constructing multiple realities influenced by social factors located in space (Frith et al., 2005, Guillemin, 2004). Collier (1957, as cited in Harper, 2002) emphasis on the importance of photographs as a visual tool in social research after using a photographic investigation about the quality of housing (Harper, 2002). Later, whilst exploring how families adapt to living in new environments, their research team used photographs of old and new environments to assist their interviews. They found that the use of photos improved the quality of the interviews in many ways. For example: It prompted memory, reduced misunderstandings and provided more comprehensive interviews (Harper, 2002). The second method in this phase is photo collection and

analysis where Teachers were asked to visualise their interview answers with their own classroom photographs. The photographs visually supplemented the interview responses, and helped to clarify interview responses (what teachers mean with certain words). The reasons for using photographs for supporting interview responses were:

- Sometimes there are diverse meanings for a certain word or expression. For example teachers have explained what they meant by “colour as a classroom design element” using their classroom photographs as a positive or negative example.
- Teachers use different terminologies to interior designers. For example, some teachers talked about windows as a ventilation element in classroom environment, others thought of windows as a natural light resource in classroom environment, while some teachers said that windows are a connection between inside classroom space and outside.
- Interview answers frame the researcher’s understanding of what teachers said. Supporting interviews with teachers’ photos helps to reduce bias.
- Classroom photographs will give the researcher the opportunity to look at learning through different lenses.
- Teachers’ photos will help to understand the relationship between what the teacher says about the classroom environment and what is really there.
- Additionally, photographs aid the researcher to detect if there are elements in classroom that teachers are not aware of.

3.4.3.3 Document Analysis

The third method in this phase is document analysis, document analysis is a systematic method for reviewing documents (both printed and electronic) (Bowen, 2009). It contains text recorded without a researcher’s intervention (Bowen, 2009). Document analysis is often triangulated with other qualitative research methods (Denzin, 1970). In this research, document analysis is triangulated with interviews and photo analysis. This method requires examination in order to elicit meaning, increase understanding, and improve empirical knowledge (Corbin and Strauss, 2008). In addition, data drawn from document analysis contextualise data collected during interview and provide supplementary data (Bowen, 2009). The documents that were analysed in this phase are teachers planning book. From the teachers’ planning book, the researcher:

- Looked to answer Question: “what classroom design elements are teachers aware of, mention in their planning book and take into consideration while planning their teaching strategy and choosing their learning approach?”
- Checked whether the teachers’ planning book showed that they are using their classroom space to support their teaching strategy, and how they are using it.
- Triangulated the teachers’ verbal responses about classroom space (semi-structured interview), what is in classroom (classroom photographs) and what they wrote about their classroom (planning book).

3.4.4 Students’ Drawing

The second user group in the classroom environment are students. For the target age of this research it is usually difficult to express themselves verbally, therefore they prefer visual expression (Guillemin, 2004). Therefore, drawings are used as a method for students to express themselves. Drawings are used in this research for students, because it can help them to express their voice, inner stories, as well as an active and empowering stake in the research study (Literat, 2013). Moreover, “because of its playful nature and its lack of dependence on linguistic proficiency, this research method is especially suitable for work with children and youth across a variety of backgrounds and cultural contexts (Literat, 2013).” In this phase, the researcher’s aim was to understand learning space perception, how to design the best learning space, and explore design elements of learning space through students’ eyes using drawings as a method to achieve this. The researcher asked students to draw “*The Classroom of Their Dreams*” and support their drawings with written notes that explain their drawings.

3.4.5 Users’ Social Medias Analysis and Participation

Social network sites give users the opportunity to share many of the most desirable qualities of good educational technologies, allow communication through peer feedback and match the social contexts of learning in schools, universities or local communities (Mason, 2006). Social media is where people connect for a certain reason (Ryan, 2011). Additionally, social media are personalisable virtual spaces for online conversations and the sharing of content, and are usually based on maintaining and sharing ‘profiles’ where users can present themselves to others through the display of everyday activities, interests, photographs and social networks (Selwyn, 2009). However, the social networking industry was boomed in the 21st century. Online social communities have shaped and

flourished, and bridged space among people from different culture, race, and gender who usually share the same interests. Today, many of social networking sites are catering to interests of millions of users all over the world (Dingman, 2012). Social media analysis and participation can be a useful qualitative research method because:

1. It provides rich data to be analysed that result of the rich communication between social media users. This communication takes the shape of photos, video, text that can be freely shared by anyone with a connection to the internet (Ryan, 2011).
2. Social media is opening up new opportunities for virtual interaction and communication with its users all over the world, with diverse backgrounds and cultures. Most social media sites are worldwide sites, which means that people can join from all over the world to communicate and interact with people that share similar interests (Dingman, 2012). The opportunity to interact and communicate with users from different cultures who share similar interests can help understand users' point of view. For a Interpretivist / Constructivist research philosophy, we need to understand what people think and feel, as well as how they communicate, verbally and non-verbally (Easterby-Smith et al., 2008). All of these information are shared and offered by users in the social media. Non-verbally through images shared by people.
3. New social media as a communication technology has built extraordinarily salient information source (Walther et al., 2010), this information source could be a data source that is ready to be collected and analysed that previously was impossible to be accessed (Walther et al., 2010).
4. Denzin and Lincoln (2011) claimed that a qualitative research consists of a set of interpretive, material practices that make the world visible, which can be seen in social media as photos, text and videos through which people make their world visible to others.

This research considered users' online community where teachers share their everyday classroom life, for example: Different classroom activities, memories, exchange their learning approaches, teaching experience and post their successful teaching projects in learning space. Furthermore, this research have benefited from using social media different ways:

- One of the positive things about data collected from teachers' social network is that usually teachers share their best experiences, activities and memories through social networking, which has influenced the research findings.
- Explore the world of learning space users worldwide, and overcoming the geographical limitation.

There are different forms of Social media. In this research Facebook, Pinterest, Twitter, Blog and Flickr were examined. However, users interact, communicate and use each social media differently therefore it is important to note how the researcher used each of these social media. The following section explains how.

1. Facebook

According to Ryan (2011) Facebook boasts millions of users and it is known as the largest social networking destination today. Facebook gives users many ways to connect with each other (Ryan, 2011). In this research, Facebook was used to communicate with different classroom users despite their age, gender and background because each one of us have been either a user of classroom space in the past or until today and all of us have different memories of this important space. Therefore, two questions were posted; the first question was "What would the classroom of your dreams look like?" And the second question was "What are the memories of your classroom? What sort of things can you still remember about your classroom? Could you please support your response with photos if you have any?" The responses of these two questions were used as *Memos*. Figure 80 and Figure 81 show examples of user responses in Facebook.

شباب وشابات الفيس بوك... احتاج مساعدتكم بقوة... 😊

احتاج منكم الإجابة على السؤال التالي: ماهي الذكريات الجميلة أو السينة التي مازلتم تحتفظون بها عن الحياة المدرسية... وإذا عندكم صور بعد بيكون عز الطلب... وبالنسبة للشباب والشابات التي حالياً تطلبه أتمنى يتكلمون عن الأشياء يحيونها حالياً عن المدرسة والصف... وباريت تدعمون كلامك بصور..... أتمنى الكل يشارك ولكم مني جزير الشكر واللي حاب يجاوب بالانجليزي هاي السؤال: what sort of things that you still remember about your classroom? you can support your answer with pictures if you like

Like · Comment · Share 9

Nehal Almerbati mmmm very interesting let me try, I really admired the groupings, and all the chit chats happening earlier to the teacher entering class. i adored my desk where i used to draw shuttles (my favorite sport) and used the tape to save it from being erased or ruined.. about the class itself we all liked its large windows opening on the main court. Those windows were our retreat when we wanted to think or dream or simply entertain by watching the road and all its movements.. In high school we once had our class shifted to an auditorium it was amazing, how we would view the teacher from above and the exterior too, sit in the windows seat and eat snack and enjoy the garden smell oh I miss those days. In elementary school group table layout where my favorites and class room were filled with posters some of my handwriting hehe In primary school we had our personal corners and a sink and I think there was a pit we all shared taking care off. Hope this helps.. will send picture to your email 25 October 2011 at 14:22 · Unlike · 1

Intd Balbusmait من الذكريات الحلوة والسينة في نفس الوقت أني لما كنت في الصف الخامس الابتدائي نزل معدلي ووايد زعلت فمر علي كتاب فيه الخرائط الذهبية واحد الامور الي وايد مهمة ان في الكتاب كان مكتوب ان الواحد لازم يكون ايجابي ويشجع روحه بحمل ورسومات ايجابية فكنت اكتب وارسم هالاشياء واعلقها في عرفتني والكل كان يتطنز علي لما يدخل الغرفة لكن هذا الشيء طلعت نتايجه في اخر الفصل ان ارتفع معدلي اكثر من قبل وحيث علامات ماكنت اتوقعها الحمد لله من توكل ع الله نال ذلك ومن ذلك الياوم وانه دوم افول حق الناس قصتي وتجربتي 25 October 2011 at 16:07 · Unlike · 1

Chat (Off)

Figure 80: Examples of User Responses in Facebook

Fatima Al Madani I hate school toilets :S 20 October 2011 at 10:52 · Unlike · 1

Fatema Qaed Fatema ...thanks this was a really direct and emotional answercould you please write about nice memories 20 October 2011 at 12:29 via mobile · Like

Sara Qaed لا أعلم إن كان لهذا علاقة بالموضوع أو لا ..و لكن أعتمد أن جزء كبير من تعلقنا بالمكان وما نحمله من ذكريات سينة أو جميلة تعتمد على الرفقة التي كانت موجودة معنا في المكان .. ألاحظ أن العديد من الناس عندما يسألهم عن المرحلة الدراسية المفضلة يقولون : إعدادي أو ثانوي .. لأنه كانت عندنا "شله" أو ربع قله ! .. أنا شخصيا كنت أحب المكان الذي قاعد فيه .. آخر صعه ! يتح لي فرصة عمل العديد من الأشياء 😊 بس معنا للإخراج .. لانسائس شيو !! .. أذكر أيضا في المرحلة الثانوية .. كنا نحب النوافذ التي نطل على الشارع .. مجرد ما يطق الحرس كنا نروح نطلع رأسنا ونشم هوا ! .. أما بخصوص الذكريات السينة .. فكانت موضوع الكرسي .. متعبه جدا! عشان جدى الطلبة كانوا يقومون بتحريك أول ما يطق الحرس ! .. آخر شئ .. كنا وايد نكتب على السبورة .. من الإبتدائي إلى الإعدادي إلى الثانوي ! مادري ليش !؟ يمكن لأنه مكان إستراتيجي .. الكل يقدر يشوف اللي بنكتبه أو نرسمه !؟ 20 October 2011 at 14:38 · Unlike · 1

Alaa Almaddah من ذكرياتي المضحكة: أنا كنت طالبة مهذبه جداً وشاطره جداً وكانت شلتي اشعب ناس!! ويوم.. ناديني المشرفه عشان بقعني اكون جاسوسه على بنات صقي وأوصلها كل الأحبار.....! إس رأيك؟؟ أفقع صح؟؟؟ ؛) وطبعاً بأست مني..... من ذكرياتي السينة: انتشار طاهرة "الإعجاب" بين البنات وكانت موضه سخيفه و مفرقه.. من ذكرياتي الحلوه: كنت اعشق المشي مع البنات في الساجه بعد انتهاء الدوام مع أبو مافي شني عدل فيها! حتى الجو سيء..... فكريتي بالذي مضى 😊 ماني من ذكريات الجامعه؟ ؛) 21 October 2011 at 01:30 · Unlike · 1

Chat (Off)

Figure 81: Examples of User Responses in Facebook

2. Twitter

“Twitter is a popular micro-blogging social network” (Paul and Hong, 2011). It is designed to record and send short bursts of content to large audiences beyond a user’s direct social network (Murthy, 2013). “Twitter is a messaging service that shares a lot of characteristics with communication tools you already use. It has elements that are similar to email, IM, texting, blogging, RSS, social networks and so forth (O’Reilly and Milstein, 2009).” However, twitter users categorize their messages using short tags with the # symbol, they use the same hashtag when somebody wants to designate related messages, then others add the hashtag to messages about that topic (O’Reilly and Milstein, 2009). Today, most social media (not only Twitter) supports hashtags, which allow different users using different social media to be connected.

The researcher searched Twitter using #classroom to see what classroom users post under this hashtag, and what they share about classroom space. Searching for #classroom led the researcher to successful teachers’ teaching experiences shared on Twitter, and through their tweets, the researcher was able to contact these teachers. In addition through #classroom, I found students photos of their classroom ‘best memories’. This helped the researcher to be inside classroom users’ community which aided the researcher to look at classroom space through users eyes. Figure 82 shows examples of searching #classroom on Twitter.

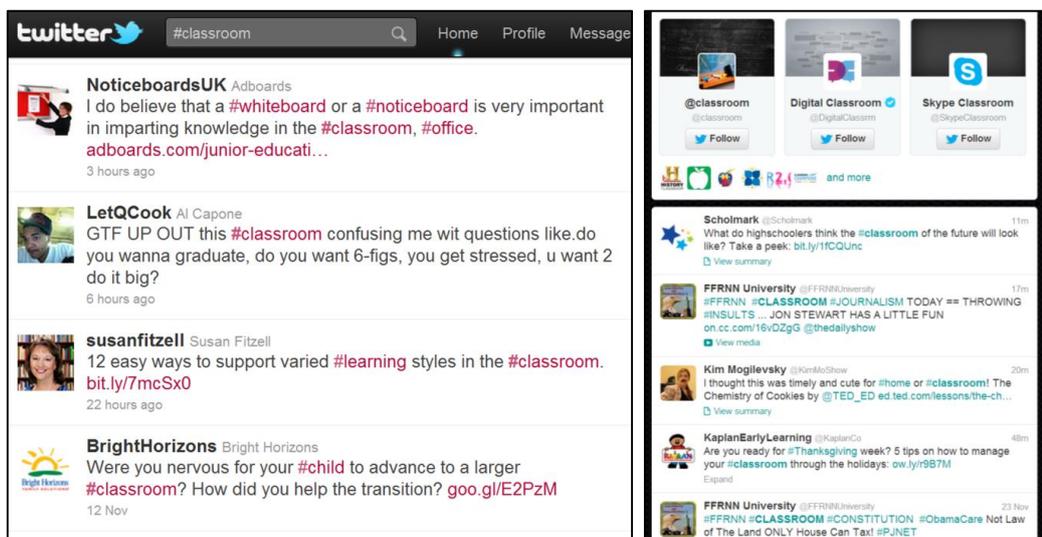


Figure 82: Examples of Searching #Classroom in Twitter

3. Blogs

“If you want the truth about school life, read the teachers’ blogs.” (Wallace, 2007). A blog is a form of micro-publishing (Williams and Jacobs, 2004), blog is an interactive website that delivers regular content to its readers, and it is a dynamic website that grows with every entry, or “post” created (Cho, 2012). Furthermore, blogs build a community of people who share the same interests, and offer feedback to each other (Cho, 2012), therefore they offer users communications tool (Williams and Jacobs, 2004). Blogging has evolved from its early origin as an online personal diaries, to the capacity to engage people in cooperative activity, knowledge sharing, reflection and argument (Williams and Jacobs, 2004). For this research, different teachers’ and educationist blogs were searched for in Google and other social media sites. For example, searching in Pinterest found teachers’ blogs, because Pinterest creates a link between photos and the blogs which were shared in.

From different teachers’ and educationalists blogs, the researcher was able be inside the community of learning space users and see closely how different teachers use and respond to classroom spaces differently, understand their space competence, and what the classroom space means to them. Furthermore, blogs have shown the researcher different ways of communicating with teachers, indicating how she can empower them to use the classroom space to support teaching and learning. Figure 83 shows examples of teachers’ blogs. Figure 84 and Figure 85 show different images posted in blogs by teachers. In Figure 84 the teacher had posted images of classroom decoration and different display ideas and in Figure 85 the teacher had posted images of different classroom teaching ideas.

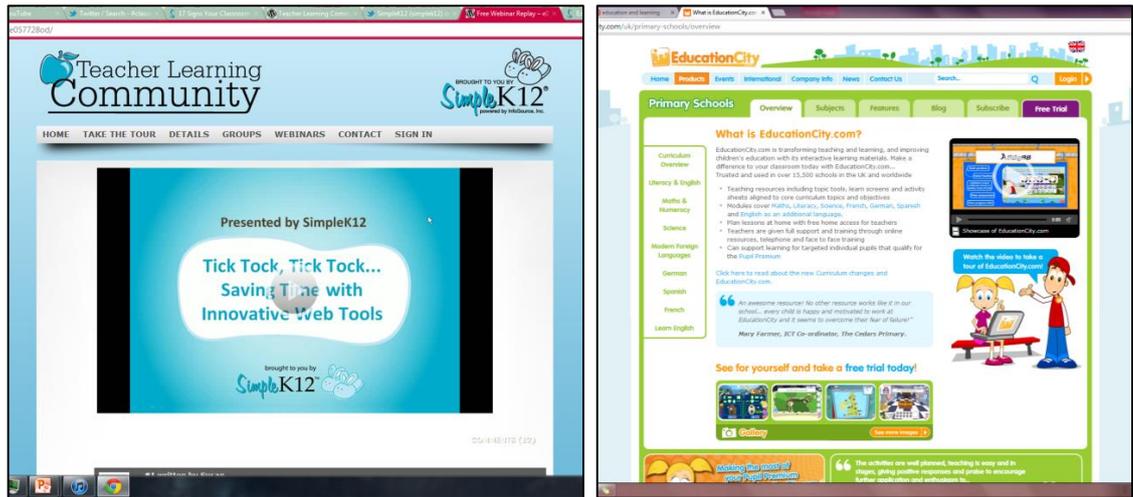


Figure 83: Examples of Teachers' Blogs

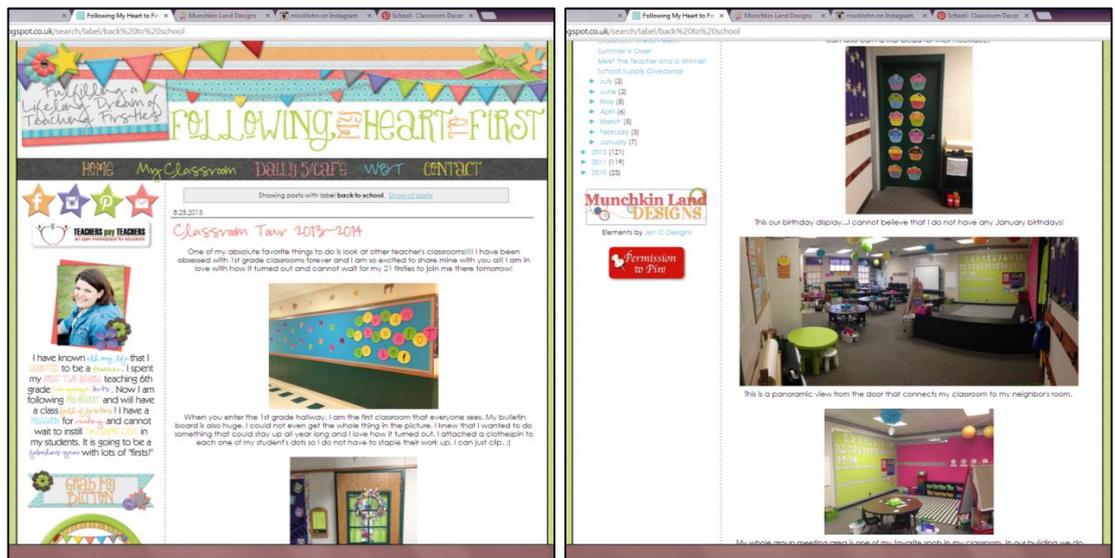


Figure 84: Teacher Had Posted Images of Classroom Decoration and Different Displays Ideas

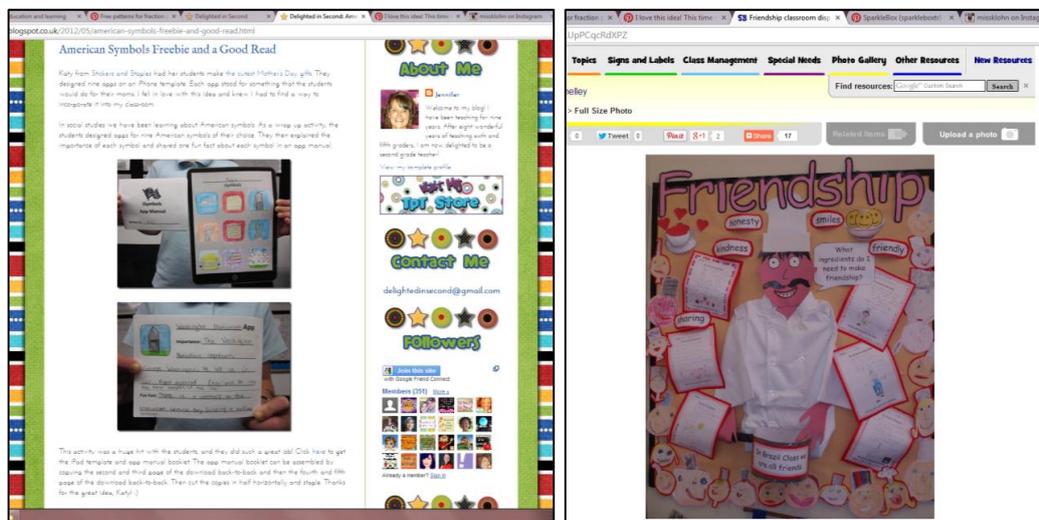


Figure 85: Teacher Had Posted Images of Different Classroom Teaching Ideas

4. Flickr

“Flickr is a combination of good images and careful networking” (The-Editors-of-Photopreneur, 2010). In Flickr teachers shared their classroom display and activity photos, and observing these photos helped researcher to understand teachers’ competence of classroom space and how they design this space. Figure 86 shows examples of classroom displays which teachers posted in Flickr.

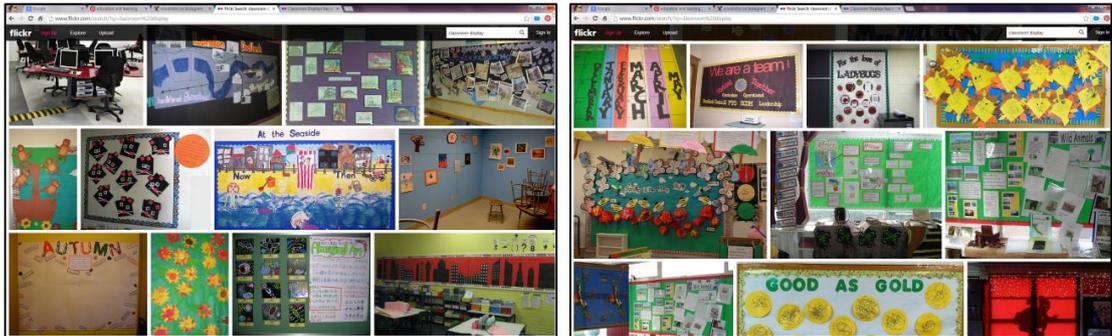


Figure 86: Examples of Classroom Displays Which Teachers Posted in Flickr

5. Pinterest

With Pinterest, the researcher found a large diverse teacher community where different teaching and learning experiences are shared. In Pinterest, teachers share classroom activities, teaching tools, classroom makeover, classroom activities, learning approaches, classroom displays and teaching strategies. Pinterest was a rich data source for the understanding of how users design classroom spaces after architects finish their work. In addition, the teacher’s posts helped the researcher to understand the relationship between classroom design elements, teaching and learning. Figure 87 shows examples of classroom activities which teachers shared in Pinterest. Figure 88 shows examples of teaching tools shared by teachers in Pinterest, Figure 89 shows examples of classroom makeover by teachers posted in Pinterest and Figure 90 shows different classroom displays ideas shared in Pinterest by teachers.

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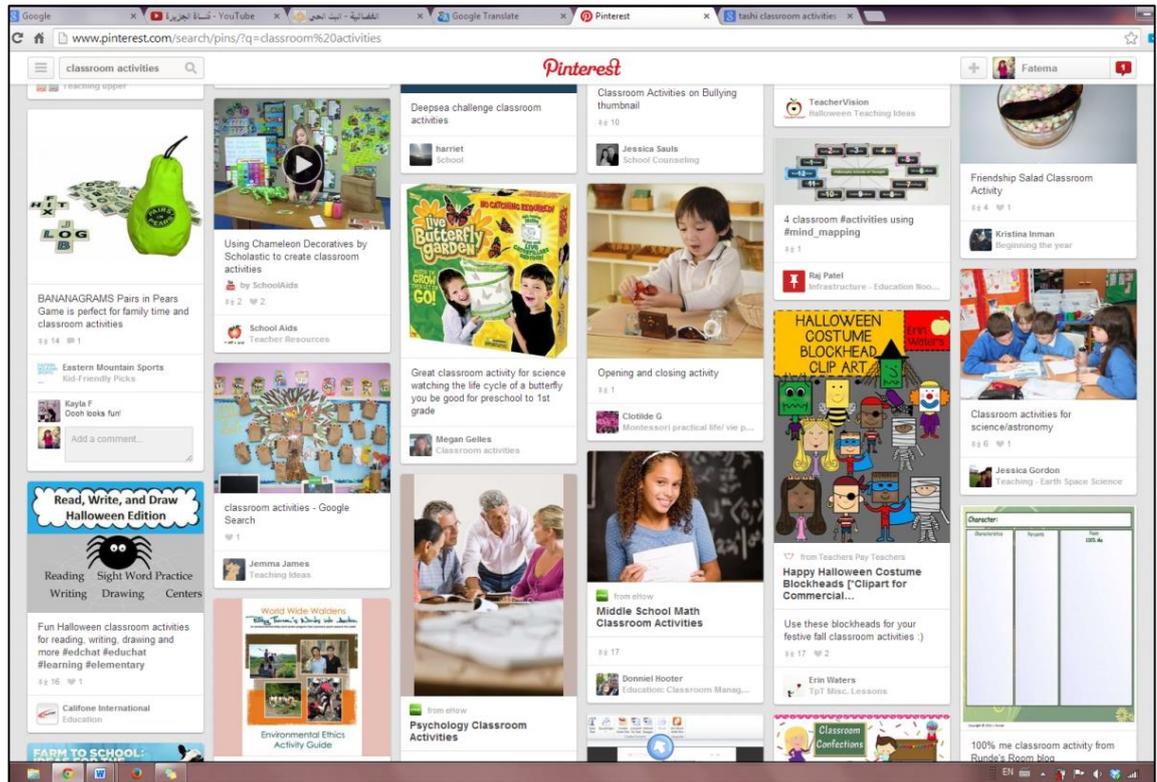


Figure 87: Examples of Classroom Activities Which Teachers Shared in Pinterest

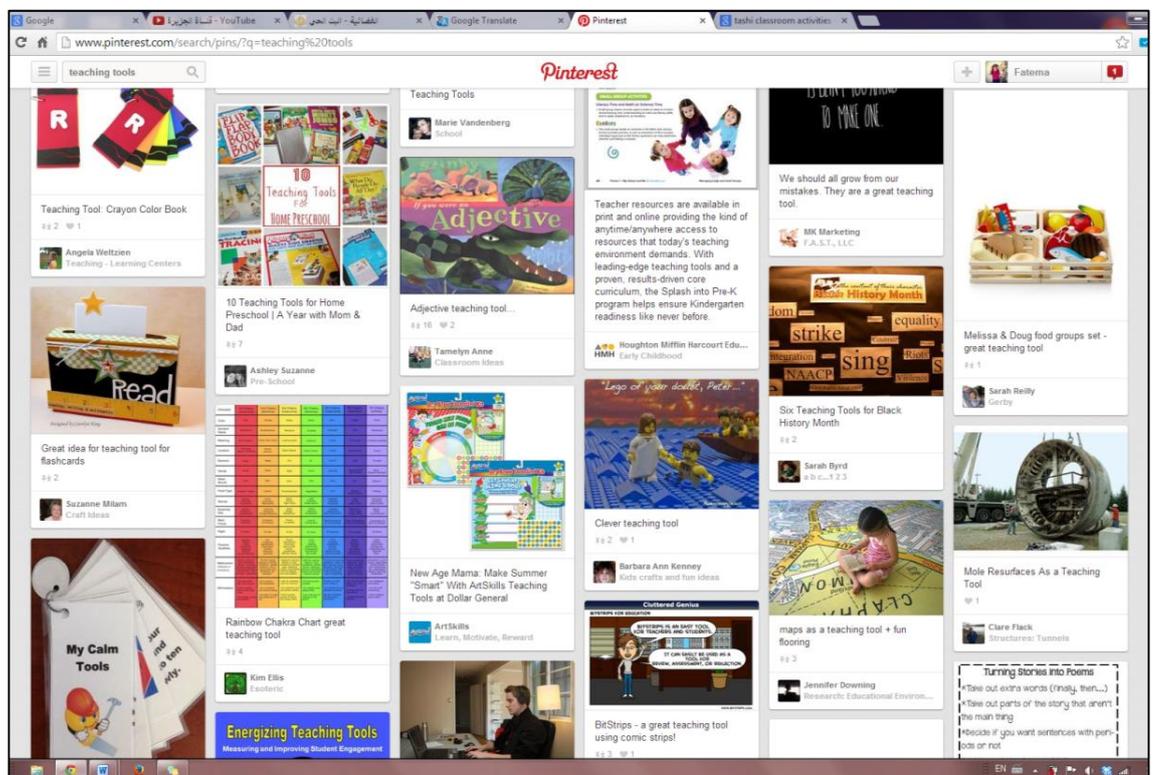


Figure 88: Examples of Teaching Tools Shared By Teachers in Pinterest

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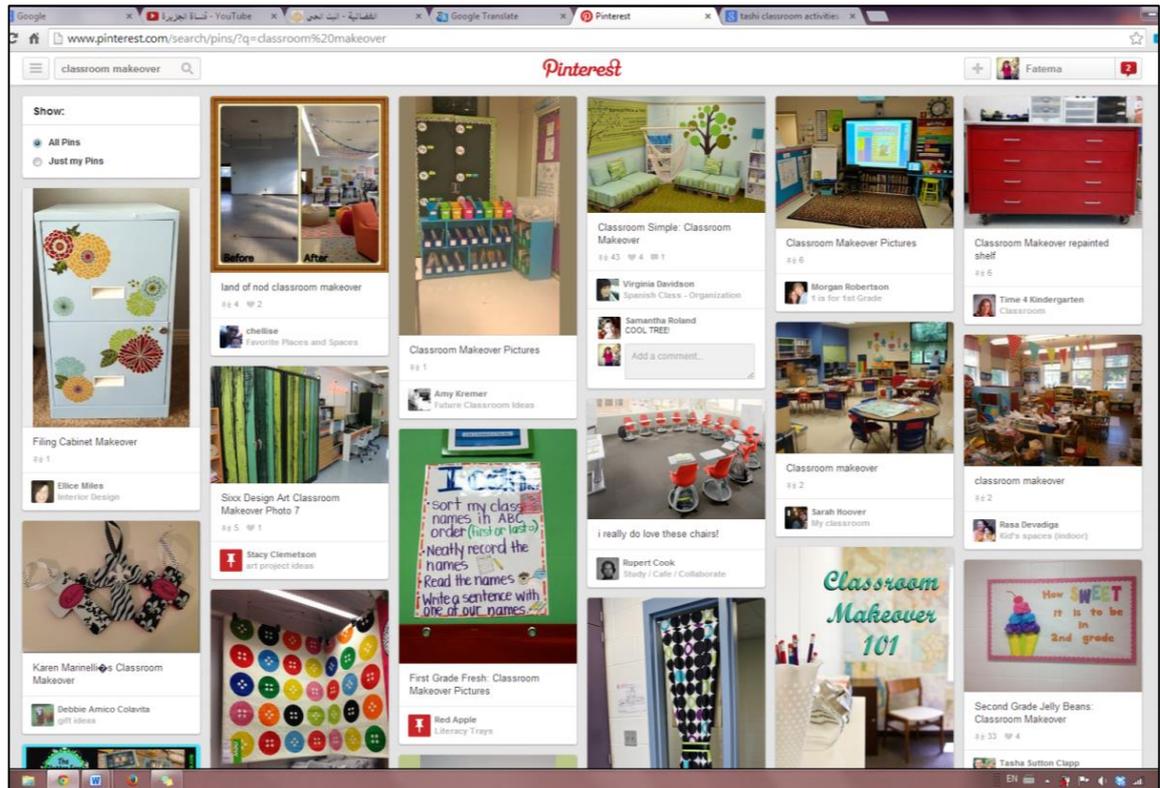


Figure 89: Examples of Classroom Makeover by Teachers Posted in Pinterest

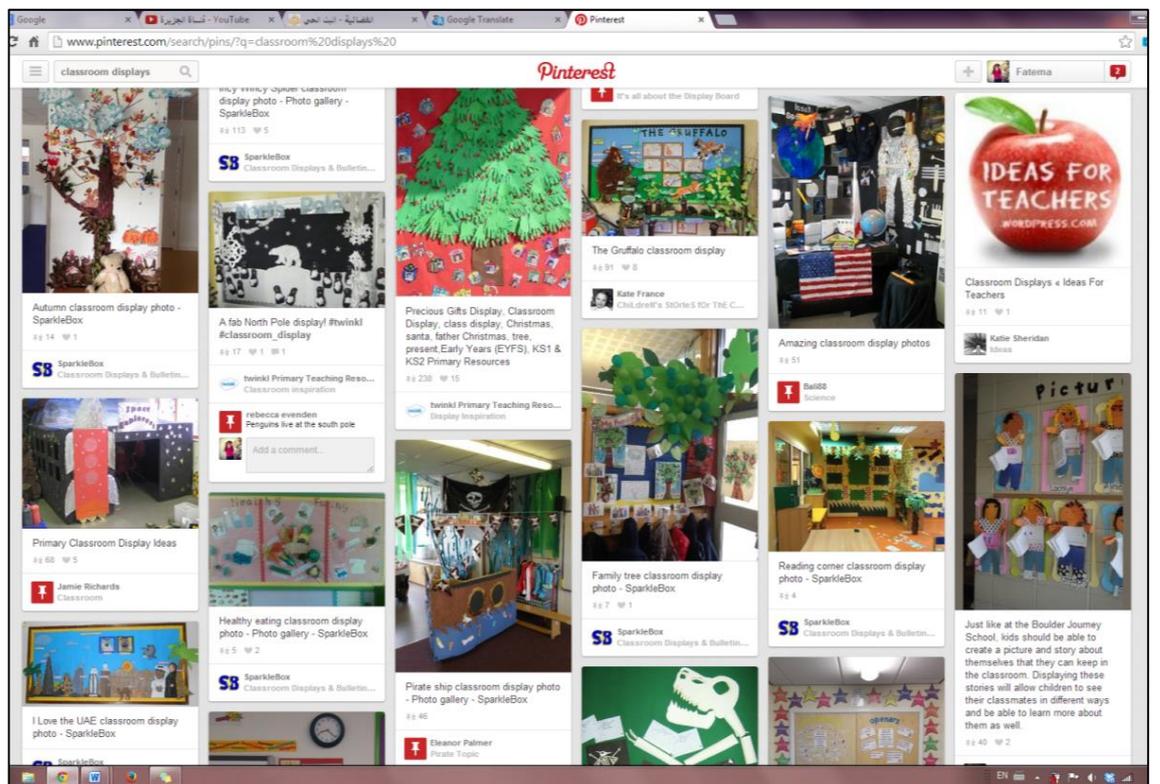


Figure 90: Different Classroom Displays Ideas Shared In Pinterest by Teachers

3.4.5.1 Data Purpose

It is important to mention that the data generated from these different methods have been used differently in different research phases: First and second phase collected data helped researcher understand and find problems, and later inspired researcher with different design solutions. In the third phase, collected data was a resource for the designed solution itself.

3.4.6 Third Phase: Action

Most of learning space design research identifies problems and describe theoretical different cases of learning space design, therefore this phase is planned to go further by designing a practical solution for some of learning space problems which revealed in phase one and two and understood in phase two. This phase begins with reflecting on the findings of previous phases (contextual review, users' perception of learning space design) and looking for solutions. This phase aimed to design a practical solution and evaluate it, supported by theoretical knowledge generated from previous phases inspired by design thinking. This tool designed to achieve the research second aim which is empowering and supporting classroom teachers to maintain effective learning spaces beyond the initial designs of architects, "Designing is a self-monitoring, self-regulating process (i.e., a second order system), where flaws introduced via an earlier activity can be caught and corrected (Cockton, 2013)." Methods for this phase are explained in details in chapter five.

3.5 Research Sampling

The aim of sampling in qualitative research is not to achieve demographic representation of the research participant (Wertz et al., 2011), but to understand the details of their perception and explore the why and how questions. Like most qualitative research (Kvale, 2008), and in order to make such analysis focused, it is important to collect a limited samples whilst exploring different kinds of data (Kvale, 2008). Therefore, it was important in this research to limit the number of sampling such as number of teachers, and explore different types of data such as classroom photos, sketches, planning books and drawings. Additionally, with the limited body of data in this type of qualitative research it was essential that the data went through deep varied analysis in order to create a detailed understanding of the topic and to improve the research validity.

3.6 Pilot Study

3.6.1 Teacher Pilot Studies

Informed by the methodology, two pilot interviews were carried out with teachers, and as a result, the researcher made these changes:

- Instead of giving teachers questions on cards and asking them to write their responses, teachers preferred to be asked in person and for the researcher to listen to them and write answers, because it is easier for teachers to talk than write.
- One of the teachers thought that this question “As a teacher, what are elements you think that designer should take into consideration while designing classroom environment?” and “Determine Elements that effect classroom environment design” would get the same response. However, the researcher did not change the questions because it might give different answers from other teachers’ point of view.
- From these two pilot studies, the researcher should be aware that some teachers’ terminologies are different from designers’ or researchers’ terminologies. It is important to ask teachers about what they mean by using certain terminology, for instance it is important to ask teachers what they mean by comfort in the classroom.
- It is important to ask them for details about some elements, for example: one of the teachers in the pilot study mentioned that nice colours in the classroom are important, it is important to ask what these nice colours are, and important for what?
- One teacher teaches in more than one classroom environment, therefore, one teacher can use more than one classroom’s photos to answer the questions.
- Some teachers didn’t have a camera, so I planned to bring my camera and ask teachers what they wanted me to capture.

3.6.2 Students’ Pilot Study

Four pilot drawings by with students resulted these changes:

- In the pilot study, when the researcher asked students about their drawings, they explained interior design details such as the type of material they wanted to be used in the space and the texture of the materials. However, the drawings by themselves did not explain these details, therefore, from pilot study conversations with students the researcher asked students to attach written notes that explained their drawings.

- During the pilot study, one of the students asked for more than one sheet of drawing paper, and she drew two different visions of the classroom space of her dreams which helped the researcher during analysis understand different aspects of the design of classroom space. Therefore, the researcher gave students the freedom to draw more than one drawing.

3.7 Reliability and Validity

“The validity of qualitative analysis depends more on the quality of the analysis than on the size of the sample (Kvale, 2008).” Therefore, the data of this research went through many level of analysis. Additionally with the small size of the data sample in this type of research it is important to explore different methods of data in order to improve the reliability of the research (Kvale, 2008), therefore, in this research different methods of data collection were used, for example in the observation notes, photos and sketching. Also, the teachers phase photos and planning books were used to support the interviews. In addition, in order to increase the validity and reliability of this research, the researcher avoided leading the participants and gave them enough space to present their own perspectives. Also, according to Silverman (2005) such research could suffer from the differences between what people say and what they do, which can affect the reliability and validity of the research, therefore, the researcher in the teacher phase had supported what they said in the interview with what they do in the classroom photos and planning book.

3.8 Summary

This chapter have explained the philosophical approach of this research by outlining the ontological and epistemological foundations. After that it described methodological approach applied and justified the chosen methodology. Finally, this chapter expounds the research strategy which shows the research three phases and the methods employed to collect data in each phase. However, it is important to be noted this research journey there was no clear linear progression of methodologies, the research strategy have developed in each chapter of this research as research phases improving according to the data analysis, findings, and the reflection on each phase.



Development of a Supportive Tool for Participatory
Learning Space Design

CHAPTER 4: UNDERSTANDING LEARNING SPACE USE AND POTENTIAL

“Although designers analyse the world in order to shape it, they also wish to understand the present situation, but this understanding is an instrument of change. (Mattelmäki, 2006)”

CHAPTER 4: UNDERSTANDING LEARNING SPACE USE AND POTENTIAL

The overall research project has been structured into three phases in order to achieve research aims. These phases are First Phase: Contextual Review; Second Phase: Users' perception of learning space, and Third Phase: Action. This chapter will start explaining the data analysis process and methods. After that it will reports on the findings of first phase and second phases and is divided into four main sections: (1) comprehending changes in classroom space; (2) creating an understanding of classroom space; (3) classroom space design elements and; (4) understanding the relationship between classroom space design, teaching strategy and curriculum.

4.1 Analysis

Analysis is an important part of research because it makes sense of the collected data. However, methods such as interviews and observations produce a descriptive account of the study, but they do not provide explanations (PopeC et al., 1999). It is the researcher's role to make sense of the collected data via exploring and interpreting during analysing data (Burnard et al., 2008).

4.1.1 First Phase Analysis

Next section will explain the observation analysis done during the first phase (Contextual Review):

4.1.1.1 Observation Analysis

During contextual review the researcher used observation methods as a comparative approach to reviewing the literature on learning space. This approach took into account the teachers' ways of utilising their space and their support for various teaching techniques and strategies. Five schools were observed in Bahrain, and the observations were recorded through written notes, drawing sketches and capturing photographs of different school learning spaces. In order to analyse observation data the researcher connected the sketches with the notes and the photographs using different analysis approaches. Next is explanation of these approaches: (1) First Approach, (2) Second Approach, and (3) Third Approach. Figure 91 explains the observation's analysis process.

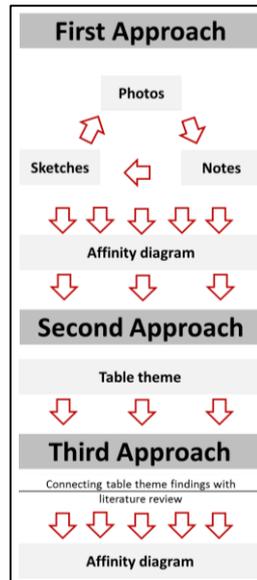


Figure 91: Observation's Analysis Process

After putting observation data together and comparing it with contextual review, an affinity diagram was used to analyse them. Affinity diagrams cluster similar observation notes into groups, while other observation notes are in different groups and the analysis continues by grouping these clusters into more abstract clusters (Koskinen, 2003). This produced an interpretation of data (Koskinen, 2003), the difference between what architects and users design in space, understand the literature review, and finally it helped to identify how our understanding of the relationship between learning and space from contextual review is reflected on the design of space. Figure 92 and Figure 93 show examples of notes that emerged from the affinity diagram.



Figure 92: Examples of Notes That Emerged from the Affinity Diagram



Figure 93: Examples of Notes That Emerged from the Affinity Diagram

4.1.2 Second Phase Analysis

Next section will explain the systemic analysis process of methods used in the second stage (Users' Perception of learning space) for both teachers and students:

4.1.2.1 Teachers Phase

The main aim of this phase was to explore classroom space and understand it from the teachers' point of view. In this phase, three qualitative methods were triangulated: Semi structured interview, visualised by Photographs and supported by the Teachers' planning books. Participant teachers were interviewed and asked to visualise their answers with their classroom photographs supported by pages from their planning books, (Figure 94) explains teachers' methods.

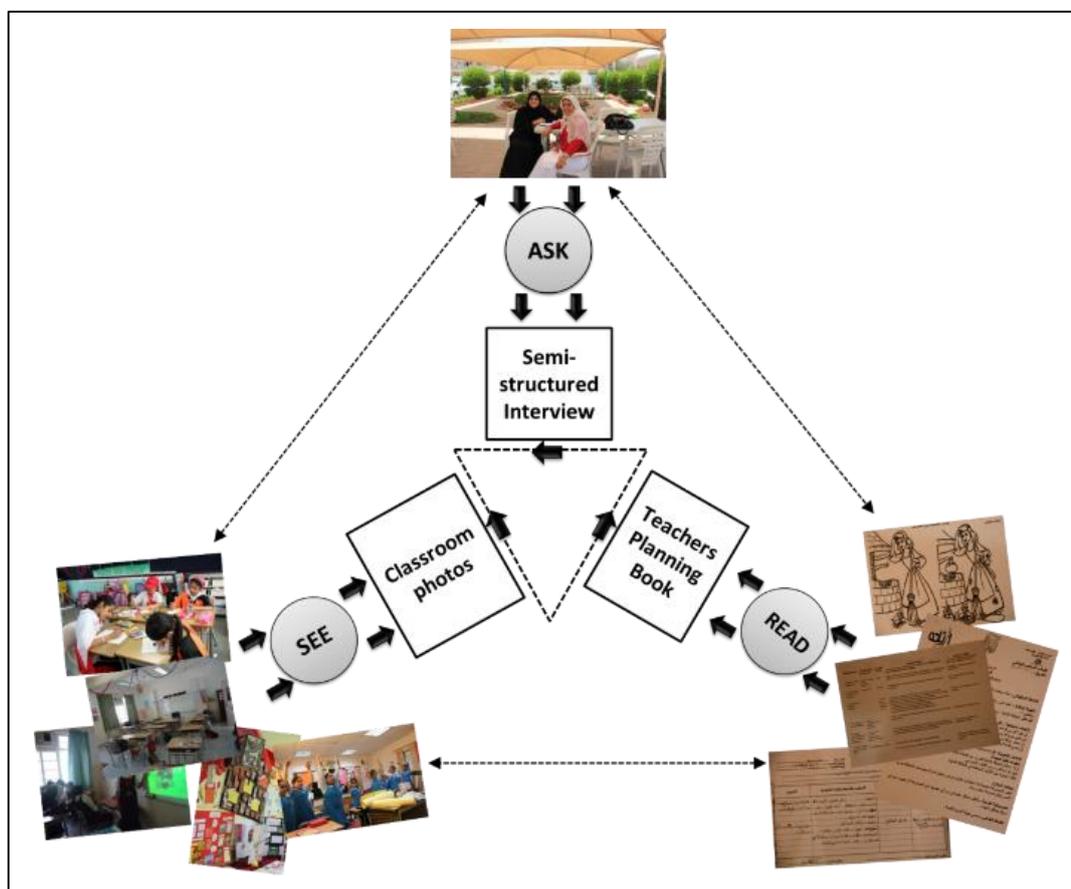


Figure 94: Teachers' Methods

The analysis process is (1) Individual Teachers syntheses, (2) Teachers aggregation, (3) Teachers' Final Analysis:

1. Individual Teachers syntheses

According to Saldana (2009) one of the most critical outcomes of qualitative data analysis is to interpret how the individual components of the study weave together. Therefore, in first level of analysis, each set of teacher data was formed from three different methods assembled individually into separate long paper sheets. For fifteenth teachers, fifteenth data sheets were created. In addition, analysing each set of teacher data individually in one sheet was important to:

1. Compare what the teacher said during interview with what was seen in teachers' photos of their learning space and what they wrote in their planning book. The comparisons between these three qualitative methods (interview, photos and planning book) in one sheet showed the relationship between design elements in the learning space and teachers. Additionally, it helped to know if the learning space supports teaching strategy and if so, how are they using it?
2. Compare what the teacher said with what existed in the learning space on one sheet. This aided the researcher to see clearly the relationship between different classroom design elements and users, which led the researcher to understand what classroom space means to users.
3. Compare interview answers together. For instance, some of the teachers mentioned classroom design elements while defining a classroom. Therefore, I moved classroom design elements from classroom definition to classroom design elements in the same sheet.
4. Identify which design elements teachers are aware of, hence they mention it in the interview and write about it in their planning book. There are some classroom design elements that teachers do not mention in the interview but they write them in their planning book.
5. Identify which design elements teachers are not aware of, for example the researcher can see them in the classroom photographs, but the teacher did not mention them in the interview or in the planning book.

Coding Methods used in Individual Teachers syntheses

Usually, Coding is a combination of data summation and data compilation that breaks the data apart in analytically relevant ways leading to more questions about the data

(Saldana, 2009). Coding methods involve attaching keywords to a text section in order to identify a statement. Additionally, coding is a main aspect of content analysis (Kvale, 2008), and it is about linking rather than just labelling (Morse and Richards, 2007). It is a process of breaking down, investigating, comparing, conceptualizing (Strauss and Corbin, 1998) and category refinement (Morse and Richards, 2007). The importance of coding is that it generates the bones of qualitative research analysis, and integrating these bones will assemble them into a working skeleton (Charmaz, 2006), because coding is a process that permits data to be: “segregated, grouped, regrouped and rethink in order to consolidate meaning and explanation (Grbich, 2007).” Although the purpose of coding is different for different methods (as well as for different research stages), all coding should have purpose (Morse and Richards, 2007). There are several purposes for coding in different qualitative methods. However, all coding types share the aim of getting from unstructured and messy data to ideas about what is going on in the data (Morse and Richards, 2007). Therefore, all coding methods allow the researcher to simplify and focus on certain characteristics of the data. All of them support the researcher in abstracting from the data (Morse and Richards, 2007). Each teacher sheet was coded individually using the same methods theme: (A) Attribute Coding, (B) Structural Coding and (C) In Vivo Coding.

A. Attribute Coding

Attribute coding is basic descriptive information on fieldwork, such as school name, or participants’ characteristics (e.g., age, gender) (Saldana, 2009). However, according to Saldana (2009) Attribute coding is particularly applicable for multiple participants and studies with a wide variety of data forms such as interview field notes, documents and artefacts (Saldana, 2009). In this research, *Attribute Coding* was used to code characters of the participating teachers in questions 1-4:

Q1: Your gender please?

Q2: Name of the subject you are teaching?

Q3: Years of teaching experience?

Q4: The gender you are teaching?

The coding of responses from all four questions was classified under one section titled ‘teacher profile’. (Figure 95) show examples of first, second and third teacher profile in the first stage analysis, which analysed using *Attribute Coding*.

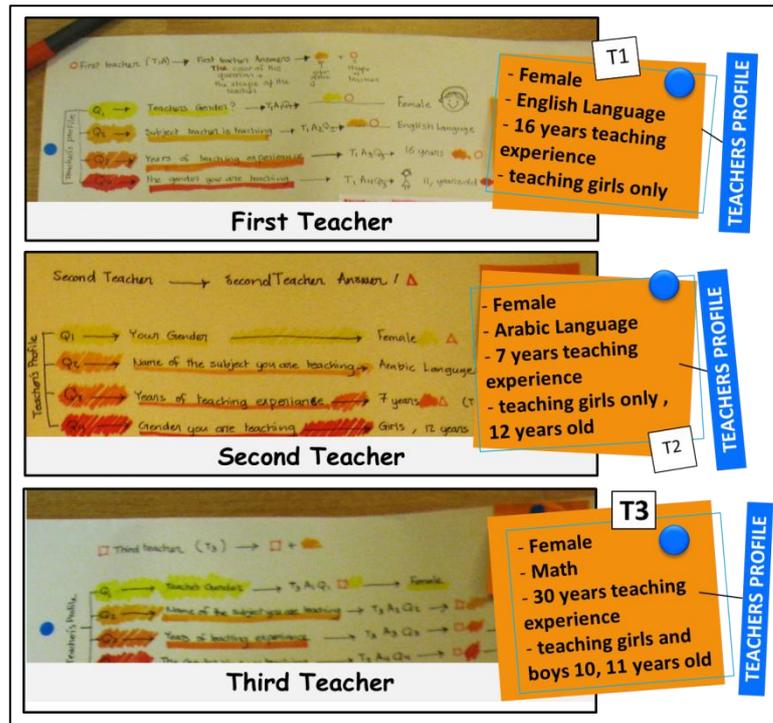


Figure 95: Examples of First, Second and Third Teacher Profile analysis using Attribute Coding

B. Structural Coding

“Structural Coding applies a content-based or conceptual phase representing a topic of inquiry to a segment of data to both code and categorize the data corpus.” Saldana (Saldana, 2009) *Structural Coding* is particularly appropriate for studies. With multiple participants and semi-structured data (Saldana, 2009). With it is more suitable for interview transcripts than other data such as researcher generated field notes (Saldana, 2009). In this research *Structural coding* was used to structure all the interview questions into five sections, which later refined to be the finding sections.

C. In Vivo Coding

In vivo identifies words or short phrases from the terms used by participants (Saldana, 2009). In this research, *In Vivo* is used to code teachers’ in the interview. Figure 96 - Figure 97 show examples of using *In Vivo* in coding teachers’ interview responses, where words and phrases from their interview answers were underlined. Figure 96 shows an example of *In Vivo* coding in fourteen teacher responses in the ninth question and Figure 97 shows example of *In Vivo* coding in teacher number six responses for the eleventh and twelfth questions.

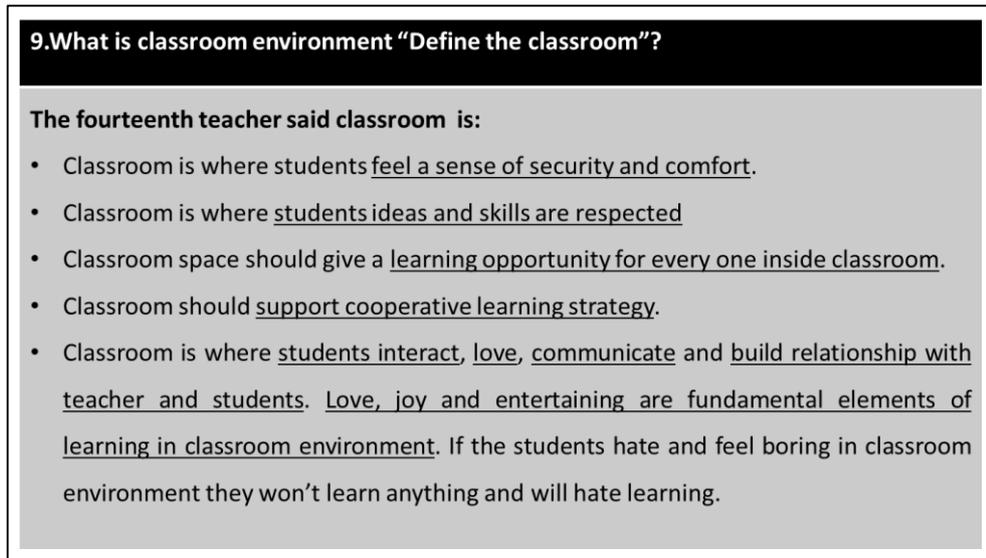


Figure 96: Example of In Vivo Coding in Fourteen Teacher Responses in the Ninth Question

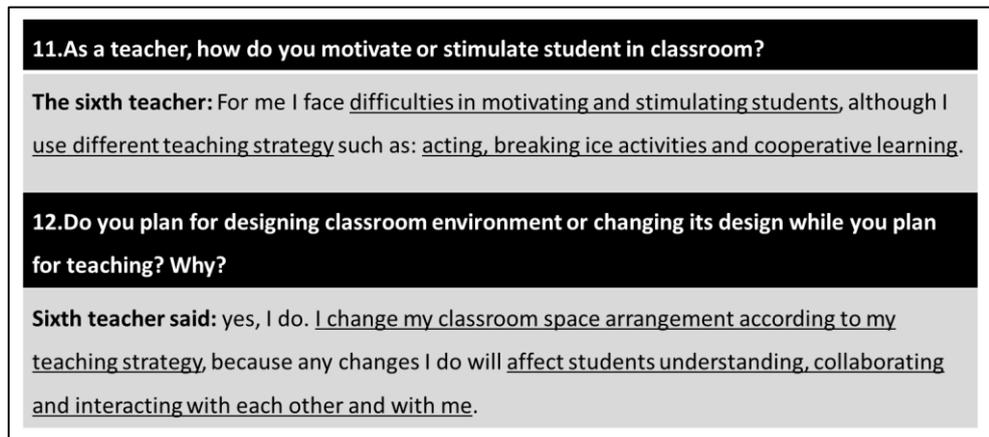


Figure 97: Example of In Vivo Coding in Sixth Teacher Responses in the Eleventh and Twelfth Question

Memos

Memos are a place to “dump your brain” during investigation through writing and thinking more (Saldana, 2009). *Memos* are “sites of conversation with ourselves about our data” (Clarke, 2005). According to Mason (2002) the purpose of *Memos* is “Thinking critically about what you are doing and why, confronting and often challenging your own assumptions, and recognizing the extent to which your thoughts, actions and decisions shape how you research and what you see”. Additionally in *Memos*, researchers can reflect on and write about how they personally relate to the participants (Saldana, 2009), and through *Memos* they can establish connections with the social world they are studying (Saldana, 2009). “The process of writing memos enables you to reflect on the data record (Morse and Richards, 2007).” Also, *Memos* sympathize and empathize with research participants’ actions in order to comprehend their perspectives and worldviews (Saldana,

2009). Additionally, *memos* may be used to record descriptions of events observed or researcher memories of the mood or the context during data collection (Morse and Richards, 2007), and link data to literature (Morse and Richards, 2007). Moreover, some *memos* can work as indirect data, to provide insights into participants’ experiences and responses can be found in literature, theatre, art and movies (Morse and Richards, 2007). Such sources provide interpretations of real life that researches can use in analysis

In this research:

- Some *Memos* came from other design disciplines such as graphic design, typography design, service design and product design, and others
- From contextual review and observation results
- Users’ Social Networks.

In the second stage, fifteen analysis sheets were created for fifteen teachers and in order to read these easily, a Key plan guide was designed. Figure 98 explains analysis sheet colour coding key plan.

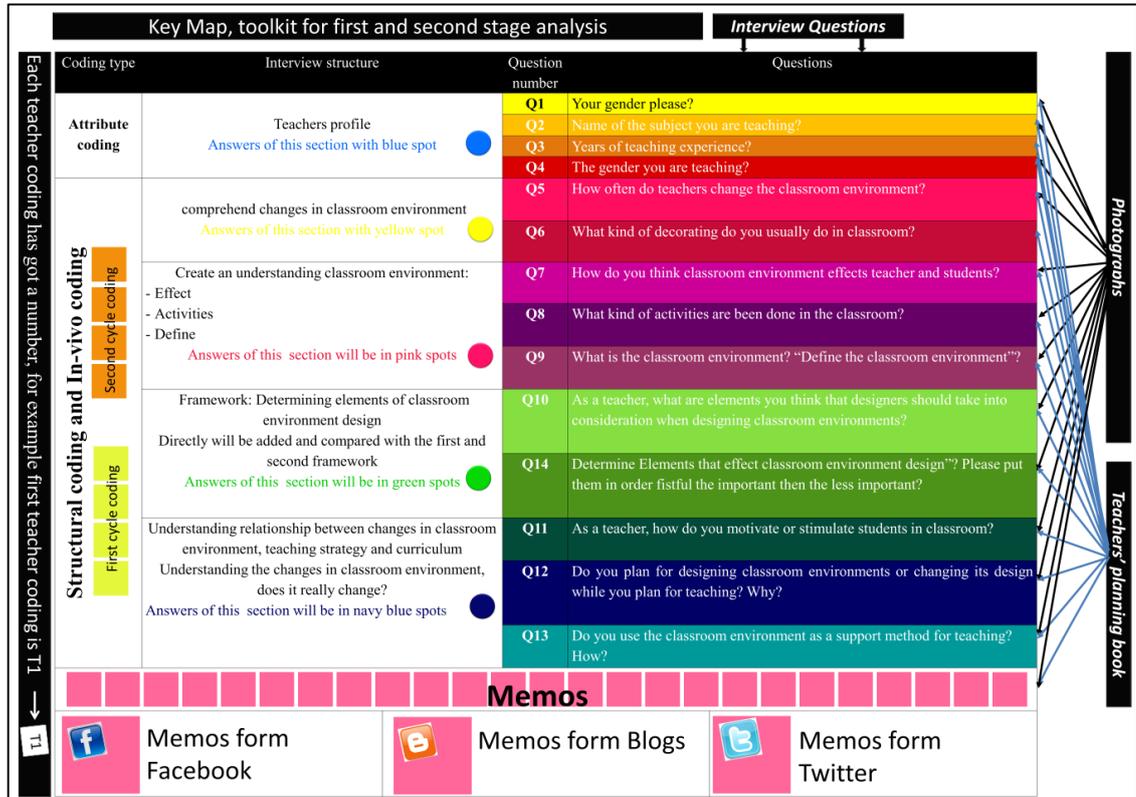


Figure 98: Analysis Sheet Key Plan

Interview questions were grouped into different sections with each represented by a different bullet colour. Questions one to four were analysed using Attribute Coding in one section titled “teachers’ profile”. Figure 99 shows questions from 1-4 and button colour of “teachers’ profile” section.

| | | |
|--|----|---------------------------------------|
| Teachers profile Answers of this section with blue spot | Q1 | Your gender please? |
| | Q2 | Name of the subject you are teaching? |
| | Q3 | Years of teaching experience? |
| | Q4 | The gender you are teaching? |

Figure 99: Questions from 1-4 and Button Colour of “Teachers’ Profile” Section

It is important to note that data went through two cycles of coding in the first level of analysis, the first cycle coding represented by yellow colour and second cycle coding represented by orange colour. The first cycle coding is a transformation process where data is prepared for the second cycle coding analysis, according to Morse and Richards (2007) the importance of this process is to keep the data as close as possible to the actual events. The first and second coding cycle is explained in the analysis sheet key plan in Figure 98, the first coding cycle is where all the data put in together as they are, and the second coding cycle is where researcher started filtering the data in the same sheet. As explained before in the first analysis sheet, three types of data were collected: interview questions, photos and planning books. Figure 100 shows first analysis sheet preparations. These three types of data were analysed together in one sheet for each teacher. Figure 101 shows the three types of data in first analysis sheet for the twelfth teacher.



Figure 100: First Analysis Sheet Preparations

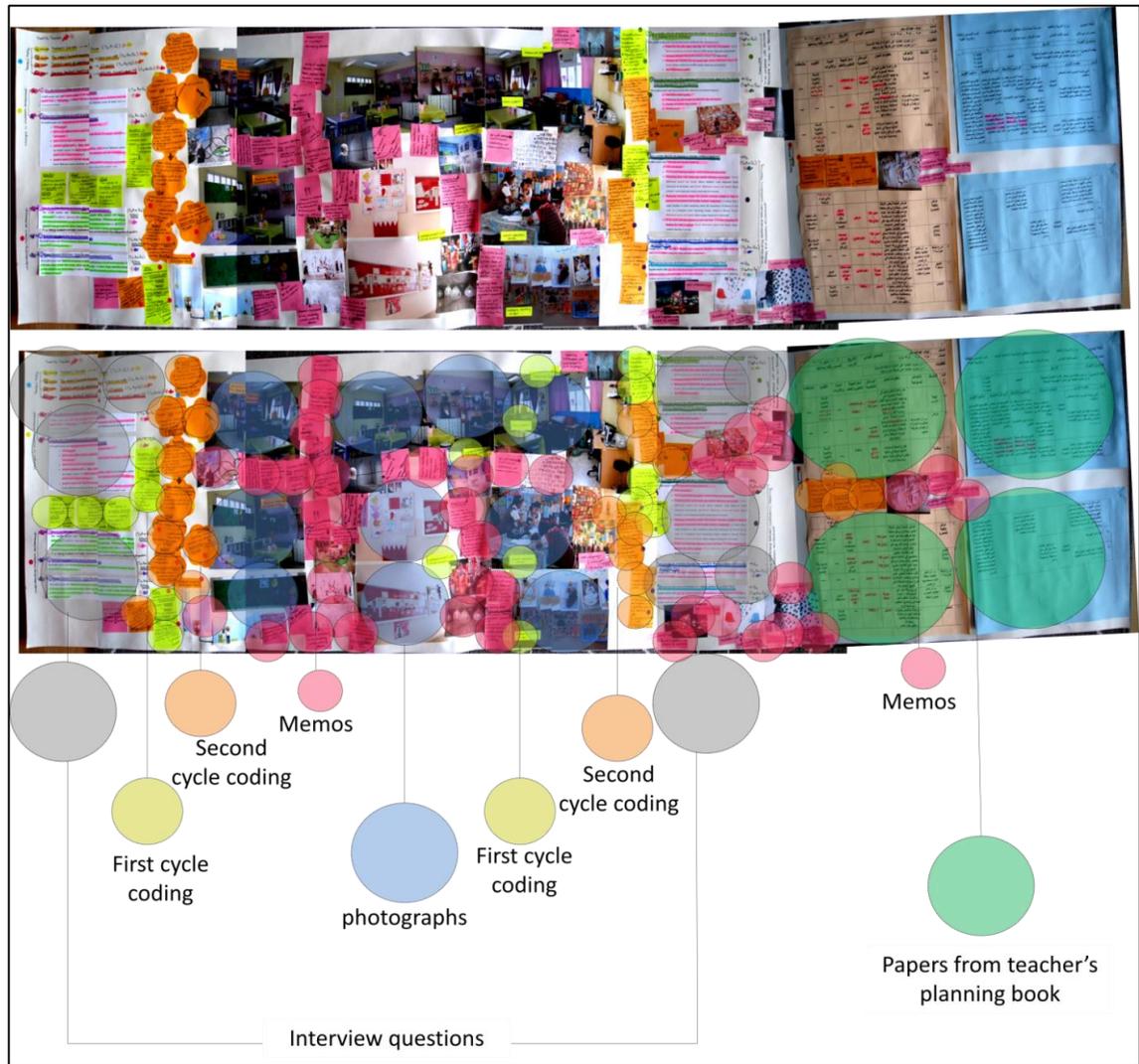


Figure 101: The Three Types of Data in First Level of Analysis Sheet for the Twelfth Teacher

Each teacher's data was analysed together on one sheet, therefore fifteen analysis sheets were created for fifteen teachers. The following figures (Figure 102- Figure 104) show teachers first level of analysis sheets.



Figure 102: First Teacher First Level of Analysis Sheet



Figure 103: Second Teacher First Level of Analysis Sheet



Figure 104: Third Teacher First Level of Analysis Sheet Second level of analysis

2. Teachers' aggregation

After the first level of analysis step, the second cycle coding of the teachers analysis were place, grouped and filtered together in one sheet, using the same coding methods and memos in another analysis sheet named teachers' aggregation. Figure 105 shows second level of analysis, used to compare the fifteen teachers' analysis results.



Figure 105: Teachers' Aggregation Sheet

In order to read Teachers’ Aggregation Sheet easily another key plan was created, Figure 106 shows the key plan of Teachers’ Aggregation Sheet.

| Coding type | Themes | Themes colors |
|---|--|--|
| Attribute coding | Teachers profile Answers of this section with blue spot | Teachers profile |
| Structural coding and In-vivo coding Second cycle coding | comprehend changes in classroom environment Answers of this section with yellow spot | comprehend changes in classroom environment |
| | Create an understanding classroom environment: - Effect - Activities - Define Answers of this section will be in pink spots | Create an understanding classroom environment: - Effect - Activities - Define |
| | Framework: Determining elements of classroom environment design Directly will be added and compared with the first and second framework Answers of this section will be in green spots | Framework: Determining elements of classroom environment design Directly will be added and compared with the first and second framework |
| | Understanding relationship between changes in classroom environment, teaching strategy and curriculum Answers of this section will be in navy blue spots | Understanding relationship between changes in classroom environment, teaching strategy and curriculum |
| Memos | | |
| | Memos form Facebook | |
| | Memos form Blogs | |
| | Memos form Twitter | |

Figure 106: The Key Plan of Teachers’ Aggregation Sheet

3. Teachers’ Final Analysis

After that Teachers aggregation, analysis results was structured into four sections which are: (1) Comprehend changes in classroom space that were represented by yellow colour, (2) Classroom space design elements which were represented by green colour, (3) Understanding relationship between classroom space design, teaching strategy and curriculum which were represented by blue colour and (4) Create an understanding of classroom space which were represented by pink colour. These four sections created the teachers findings in one A0 size sheet and it will be explained in details later. A small size of teachers’ finding sheet is shown in Figure 107,



Figure 107: Teachers Findings

4.1.3 Students' Drawing Analysis

The second user group in a classroom space is students. Therefore, a way of exploring the classroom is to ask those who learn in classroom space. Therefore, the researcher asked students to draw “*The Classroom of Their Dreams*” and support their drawings with written notes. 170 Drawings were collected, supported by students’ notes Figure 108 shows examples of students’ drawings with their notes. Drawings and notes were analysed in two level of analysis which are: Affinity Diagram and Comic Strips.



Figure 108: Examples of Students' Drawings Supported with Their Notes

4.1.3.1 Affinity Diagram

The first level of analysis used an affinity diagram to analyse the 170 drawings collected, supported by students' notes. Figure 109-Figure 110 show students' first level of preparation and analysis.



Figure 109: Students' Affinity Diagram Preparation



Figure 110: Students' Affinity Diagram

4.1.3.2 Comic Strips

After analysing the students' drawings and notes using an affinity diagram, the researcher realized that there were several classroom design stories that students expressed through their drawings and notes while imagining the classroom of their dreams. Students' stories cannot be understood well without their drawings, therefore the researcher organized the affinity diagram notes into groups of stories using comic strips style; in order to be able to read the students classroom design story with its drawings. Students' drawings in comic strips here provide stream of ideas not sequence narratives and it helped to understand and read scattered stories hidden in students' drawings.

Researcher linked the affinity diagram notes creatively to students' drawings in comic strips, and retell group of stories about classroom space design using drawings as a lens.

According to students' drawings, there were two ways of looking at the classroom space before thinking of its design elements; these two ways are outside the classroom box and inside the classroom box. Thus, students' comic strips stories is divided into two sections which are: living outside the box and it's represented with orange colour, and living inside the box and it's represented with purple colour. Figure 111-120 show students' comic strips "living outside the box". Figure 114-Figure 120 explain students' comic strips "living inside the box". In "living outside the box" comics students' told stories about classrooms in the sky, outer space, in the sea (Figure 111), classrooms in outside gardens (Figure 112) and in imaginary worlds (Figure 113). In "living outside the box" students explained imaginative design details such as colour, activities in space and furniture. Also they explained relation between space design objects, activities and users (Figure 114-Figure 120).



Figure 111: Students' comic strips "Living outside the Box"



Figure 112: Students' Comic Strips "Living outside the Box"

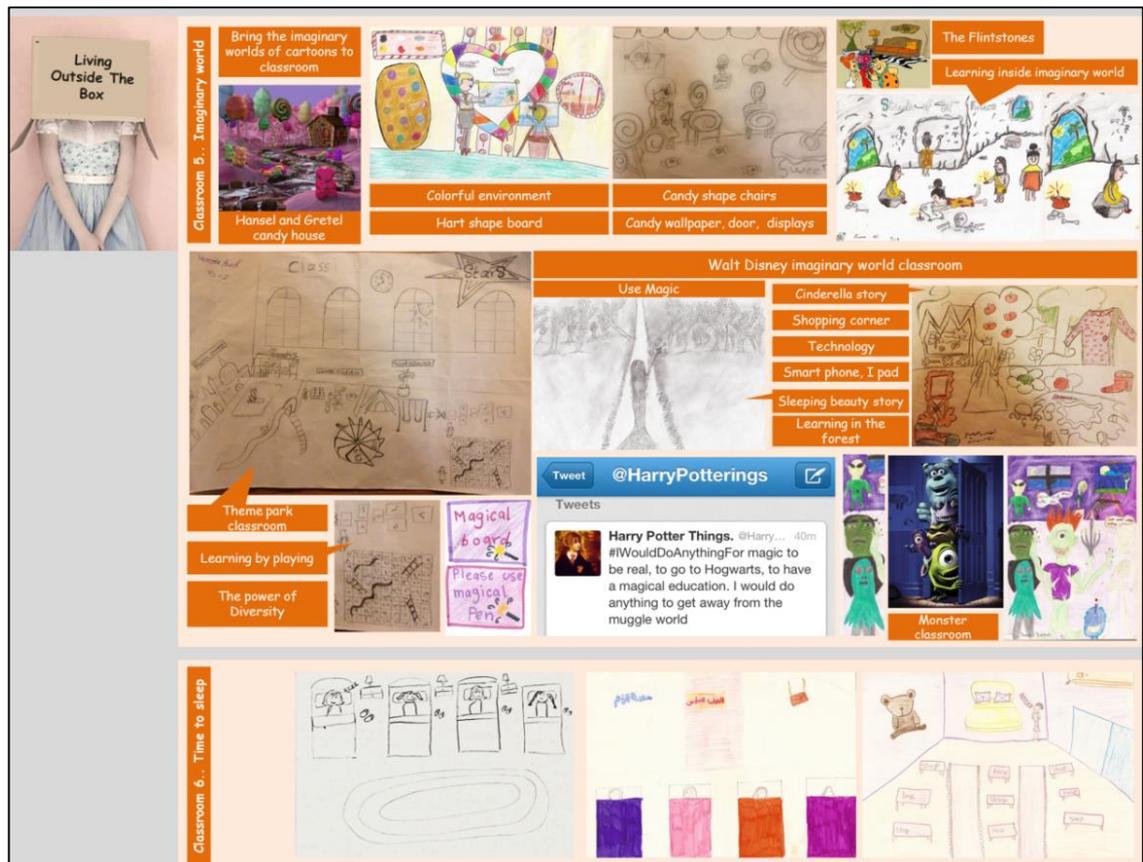


Figure 113: Students' comic strips "Living outside the Box"

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Figure 114: Students' comic strips "Living inside the Box"



Figure 115: Students' Comic Strips "Living inside the Box"

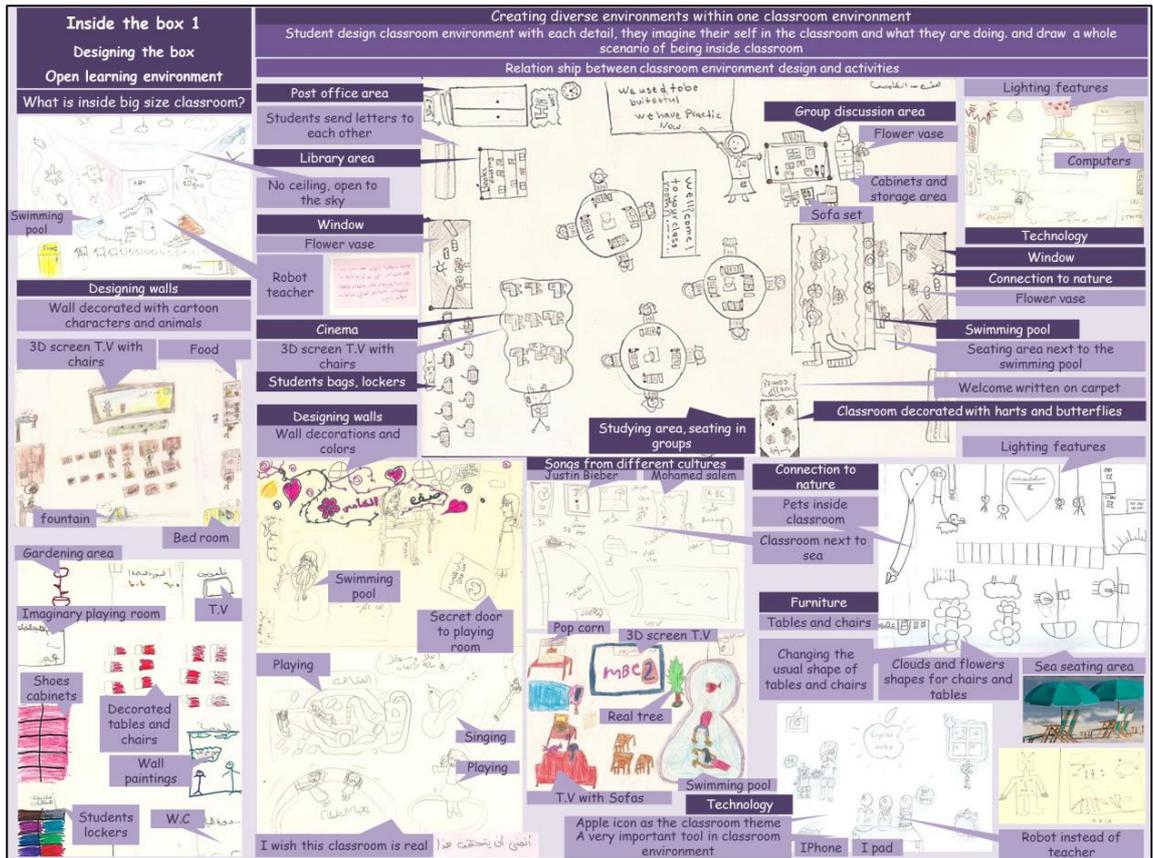


Figure 116: Students' comic strips "Living inside the Box"



Figure 117: Students' comic strips "Living inside the Box"



Figure 118: Students' comic strips "Living inside the Box"



Figure 119: Students' Comic Strips "Living inside the Box"

After that Students’ comic strips “*Living outside the Box*” and “*Living inside the Box*” were combined and compared together in one sheet, Figure 120 shows Students’ comic strips analysis in one sheet. Detail explanations of these stories is next.



Figure 120: Students’ Comic Strips Compared Together in One Sheet

4.1.4 Holistic Analysis (Teachers and Students)

Finally students’ second level of analysis were merged with the teachers’ second level of analysis through four emergent themes: (1) Comprehend changes in classroom space which are represented by yellow colour, (2) Classroom space design elements which are represented by green colour, (3) Understanding relationship between classroom space design, teaching strategy and curriculum which are represented by blue colour and (4) Create an understanding of classroom space which are represented by pink colour. Figure 121 shows the final analysis sheet which represents classroom users’ perception and vision of classroom space results. The reason for merging teachers’ and students’ analysis together is to be able to compare teachers’ vision and perception of classroom space with students in order to understand the similarities and differences. The final analysis sheet will be explained in details in the finding chapter.

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Figure 121: The Final Analysis Sheet

More detail explanation of the analysis is provided in APPENDIX 4: Data analysis

4.2 Studies of Users' Perceptions of Learning Spaces

The main second phase studies revealed many learning space problems and inspire some later solutions. The results are based on analyses of teachers' interviews, photos, and planning books, students' drawings, and users' social media. As Mattelmäki (2006) argues "Although designers analyse the world in order to shape it, they also wish to understand the present situation, but this understanding is an instrument of change. In looking for solutions, designers examine the situation and the range of solutions, which adds to understanding (Mattelmäki, 2006)", and this chapter finding is an instrument for change. Therefore, this section attempt to understand the current design situation in classroom space, and to use this understanding as an instrument of change to rethink and improve space design with learning and teaching in mind, and thus empower users to redesign and user learning space to facilitate teaching and learning. From the interviews with teachers, four themes emerged. The findings are presented under these four sections using a colour key: Yellow (1) Comprehend Changes in Classroom Space; Pink (2) Create an Understanding of Classroom Space; Green (3) Classroom Space Design Elements; and Blue (4) Understanding Relationship between Classroom Space Design, Teaching Strategy and Curriculum.

4.2.1 Synthesis of Results

Previously teachers and students data were presented separately, next the data analysis of teachers, students, and users' social media all merged in one sheet, Figure 122 shows the findings. It is important to mention this finding had shifted researcher thinking radically about learning space, users and learning. The colours yellow, pink, green, and blue are the findings four sections, while the colour red is inspirations and thoughts researcher thought of during the analysis and will inspire the tool content later in chapter five.



Figure 122: Finding Sheet

The Synthesis finding sheet which shown in Figure 122 will now be explained in.

4.2.1.1 Comprehend Changes in Classroom Space

This section explains details of the yellow section, (Figure 123), which covers why and how classroom users' change the classroom space after receiving it from architects. This explains the nature of the relationship between users, space and space purpose, and shows how design elements in learning space are operated and used by which can expose

the relationships between architectural design, learning and teaching. This answers some of the questions raised in the contextual literature review chapter, which are:

1. What happens to learning space design after architects finished their work, how users occupy and response to the designed space?
2. How can our understanding of learning relationship with space be reflected on the design of space?
3. How the design of learning space shape its users (teachers and pupils) and stimulates them, in turn, how do users (teachers and pupils) influence and adapt with the designed learning space?
4. How the current learning space designs influence student engagement with learning do and what do students want from space?

Figure 124 expand the yellow section from Figure 124.

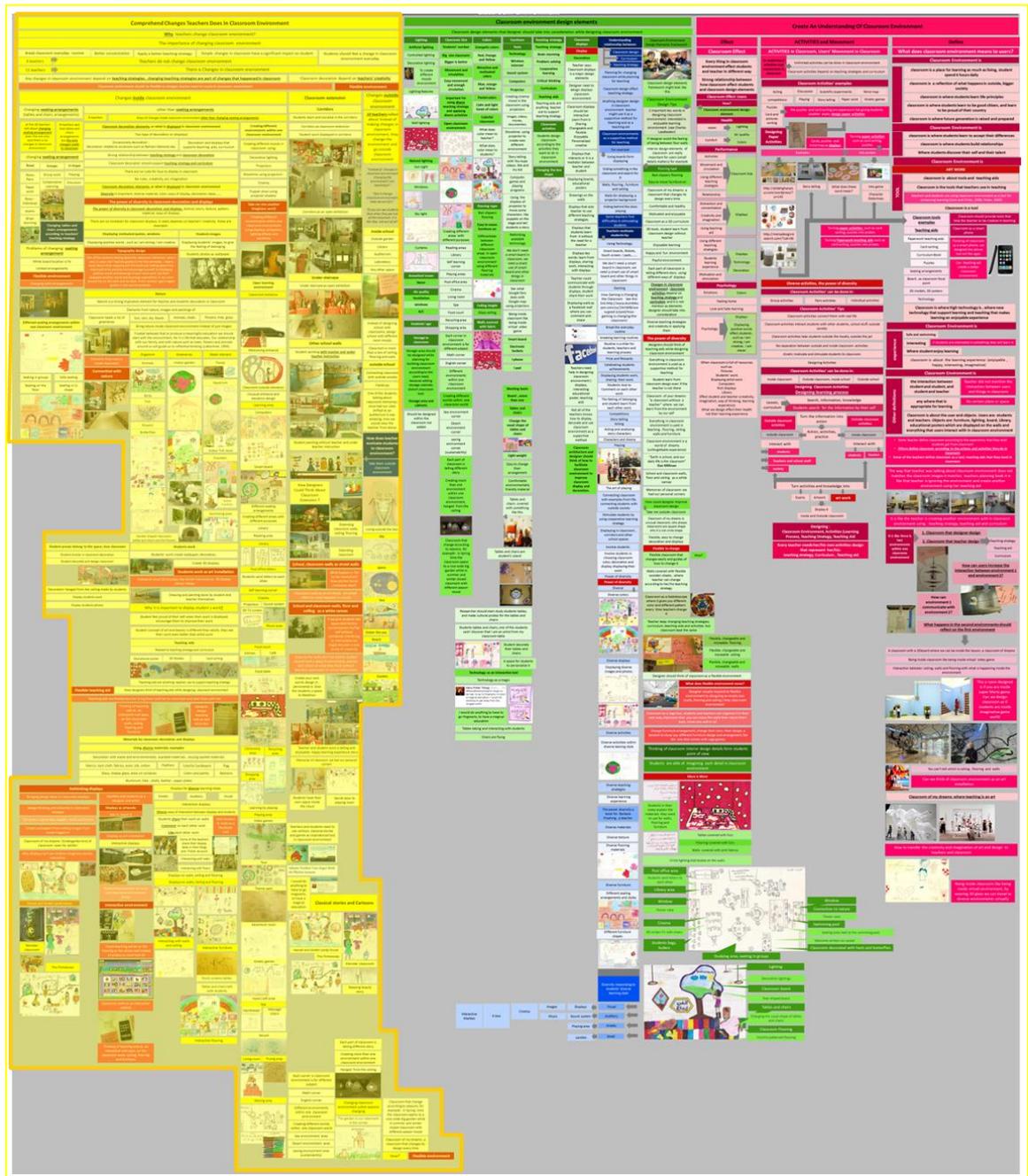


Figure 123: Yellow Section Presented In Second Stage Finding Sheet

Users gave different reasons for changing the learning space which they ‘live in’ (user phrase). Both teachers and students argue that changing classroom space is important to break everyday routine and to increase student concentration. In addition, teachers claim that changing space aids them in applying better teaching strategies. Users emphasised that simple changes in classroom space can have significant impact. Therefore, it is argued as important that students can detect a change in classroom space every day.

4.2.1.1.1 How Users Change Classroom Space

Although all of the teachers’ emphasise the importance of changing classroom space, many teachers find it difficult to change space because they don’t know how to. Changes in classroom space according to users could happen in three different ways: (1) changes happen inside classrooms, (2) changes happen outside classroom, but inside school, and finally (3) changing the classroom. Figure 125 and Figure 126 illustrate how users change and respond to classroom space, these figures show how users think of classroom changes in each one of these three ways, as explained in detail in the next sections.

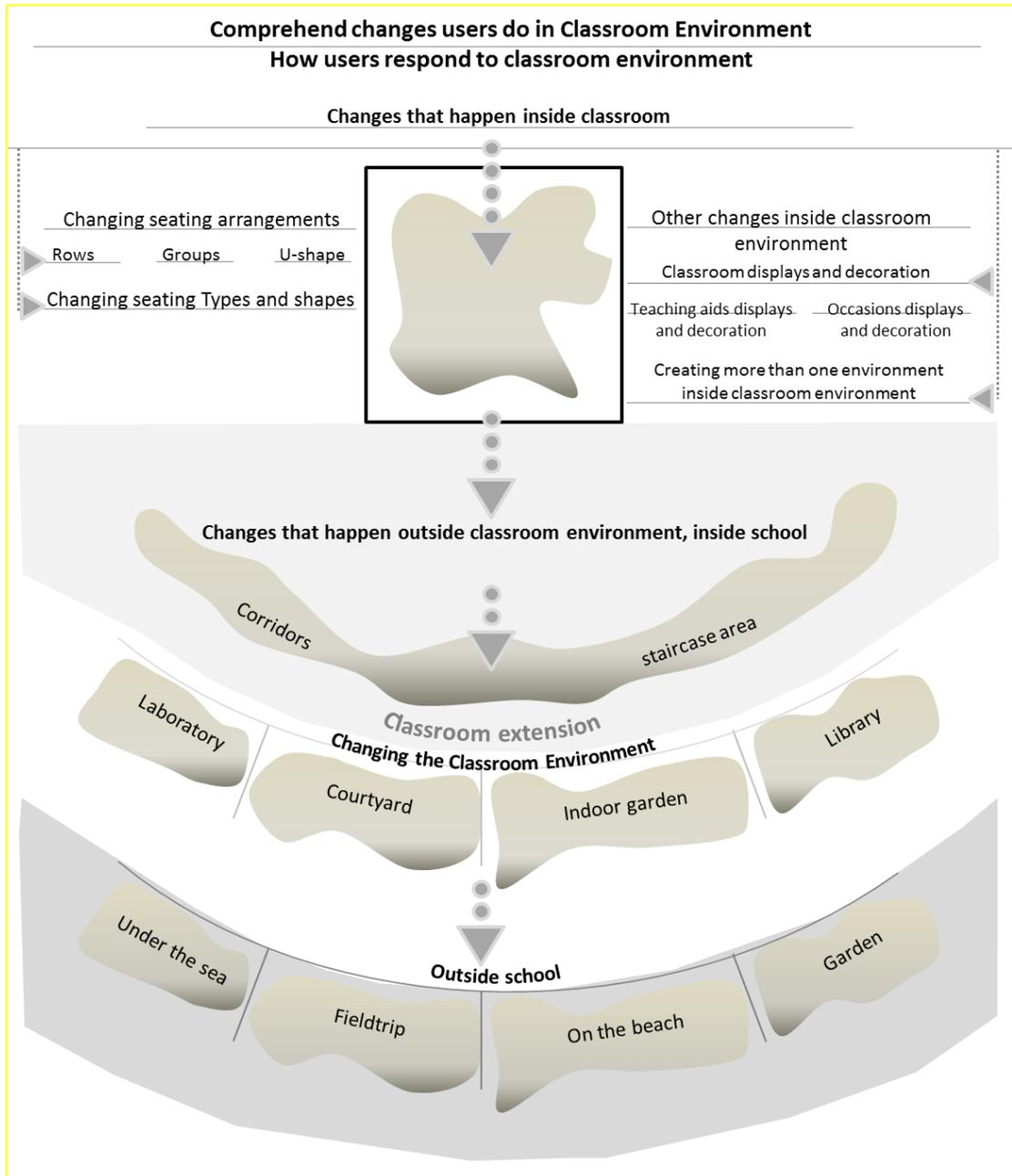


Figure 125: How Users Change and Respond To Classroom Space

Figure 126 shows the extent of user movement. It reveals weak interaction between users and space boundaries such as furniture, floor and walls.

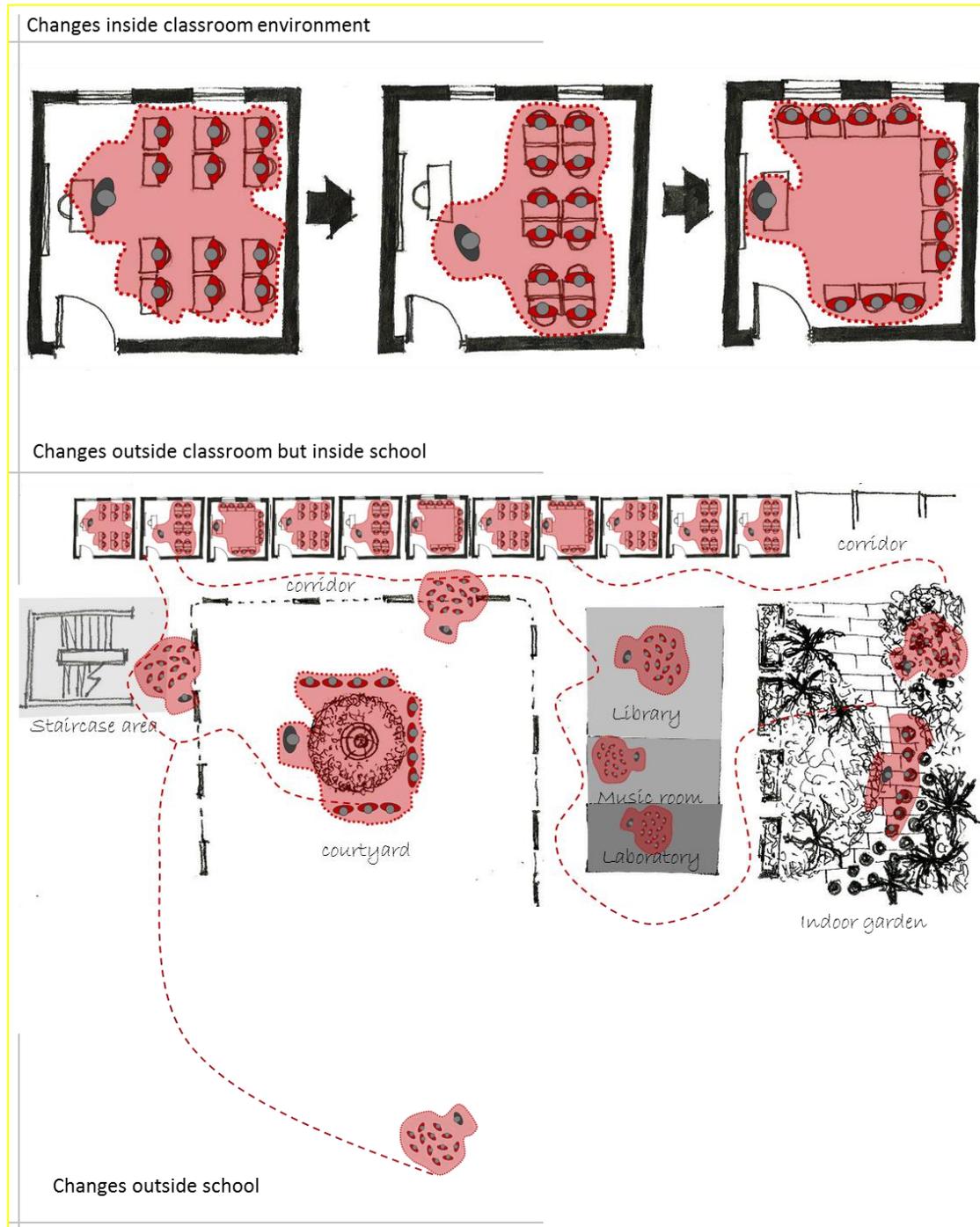


Figure 126: User Movements Within and Between Learning Spaces

4.2.1.1.2 Changes Happen Inside Classroom

When users talk about changes happen inside classroom, they mostly talk about changing tables and chairs arrangements. Figure 127 shows changing tables and chairs arrangements. However, few users talk about other changes inside the classroom space.

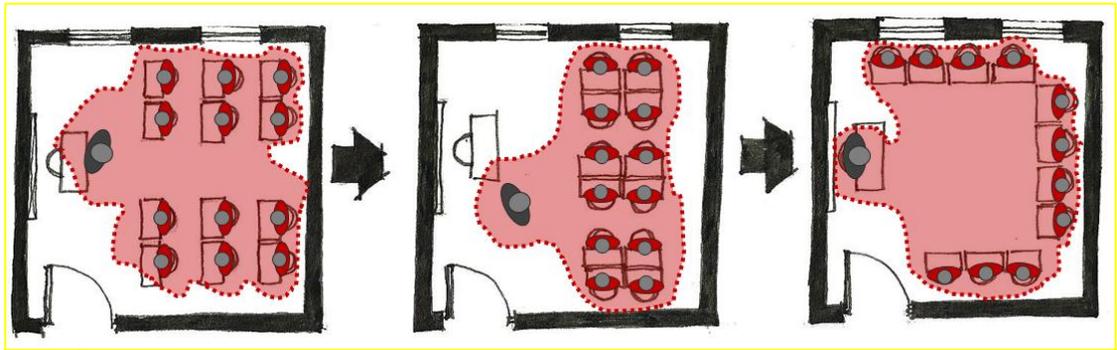


Figure 127: Tables and Chairs Arrangements in Classroom

The next section provides visualised detail description of how users explained changes that happen inside classroom.

A. Changing Seating Arrangements

There is a common language between teachers about seating arrangements. Teachers change seating arrangements according to their teaching strategy and learning approaches, students usually know the teachers' strategy from seating arrangements. Different seating arrangements are used for different purposes. Common seating arrangements that teachers use are: (1) *Rows*, (2) *Groups* and (3) *U-shape*, (Figure 127).

1. **Rows:** Teachers use pairs of rows arrangements when students need to do paper-based work, and individual rows arrangements for exams and brain storming. Figure 128 shows row seating arrangements.



Figure 128: Row Seating Arrangements

2. **Groups:** Teachers use groups seating arrangements for group work, when they are using cooperative learning strategy. Figure 129 shows group seating arrangements.



Figure 129: Group Seating Arrangements

3. **U-shape:** Teachers use U-shape arrangements for discussion and praying. Figure 130 shows in U-shape seating arrangements.



Figure 130: U-Shape Seating Arrangements

In contrast to teachers, students drew changes in seating *shapes* and *materials*, such as different ways of seating including sitting on carpet and sofa seating, and they drew different seating types, for example, in Figure 131 a student drew hand shape chairs and fluffy carpet to sit on. In Figure 132 a student drew groups of U-shape seating.



Figure 131: Hand Shape Chairs and Fluffy Carpet to Sit On



Figure 132: Groups of U-Shape Seating

B. Other Changes inside Classroom

Other changes inside classroom, other than seating arrangements are: (1) Classroom display, (2) Creating diverse spaces or (worlds) inside classroom

a) Classroom Display

Displays of classroom space are either teaching aids or occasion displays. Teaching aid displays are related to the curriculum as teachers use them as a tool to support teaching strategy (Figure 133).



Figure 133: Teaching Aids Displays Related To Curriculum

Using classroom displays as a teaching aid can support the concept of learning space as a silent curriculum that increases engagements. This concept was mentioned by (Taylor, 2005b), but she did not explain how learning space can work as a silent curriculum. However, teachers show examples of different displays which can work as a silent curriculum.

Occasion displays relate to certain occasions such as Mother's Day, Eid celebration, National day or Halloween. Figure 134 shows a display during Bahrain national day, where users used the red and white colours from the Bahrain flag. Figure 135 show Christmas decorative lighting and a Christmas tree. However, most classroom decorations relate to teachers' teaching strategy.



Figure 134: Classroom Occasions' Display during Bahrain National Day



Figure 135: Classroom Users Celebrating Christmas

Source: <http://www.flickr.com/photos/davidnoble/6478684361/>

It is important to note that there are no rules for classroom displays; it depends on teachers' creativity. Nevertheless, teachers reported that they need help in designing classroom space displays. Teaching aid displays, which are related to the curriculum and used as a teaching aid, include: (1) students' photos, (2) motivational words, quotes, wisdoms and classroom regulations, (3) Educational posters, (4) Student work and projects.

i. Students' Photos:

Because according to teachers, displaying students' photos feeling of belonging, (Figure 136) photo on door, Figure 137 students' photo displays honour special students.



Figure 136 on Left: Class Students' On Door

Figure 137 on the Right: Students' Photo Displays Honour Special Students

ii. *Motivating Words, Quotes, Wisdoms and Classroom Regulations:*

Being inside a space that is surrounded by motivating words, quotes and wisdoms affects classroom users positively. Figure 138 shows examples of quotes and wisdom display.



Figure 138: examples of Displayed Quotes and Wisdoms

iii. *Educational Posters:*

Support teaching strategy and curriculum (Figure 139).



Figure 139: Different Examples of Educational Posters

iv. *Students' Work.*

Teachers claim that displaying students work is important because they feel proud of themselves when their work is displayed. Displaying students' work encourages them to improve their work by looking at each other's work, as well as supporting feelings of belonging. Displaying students' projects has a significant impact on motivating students

to learn in the classroom. However, student concepts of beautiful classroom is different to adults, therefore it is important to involve students in classroom decoration by displaying their work. Figure 140 and Figure 141 show examples of students' works displayed inside classrooms. Students' work could be 2D such as paper work and posters, or 3D such as models and boxes.



Figure 140: Students' Works Displayed Inside Classroom Environment



Figure 141: Students' Works Displayed Inside Classroom Environment

While analysing Classroom Displays, the researcher found some common design features across displays:

1. **Nature elements** are a strong inspiration in users' decoration, because classroom users like to be connected with nature. There are no limits for nature elements that users are inspired by, for example greens (trees, indoor gardens), water elements (ponds, aquarium, and fountain) and organisms (animals, birds, fish, flower, butterflies). Teachers communicate inspiration from nature by displaying nature elements images, while students bring real elements of nature inside classroom space and by shaping classroom furniture as nature elements (e.g., flower tables and butterfly chairs).

Figure 142 shows examples of displays inspired by nature done by teachers, she displayed drawings of flower, trees and bees inside classroom.



Figure 142: Teachers Displayed Drawings of Flower, Trees and Bees inside Classroom

In Figure 143 the teacher used the sun flower leaves to display students name on it.



Figure 143: Students' Names Displayed on the Sun Flower Leaves

In Figure 144, the teacher's display inspired by rainbow colours, in this display the teacher asked students to cut images with rainbow colours and then create a collage rainbow by sticking these images on the window.



Figure 144: Teacher's Display Inspired by Rainbow Colours

Source: <http://usefulwiki.com/displays/tag/collage/>

Nature was also an inspiration in students' classroom drawings. Figure 145-Figure 149 show different examples of nature inspiration in students' classroom design

drawings. In Figure 145, the student has designed floral pattern wallpaper. While in Figure 146, students have designed an indoor garden inside the classroom space.



Figure 145: Nature Inspiration in Student's Drawing, Floral Pattern Wallpaper

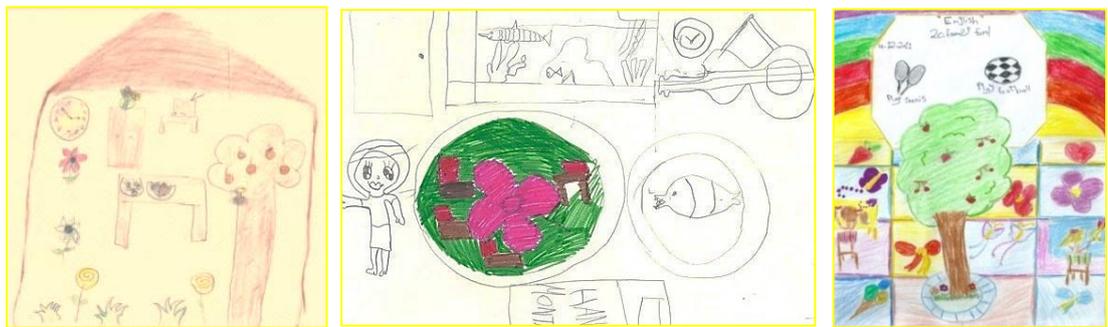


Figure 146: Nature Inspiration in Student's Drawing, Indoor Garden

Additionally, water elements were strong features in some student drawings (Figure 147). In Figure 147 one student designed the classroom as a glass sphere with transparent aquarium flooring where students can look through it to different sea creatures with their diverse colours and shapes.

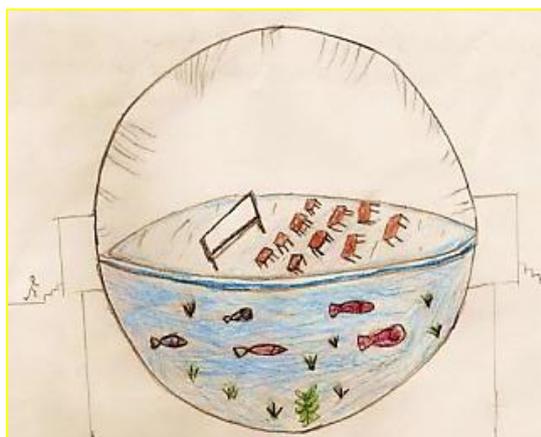


Figure 147: Water Elements in Student's Drawing (Aquarium)

Additionally, in Figure 148 some students have designed swimming pools and fountain inside classroom space.



Figure 148: Water Elements in Student's Drawing (swimming pool and fountain)

In Figure 149 students designed furniture such as tables and chair with colourful flower shapes.



Figure 149: Furniture with Shapes Inspired From Nature

This shows that nature is very strong design element for learning space users where it used as a teaching tool, decoration and for furniture. However, this strong relation between learning space design and nature is not mentioned in current literature.

2. **Displays and decoration could be on any surface such as:** walls, ceiling, flooring, drawers and cabinets. For example, Figure 150 shows different educational poster displays on walls, which turn these walls to teaching instruments.



Figure 150: Educational Poster Displays on Walls

Additionally, ceiling (which is usually overlooked in the literature) is redesigned by classroom users (Figure 151) adding colour and encouraging interaction. Figure 152 shows another interesting example which displays are on the walls, drawers, cabinets and hanging from ceiling.



Figure 151: Displays Hanging From the Ceiling



Figure 152: Displays on the Walls, Drawers, and Cabinets and Hanging from Ceiling

Users' aesthetics is different than designers, for example although in Figure 152 the space looks crowded with displays on all the surfaces, but users loved the space because it was designed by them.

3. *Diverse materials* are used in classroom display for example: feathers, papers, cardboard, sack cloth, fabrics, wool, silk, cotton, glass, tiles and aluminium. Figure 153 and Figure 154 show different display materials, which created a space with a variety of texture and colour to stimulate and motivate students. In Figure 153, teachers have used paper; fabric and artificial flowers to change the learning space using design elements such as texture and colour.



Figure 153: Different Display Materials (Paper, Fabric and Artificial Flowers)

Figure 154 shows the use of traditional textile, textured wall painting, aluminium and plastic. These figures show detailed examples of how variety of texture and colour could be reflected in learning space design, which is not currently covered in the literature.



Figure 154: Different Display Materials

Students' drawings also illustrated different types of display materials in the design of classroom space; Figure 155 shows different display materials in students' drawings.



Figure 155: Different Display Materials in Students' Drawings

Some teachers explained that it is important to reuse waste materials like magazine and newspaper papers. Figure 156 shows example of reused waste magazine and newspapers. In addition, other teachers use materials that are environmentally available, for example because Bahrain is an island, seashells are widely used as a decoration. Figure 157 shows seashells collected to be used in decorating classroom.



Figure 156: Reuse Wasted Magazine and Newspaper Papers



Figure 157: Seashells Collected To Be Used In Decorating Classroom

4. **Teachers' use interactivity** to involve students in the classroom to increase their sense of belonging in the space. Furthermore, teachers claim that one of the important interactive displays features students' work, because students enjoy sharing their work and commenting on it. However, although teachers emphasise the importance

of interactivity in displays, most of their displays give students no opportunity to interact.

Socio-constructivism theory (chapter 2) assumes there is a third dimension to the interaction between students and their space: other people such as other learners or instructors (Holmes and Gardner, 2006). Some students had drawn interactive space, for example interactive flooring, ceiling, walls, and furniture with touch screens where they could talk, push buttons, change colours and interact with. Figure 158 shows interactive flooring, Figure 159 shows interactive walls and Figure 160 shows interactive ceiling.



Figure 158: Interactive Flooring



Figure 159: Interactive Walls

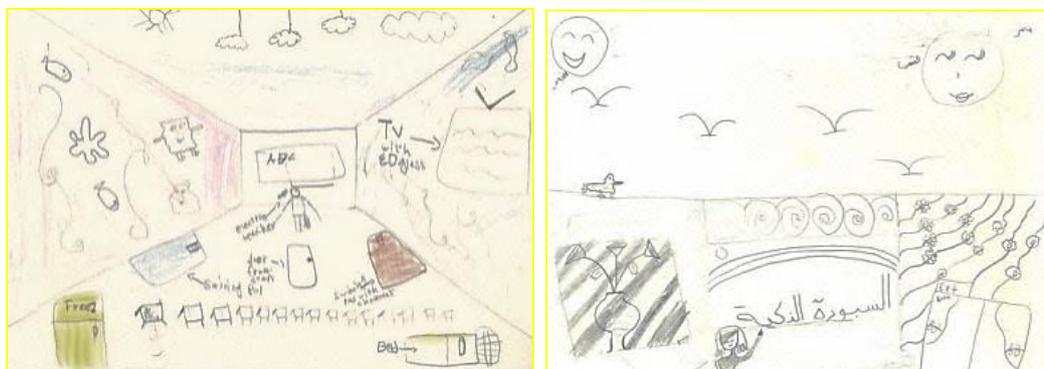


Figure 160: Interactive Ceiling

Furthermore, Figure 161 shows interactive furniture, where students draw furniture as an interactive design element. However, importance of creativity is mentioned by Constructivism educationalists but it is over looked by architects.

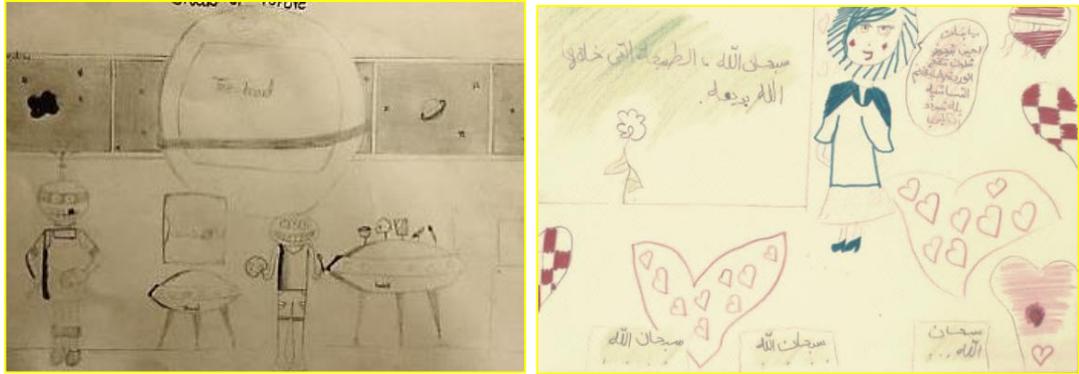


Figure 161: Interactive Furniture

5. **Diversity** is a key element in classroom decoration and displays design. In terms of colours, texture, pattern and material.

b) Creating Diverse Spaces or (Worlds) Inside Classroom Space

Knowledge of how teachers and students redesign learning spaces is largely missing in the literature. This section explains that when some users perceive space they don't think of it as a box that offers one world as it was designed to be. They redesign it to take them on a journey to visit different worlds. Some users create diverse worlds inside classroom space, and break the boundaries of the box. Users create different worlds inside classroom space in different ways for example:

- Some users create different sensory moods inside classroom environment, using decorative colourful lighting and candles (Figure 162). In addition they use projectors to create a ShowTime mood or use projectors for fingers shadows shows. Figure 163 shows ShowTime inside classroom space.

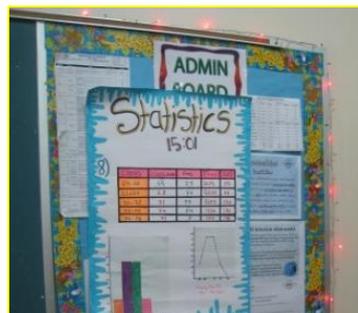


Figure 162: The Use of Decorative Lighting inside Classroom Environment



Figure 163: ShowTime inside classroom space

- In another way of responding to the box designed by architects, some teachers redesign classroom space at the beginning of the semester. They divide classroom space into areas with different activities and seating arrangements and footprints. Different users had different views about what is in the open learning space. The researcher combined these different views in one drawing (Figure 164). This figure combines different students' drawings with different teachers' space design photos on a classroom plan sketch drawn by the researcher. The reason for putting these different views in one drawing of classroom plan is to support rethinking of the learning space design in the planning stage for example: what activities can architects design to be in the classroom space, how can the design of learning space be developed to respond to different activates that facilitates different teaching styles. This drawing shows that the empty white box that architects usually design does not fulfil users' needs. Figure 164 presents an open learning space using users' visuals photos and drawings to create an image of the learning space they want. Analysing users' open learning space plans provides concrete examples of many theoretical aspects of teaching and learning mentioned in literature review. For example, learning approaches have changed fundamentally from the teacher-centred model and therefore learning spaces need to express the new educational requirements of 21st century learners (Chism, 2005b, Fisher, 2002, Temple, 2007), Figure 164 shows examples of learning spaces that express new educational requirements through activities in the space. Additionally, designers can design relationships between users and space via different activity areas.

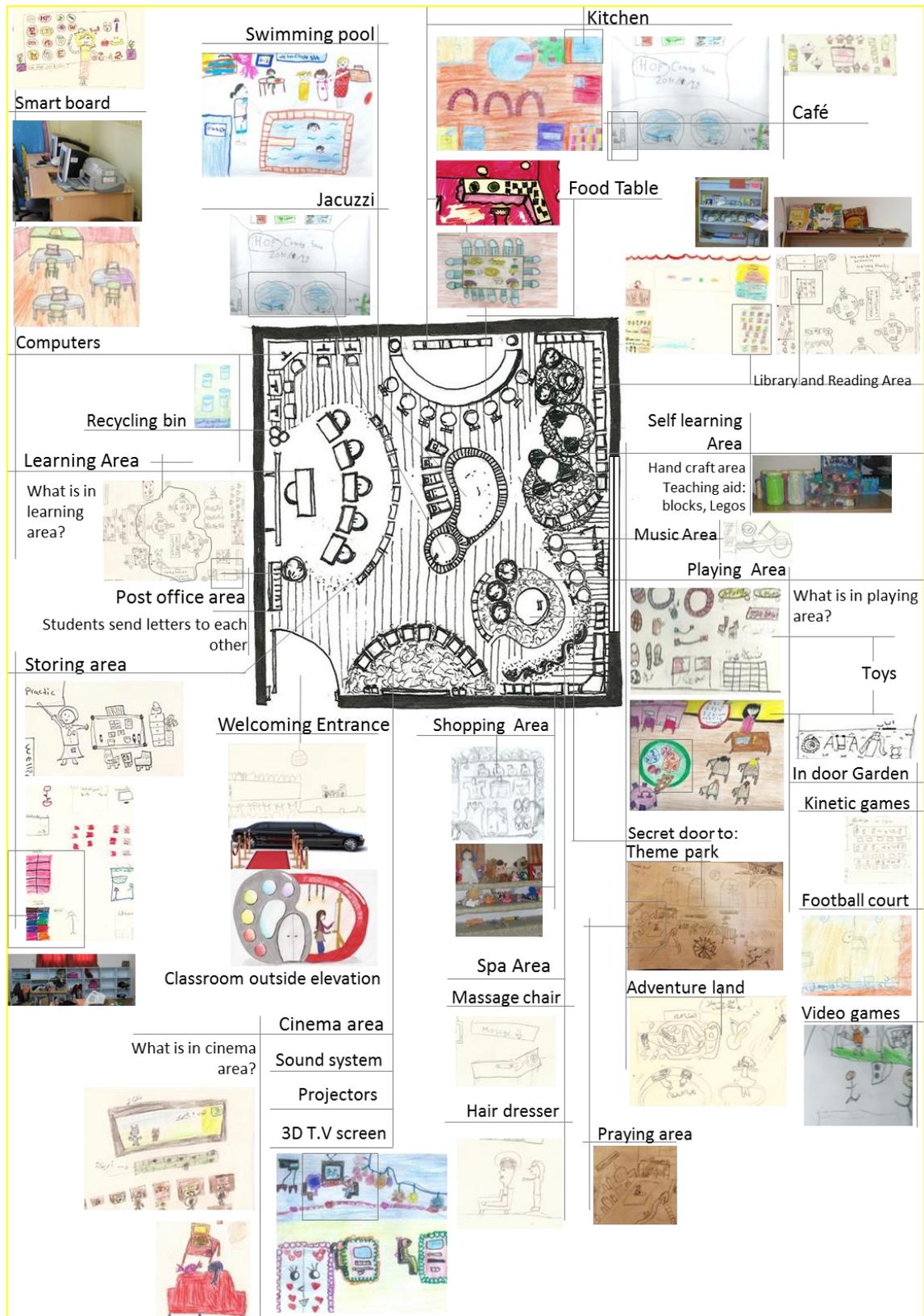


Figure 164: Users' Open Learning Space

The open learning space according to users has a welcoming entrance (Figure 165). One student imagined that classroom entrance would look like famous stars' entrance on

a red carpet from an expensive black car. Another student imagines the outside classroom elevation as colour palate.

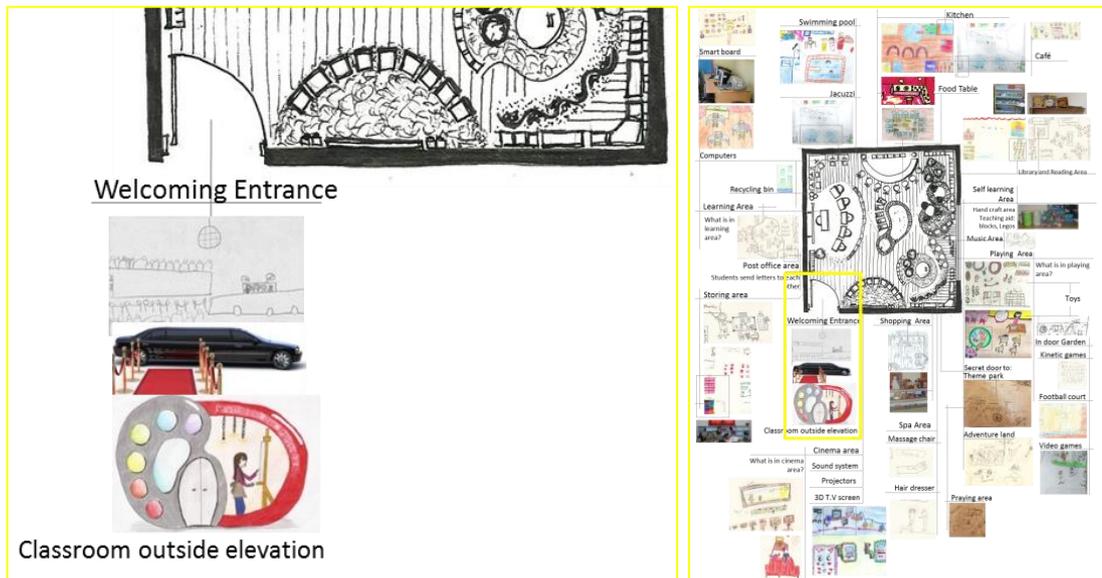


Figure 165: Classroom Entrances

C. Changes outside Classroom, but Inside School

Outside classrooms, inside school areas are corridors, staircase area, school courtyards and other spaces inside school and outside classroom Figure 167 and Figure 166 summarises changes outside classrooms but inside the school.

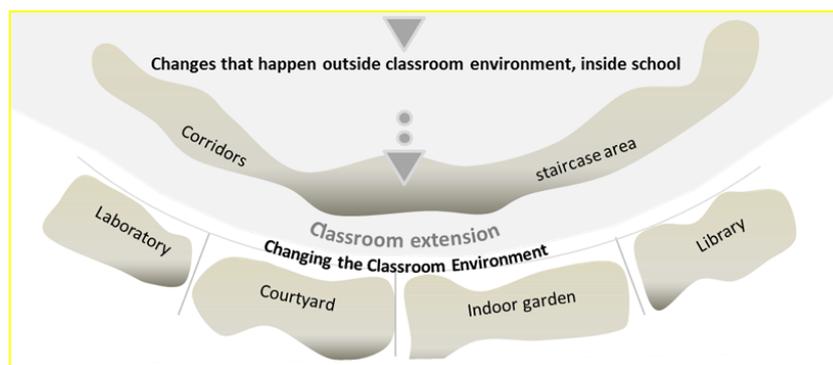


Figure 166: Changes Outside Classroom But Inside School

Figure 167 also shows how users move between different spaces inside school using a red dotted line.

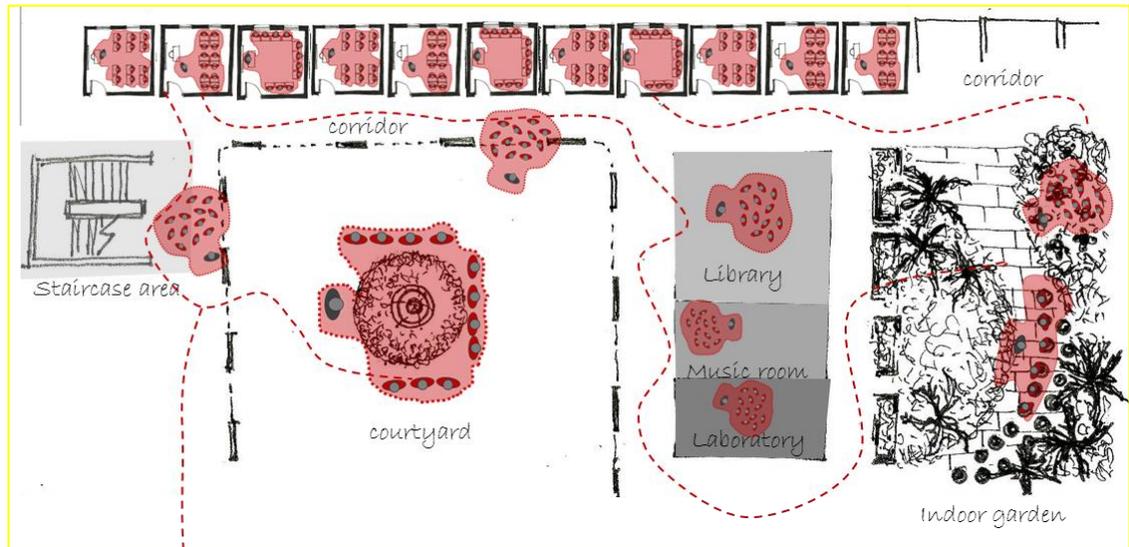


Figure 167: Changes Outside Classroom But Inside School

Users redesign school areas as extensions to their classroom and change them according to their needs. Figure 168 shows how classrooms extensions create new learning spaces by changing their function. Figure 168 is further clarified by detailed examples from fieldwork.

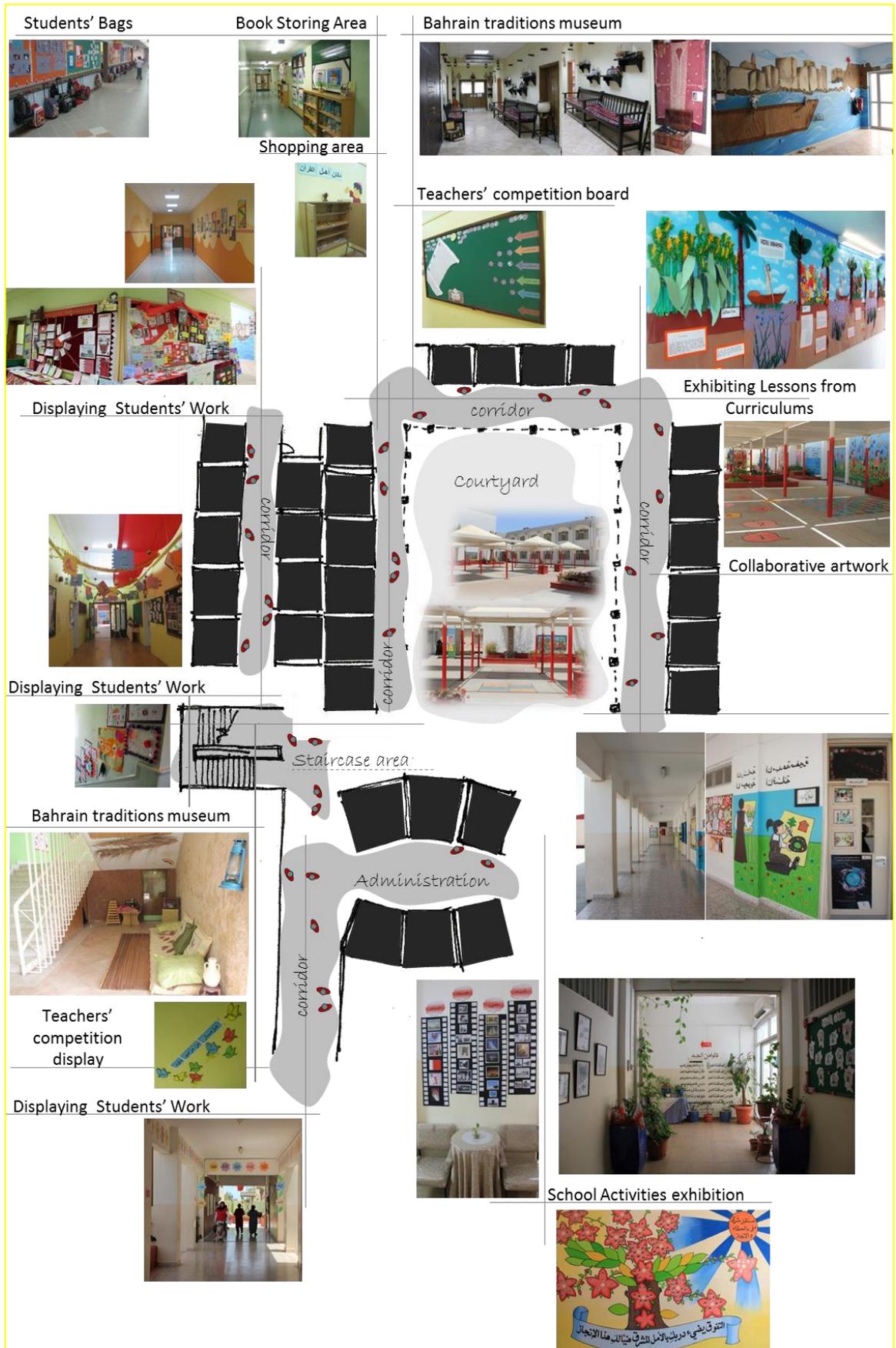


Figure 168: How Users Use Classrooms Extensions

Explaining Figure 168 and how users use and design classroom extension: Students socialise and learn with each other in the corridors and under staircase areas, so sometimes teachers display students' work under the staircase area and on corridor walls and ask them to comment on each other's work. Figure 169 shows examples of students' work displayed in the corridors.



Figure 169: Students' Work Displayed In the Corridors

Figure 170 shows examples of students' work displayed on the corridors' walls and hanging from the ceiling, which creates different ceiling levels in the corridors and provided variety of colours and texture in the space.



Figure 170: Students' Work Displayed On The Corridors' Walls and Hanging from the Ceiling

Figure 171 shows students' work and motivational quotes displayed in the courtyard corridors, while in Figure 172 it's displayed on the staircase walls.



Figure 171: Students' Work and Motivational Quotes Displayed in the Courtyard Corridors



Figure 172: Students' Work Displayed on the staircase walls

Source: <http://www.hilltop.doncaster.sch.uk/pages/viewpage.asp?uniqid=4053>

Some teachers design corridors and under staircases as an exhibition. Figure 173 show corridors used as an exhibition to exhibit school activities.



Figure 173: Corridors as an Exhibition Exhibiting School Activities

In Figure 174 the teacher has designed the corridors as a museum exhibiting Bahrain traditional fashion, jobs and culture. These corridors reflect what students are learning in the curriculum, and teachers are using these corridors as a powerful teaching instrument.



Figure 174: Corridors as a Museum Exhibiting Bahrain Traditional Fashion, Jobs and Culture

Also Figure 175 shows another side of the same corridor where a teacher displayed traditional Bahraini items. Figure 176 shows corridors as a museum for a Bahraini traditional job, diving for pearls.



Figure 175: Corridors as a Museum Exhibiting Traditional Bahraini Items



Figure 176: Corridors as a Museum Exhibiting Bahraini Traditional Works (Diving For Pearls)

Figure 177- Figure 178 show examples of using under staircase area as a museum. Figure 177 under staircase area designed as old Bahraini home interior, and in Figure 178 exhibiting old Bahraini fashion.



Figure 177: Under Stair Case designed as old Bahraini home interior



Figure 178: Under Stair Case Museum Exhibiting Old Bahraini Fashion

Some teachers compete between classrooms, each classroom as one team and display the competition board in the corridors and staircase area. Figure 179 shows examples of teachers' competition boards.



Figure 179: Examples of Teachers' Competition Boards

In addition, some users used corridors as a student bag and book storing area, which give the corridor different function (Figure 180 book storing area in corridors; Figure 181 students' bags in corridor).



Figure 180: Book Storing Area in the Corridors

Source: <http://www.hilltop.doncaster.sch.uk/pages/viewpage.asp?uniqid=4053>



Figure 181: Students' Bags in the Corridors

Other users create a shopping area in corridors, where students can buy things using fake money to learn mathematics via meaningful educational experience (Figure 182).



Figure 182: Corridor Shop

Furthermore, corridors are a space for teachers and students' collaborative artwork, under teachers' supervision where corridors and courtyards worked as a white canvas for users to express themselves on it (Figure 183-Figure 184).



Figure 183: Students' Collaborative Artwork under Teachers' Supervision



Figure 184: Students' Collaborative Artwork under Teachers' Supervision

Other students were given to do their choice of artwork without teachers' supervision (Figure 185).



Figure 185: Students' Artwork without Teachers' Supervision

4.2.1.1.3 Moving Beyond the Classroom

When I asked teachers 'how do you change classroom space, some teachers claimed instead of making changes inside classroom, they wanted to change the space and teach students outside classroom. The teacher said: *"Instead of making changes inside classroom environment I change the environment I am teaching in, I go outside classroom environment"* another teacher argued: *"Don't change classroom environment, take me out of it"*. In addition, other teacher said *"If you can see students' face when they get out of the classroom, it is like they are out of jail"*. According to teachers, although it is really important to change the teaching space in order to motivate and stimulate students, they

rarely take students outside classroom space. When teachers take students outside classroom space they go to: School's indoor garden, Figure 186- Figure 187).



Figure 186: School Indoor Garden



Figure 187: School Indoor Garden

Other teachers said they could take students to library (Figure 188-Figure 189).



Figure 188: School Library



Figure 189: School Library

However, rarely teachers think of taking students to school courtyard (Figure 190). Furthermore, some teachers mention that they can take students outside school into an educational field trip or gardens or at the beach.



Figure 190: Different School's Courtyards

In contrast, when drawing a 'classroom of their dreams', a group of students made a radical move and moved the classroom outside school. Figure 191 moves the classroom to the sky. Although this an imaginary concept, students were making it an applicable idea by using the sun as a white board, clouds as furniture and creating a secret room inside the cloud.

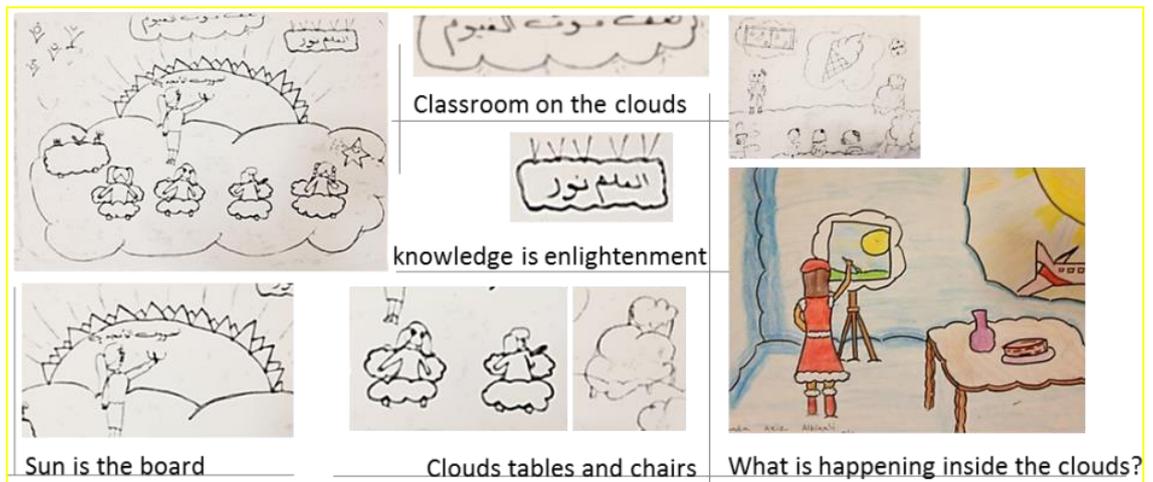


Figure 191: Classroom in the Sky

In Figure 192 another group of students drew a classroom in space, and they interact with the moon, talk to aliens and used the spaceship as a table.

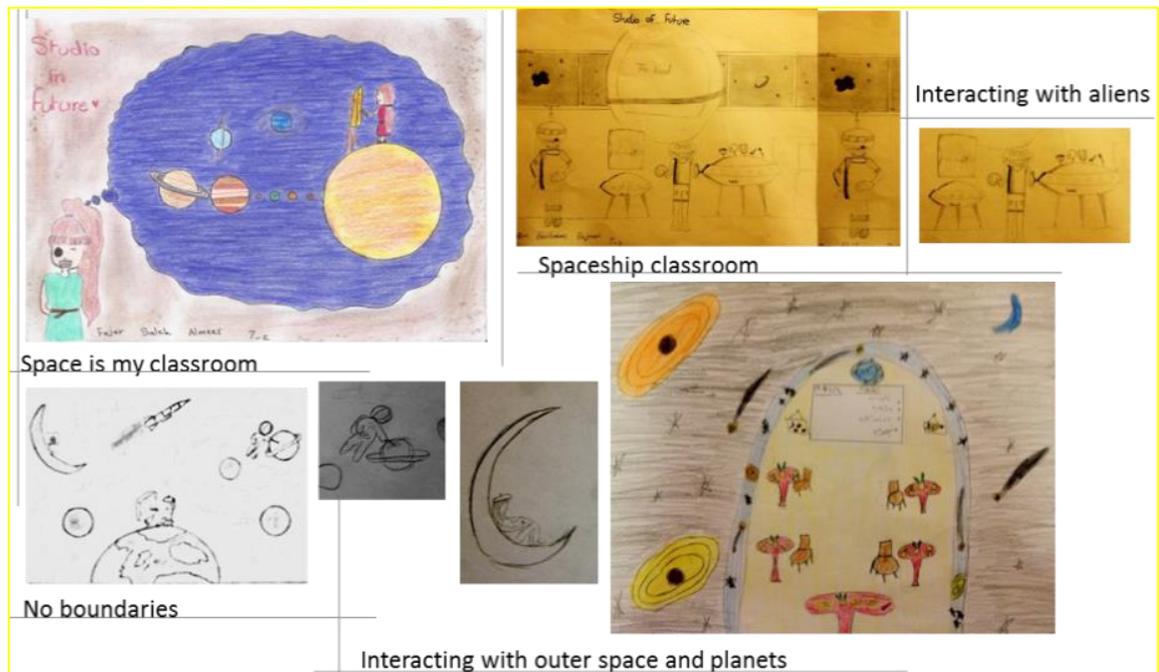


Figure 192: Classroom in Space

Figure 193 shows a classroom under the sea and Figure 194 show a classroom on the beach. These two figures show how students are interacting with the water, nature and creatures under the sea: a mermaid is the teacher and seahorse attends with the students.

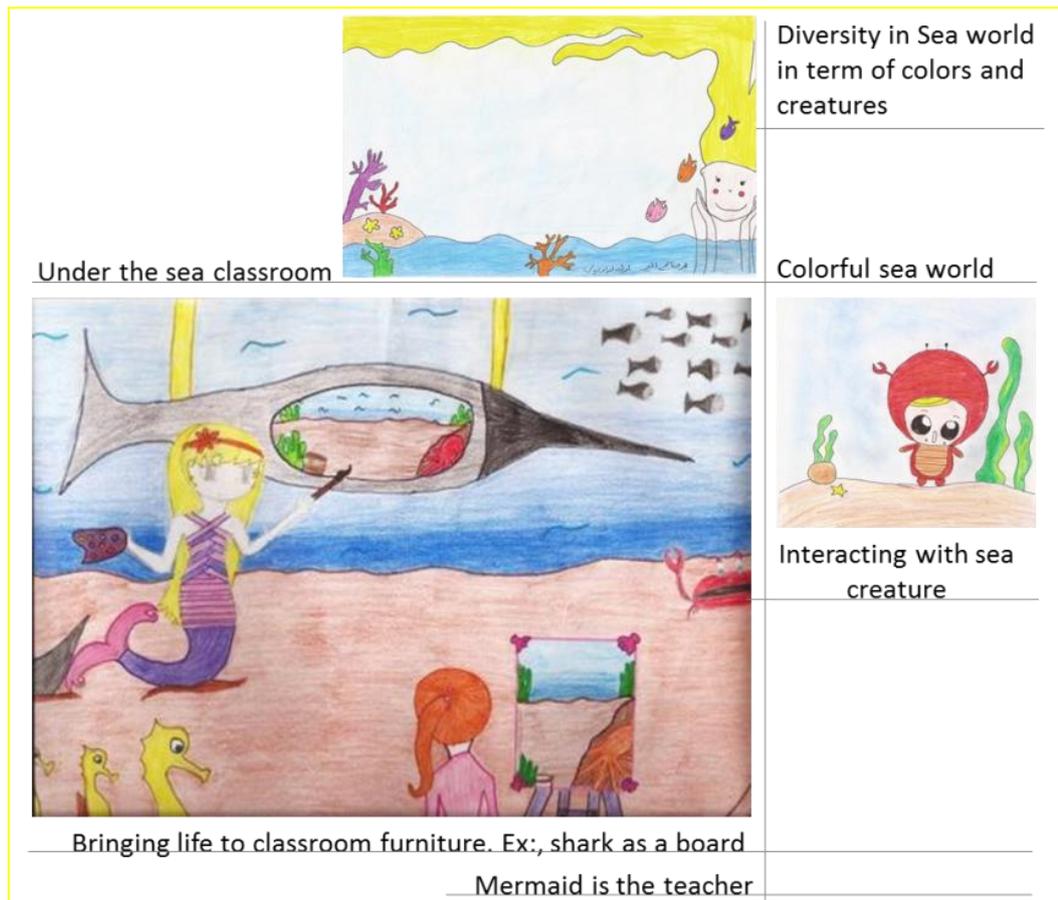


Figure 193: Classroom under the Sea



Figure 194: Classroom on the Beach

Figure 195 shows classroom in the garden; the details of these drawings show that students want to be connected with the outside world. Animals, trees and sun are part of

the space students' design. Additionally, the gardens in students' drawings add a variety of colours, textures and smells.



Figure 195: Classroom in the Garden

Figure 196 shows classroom inside imaginary film worlds, offering a variety of learning experiences to the classroom space. In the literature review, variety was mentioned as a design element, and as researchers recommended offering some variety of choices which respond to a variety of individual responses (Barrett and Zhang, 2009b). Students' drawings in Figure 191- Figure 196 add new meanings to variety as a design element.

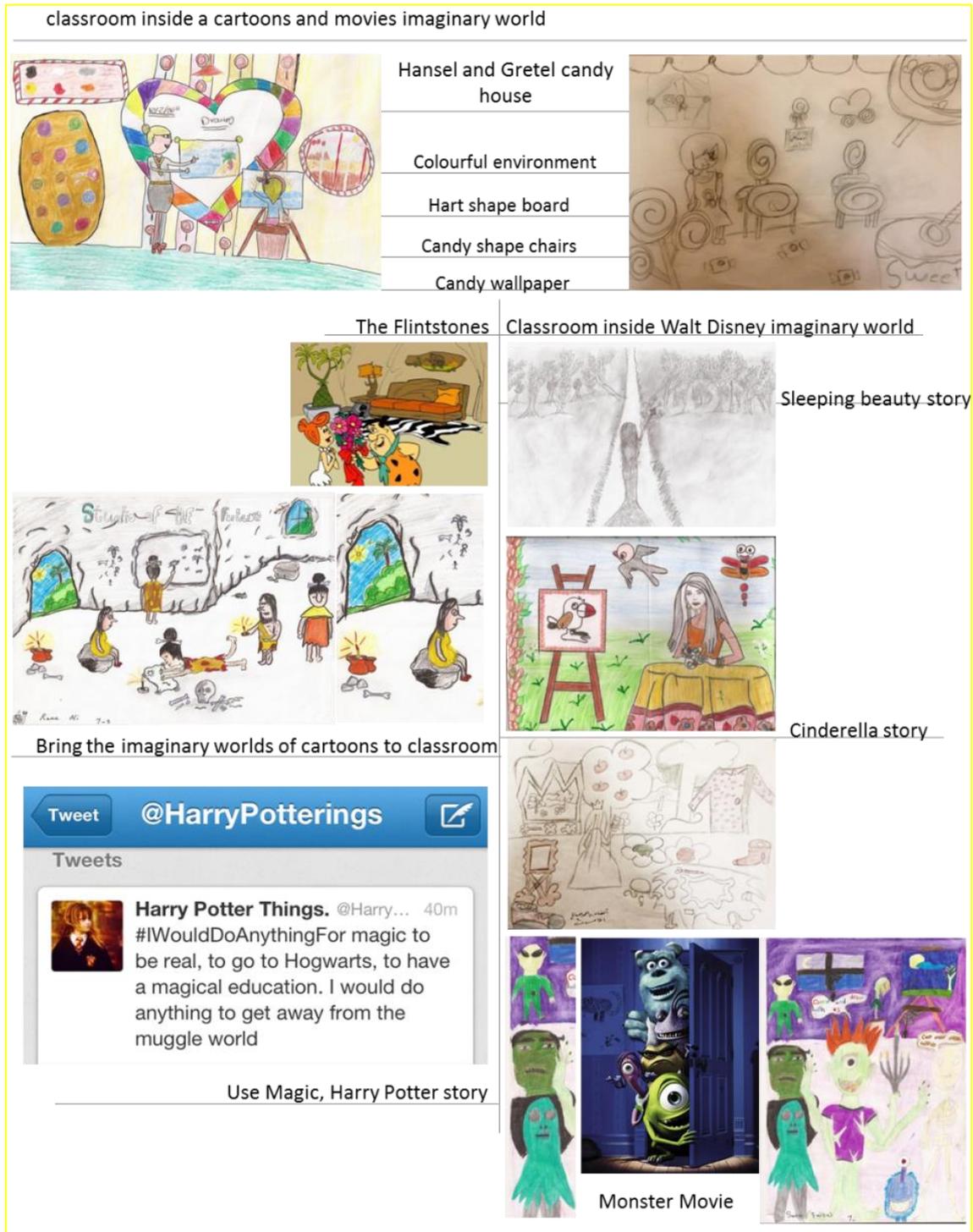


Figure 196: Classroom inside a Cartoons and Movies Imaginary World

These classrooms designed by students showed a strong relationship via interaction between students and outside environments. Students did not draw walls or ceilings; they did not only think outside the box they removed the classroom box lines, and they draw their self not as passive learner, but as a learner who is involved in the space and interact with it. Students' drawings reveal that classroom space design should encourage interaction. Additionally, students' drawings redefine tables, chairs and other objects and

rethink the relationship between learning, users and designed space. When I asked students to support their drawings with notes, some students wrote: “if you could apply my classroom ideas I will be the happiest student in the world”, “I wish I can get out of classroom”. Their radical moves students bring new and different meanings to how we can understand learning space.

The concept of creating different worlds within one space is achievable since it has been adopted in different workspaces, such as Google office space. Figure 197- Figure 198 show different worlds within one workspace in Google offices. Although creating different worlds is achievable, current school design does not support this concept because all the classrooms are designed in the same way. This idea can offer learning space users’ opportunities to travel into a variety of worlds while they are learning. Every time they will be surrounded in a different imaginary world that motivates and stimulates them via a variety of learning experience.



Figure 197: Different Worlds within One Workspace in Google Offices

Source: <http://www.home-designing.com/2009/10/googles-offices-from-around-europe>



Figure 198: Different Worlds within One Workspace in Google Offices

Source: <http://www.home-designing.com/2009/10/googles-offices-from-around-europe>

4.2.2 Create Understanding of Classroom Space

This section explains details of pink section (Create Understanding of Classroom Space, Figure 199). The finding of this stage answers these questions: what the classroom means to its users, what kind of activities users do in the classroom, how users move, and finally how physical classroom space effects users. These answers came from teachers' data analysis, students' drawings, and social networks. Understanding users' learning and teaching activities in space helps researcher to understand how to integrate space design with different learning and teaching methods. Furthermore, understanding users' movements helps to in comprehend the nature of the relationship between space, learning and users, and reveals unspoken latent needs.

Figure 199 shows the *Create Understanding of Classroom Space* section in the finding sheet. This section responds to these questions from the contextual review:

1. How do classrooms affect teachers' ability to teach and how they facilitate the space to support different learning activities?
2. How the relationship between users, learning and space design elements is built, and how these three elements interact with each other.
3. How the design of learning space shapes its users (teachers and pupils) and stimulates them, in turn, how do users (teachers and pupils) influence and adapt with the designed learning space?
4. How do the current learning space designs influence student engagement with learning, and what does learning space mean to its users?

This section revealed differences in intent between the way the classroom space was built and the way users use it. In addition, there is a difference between users' and architects understanding of classroom space. Creating an understanding of learning space highlights new approaches for rethinking classroom space design.

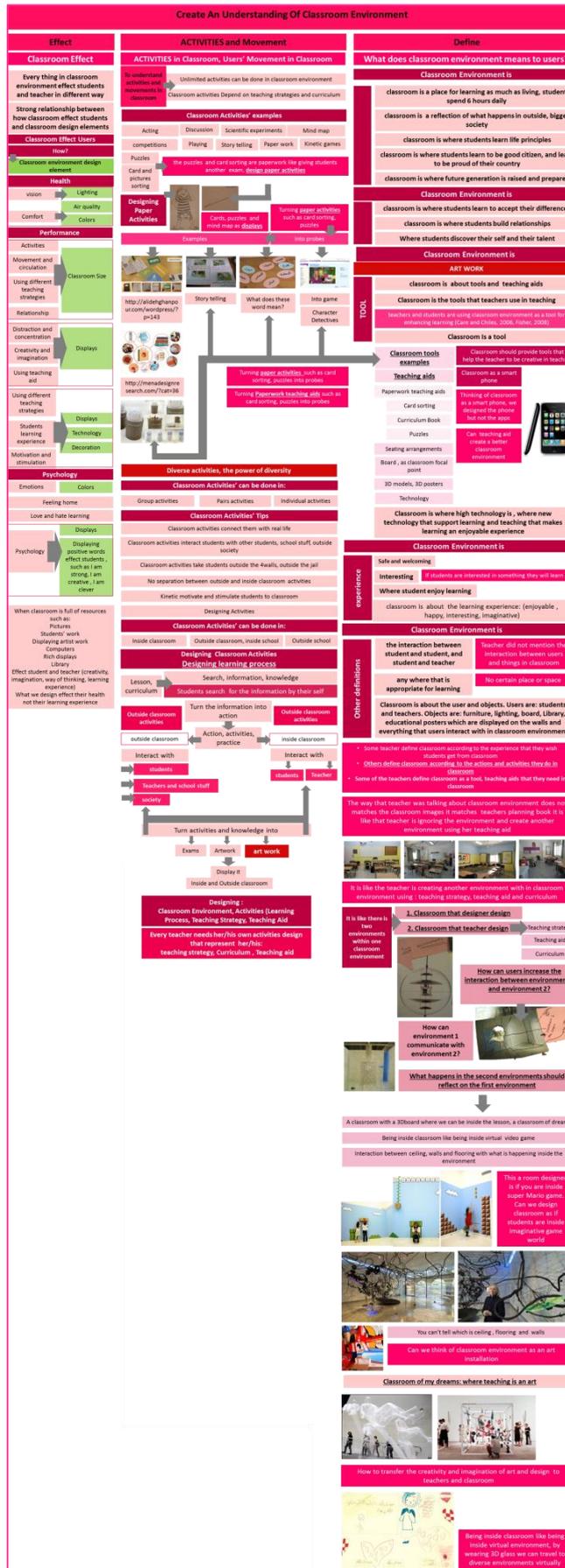


Figure 199: Create Understanding of Classroom Space Section in Finding Sheet

4.2.2.1 What Does Classroom Means to Its Users?

When teachers were asked what the classroom space means to them, they emphasised that classroom is anywhere that is appropriate for learning. Users think of classroom space from different perspectives, for some of them it is about what students learn, for others it is about the experience students receive, and for most of the teachers’ classroom space is a tool which aids them in teaching. However, some users describe classroom space as the interaction that happens in it. Table different perspectives on classroom space.

Table 2: Users’ Different Perspectives of Classroom Space

| Users’ Perspective | Examples From Users’ Data |
|--|---|
| Classroom space should relate to what students should learn | <ul style="list-style-type: none"> • A place for learning as much as living • A reflection of what happens in society • Where students learn life principles and manners • Where students learn to be good citizens, and learn to be proud of their country • Where future generations are raised and prepared • Where students learn to accept their differences • Where students build relationships • Where students discover their self and their talent • Anywhere appropriate for learning |
| Classroom is about the experience that students receive | <ul style="list-style-type: none"> • Interesting, if students are interested in something they will learn it • Where students enjoy learning • classroom is about the learning experience: (enjoyable , happy, interesting, imaginative) |
| Classroom space is a tool | <ul style="list-style-type: none"> ▪ Classroom space is a tool or a group of tools that teachers use in teaching. This tool could aid or hinder teacher in teaching and students in learning. |
| Classroom space supports the interaction that happens in the space | <ul style="list-style-type: none"> ▪ The interaction between student and student, and student and teacher |

| Users' Perspective | Examples From Users' Data |
|--------------------|--|
| | <ul style="list-style-type: none"> Classroom is about the user and objects. Users are: students and teachers. Objects are: furniture, lighting, board, Library, educational posters which are displayed on the walls and everything that users interact with in classroom environment |

4.2.2.1.1 Classroom Space Is a Tool

Users emphasize that classroom space is a tool; they use it as a teaching aid to support their teaching strategies, with teaching aids such as card sorting, puzzle papers, 3D models, educational posters, projector, smart board and high-speed internet (Figure 200). A classroom space as a tool should offer users diverse teaching aids that support teachers' teaching strategies, and should be able to provide interesting, enjoyable, imaginative and creative learning experiences,



Figure 200: Examples of Teachers' Teaching Aids

4.2.2.1.2 Classroom 1 and Classroom 2

When comparing what teachers wrote in the planning book about classroom space and classroom photos, the researcher realised that what is in the photos did not really capture what was happening in the classroom. It was as if the teachers' planning book describing another classroom space. Figure 201 shows comparison between teacher number seven planning book and classroom photos during analysis process. Classroom space should reflect what users do in space, but does not.



Figure 201: Comparison between Teacher Number Seven Planning Book and Classroom Photos

In Figure 201, the classroom photos shows empty space with nothing on the walls, board, ceiling or floor. It looks like this space was not occupied by users. However, comparing these photos with what is written in the teacher’s planning book about classroom activities, the planning book described many interesting and creative activities happening in the classroom space. The comparison showed that users did not reflect their activities in space and as a result did not interact with the designed space, which worked as an empty box for them (this is Classroom 1). Yet users described a different classroom space in their planning book, created by them and their teaching aids (this is Classroom 2).

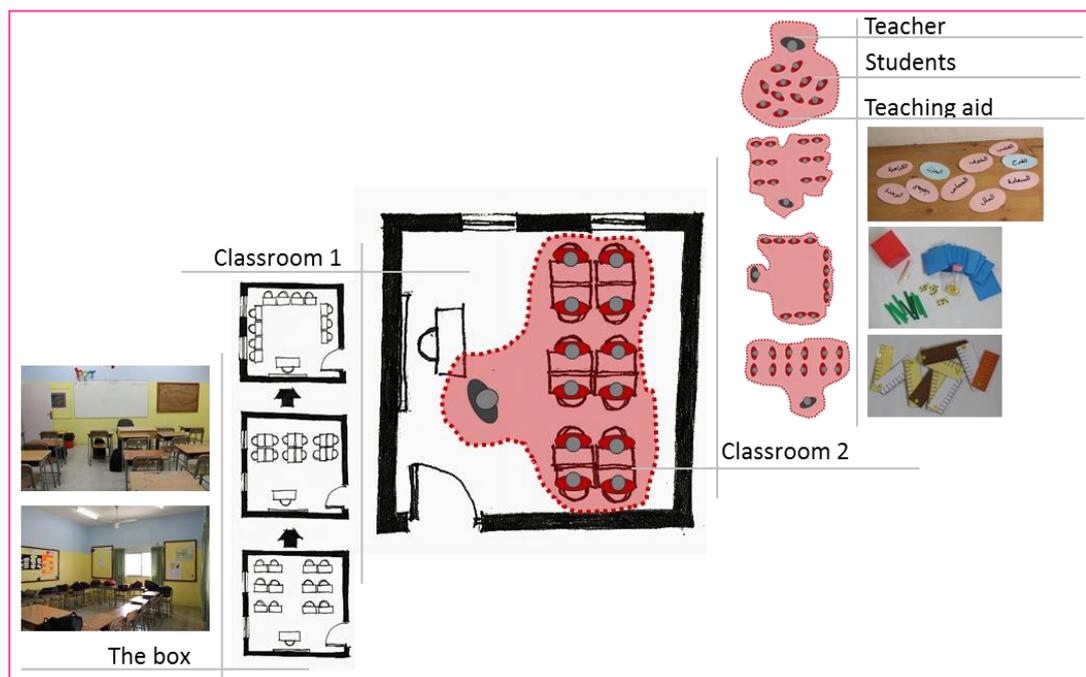


Figure 202: The Concept of Classroom 1 and Classroom 2

In Figure 203, Classroom 1 is the box that architects design. It is fixed and does not move. Classroom 2 is created by users with their teaching aids, learning methods and curriculum. Classroom 2 is movable because sometimes teachers take their teaching aid and teach students outside Classroom 1. The amount of interaction and communication between Classroom 1 and Classroom 2 depends on teachers' awareness of the classroom space design elements, and on what architecture does to encourage users to engage with classroom space.

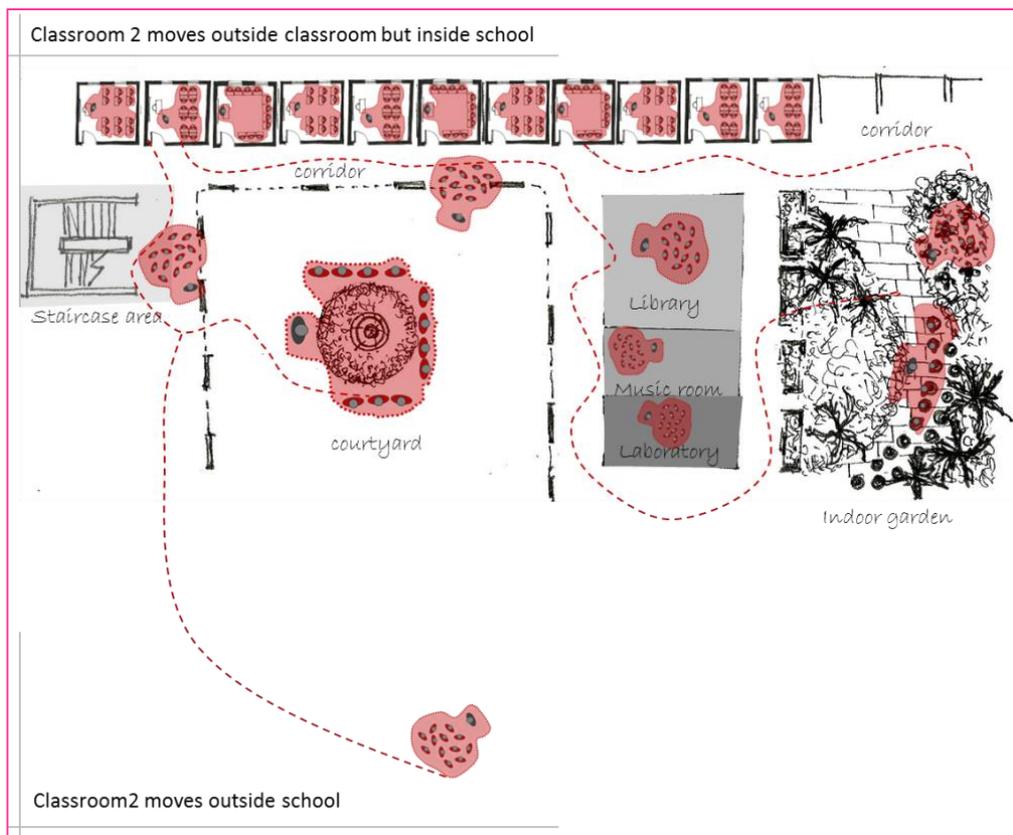


Figure 203: Classroom 2 Movement

In order to design a classroom space that is powerful teaching tool, as a three dimensional curriculum that sends a silent messages to its users, it is very important that Classroom 1 design encourages users' interaction and reflects what can happen in Classroom 2, (Figure 204).

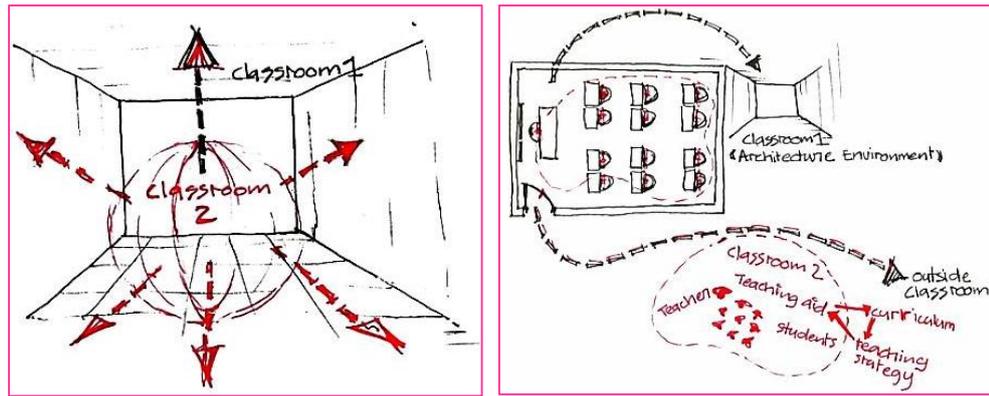


Figure 204: Reflection and Communication between Classroom 1 and Classroom 2

Increasing the interaction between Classrooms 1 and 2 helps users to avoid the feeling of being inside a box, which was a problem mentioned by users. Additionally, thinking of Classroom 1 and 2 concepts suggests several design solutions that can engage learning methods and theories within space design, which is missing in literature. For example, in theories such as Constructivism learning should be interactive to allow development of higher-level learning and social skills (Ally, 2003). The concept of Classrooms 1 and 2 helps architects to design an interactive learning space that engages its users in support of this theory. Figure 205 -Figure 206 show examples of art installation works that support this concept.

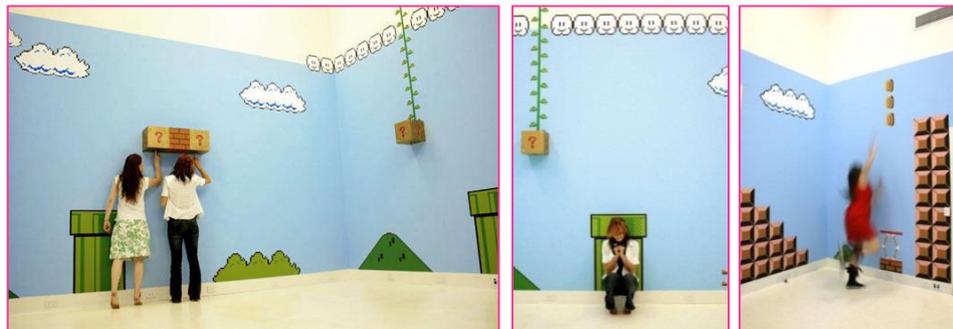


Figure 205: "Mario's World Brought To Life in Real Room" Art Installation Work by Artist Antoinette J. Citizen

Source: http://fooyoh.com/geekapolis_gadgets_camcorders/763377

In Figure 205 and Figure 206 the artist had designed the space walls (which present classroom 1) as a game that users (which present classroom 2) could play with, this game have created an interactive walls, walls that communicate with space users.

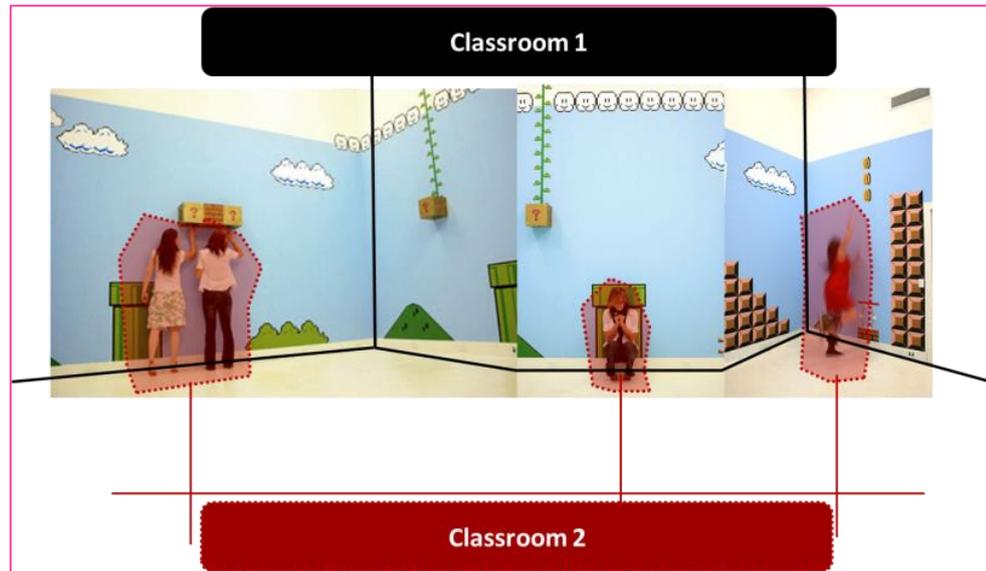


Figure 206: Art Installation Work, Classroom 1 and Classroom 2

4.2.2.1.3 Classroom as a Smart Phone

According to classroom users, the classroom is a tool that is used as a teaching aid to support teaching strategies and learning approaches inside and outside classroom box, therefore classroom space as a tool can be compared with the smartphone tool. The box of classroom space can be compared with the smartphone device. This analogy helps understanding of design elements that are missing in a classroom space. In general, designers concentrate on elements such as lighting, acoustical issues and air quality, elements that are similar to the power of the battery, screen resolution and processor speed in a smartphone. However, Smartphone companies create “developer tools” that allows developers to develop applications that enable users to modify smartphones. These applications give users different beneficial user experiences which encourage communication and interaction between a smartphone and its user. Additionally, these applications allows changes to a smartphone according to different users’ needs. Comparing classroom space with a smartphone, classroom space is designed by architects with no “developer tool” that allow teachers to develop applications which enable users (teachers and students) to better use the classroom box, which can make classroom space interact and communicate with its users and change depending on their teaching and learning approach. Figure 207 explains the comparison between classroom environment box and smart phone.

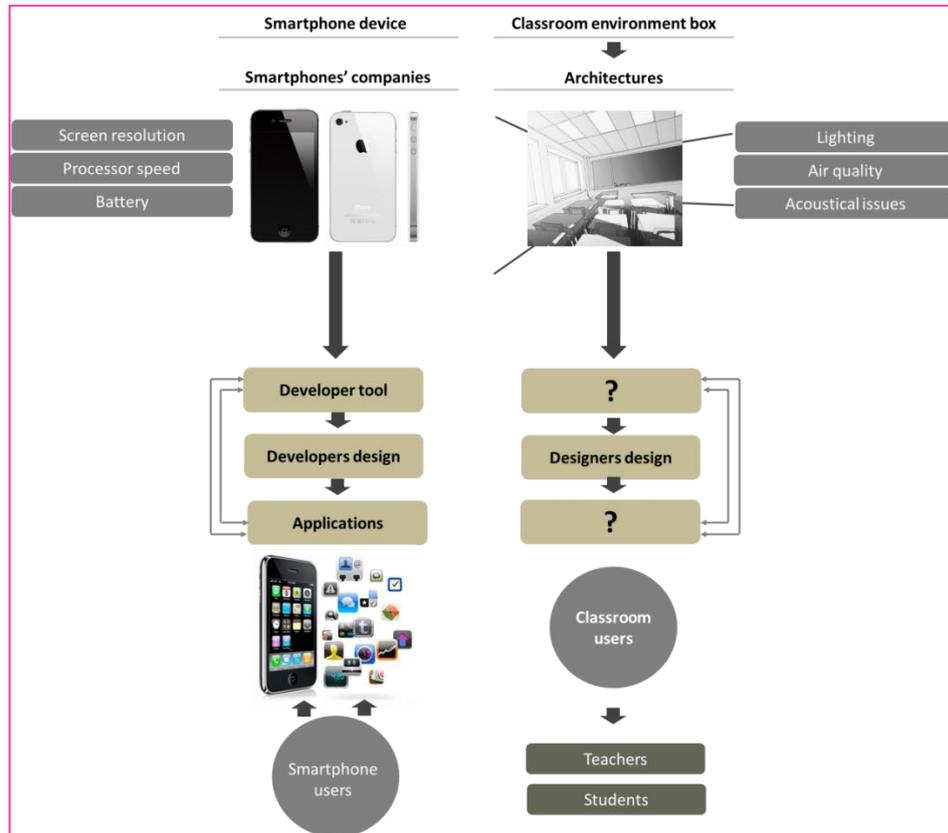


Figure 207: The Comparison between Classroom Environment Box and Smart Phone

4.2.2.2 What Kind of Activities Do Users Perform in The Classroom?

Classroom activities depend on teachers’ teaching aids, strategy and curriculum. However, activities can be engaged with by groups, pairs and individuals. In addition, teachers argue that classroom activities should highlight real life problems, and encourage interaction between students, school and society. Therefore, activities’ can occur in inside classroom, (Figure 208) outside classroom but inside school (Figure 209) and outside school. Classroom activities are key elements for motivating and stimulating students to engage with the classroom, especially when involving kinetic activities such as running and dancing.



Figure 208: Students’ Activities in Classroom Environment



Figure 209: Students' Activities outside Classroom

Furthermore, it is important to mention that users emphasise that there are unlimited activities can occur in the classroom, for example: acting, competitions, scientific experiments, playing, mind map (Figure 210: examples of students' mind map), discussion, storytelling (Figure 211: example of storytelling cards), paper work, Puzzles (Figure 212 and Figure 213: examples of teachers' puzzles) and card sorting.



Figure 210: Examples of Students' Mind Map



Figure 211: Shows Example of Storytelling Cards



Figure 212: Examples of Teachers' Puzzles

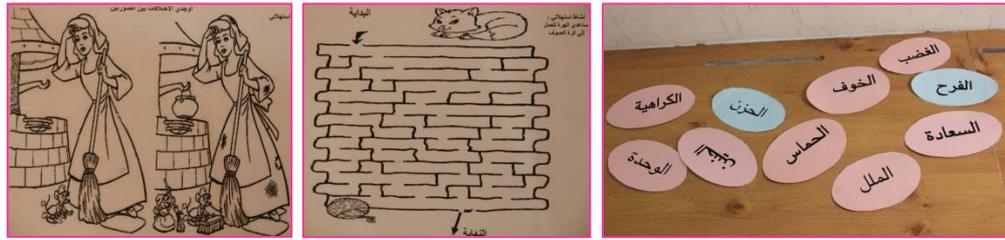


Figure 213: Examples of Teachers' Puzzles

Teachers design classroom activities Figure 214 shows an art teacher's classroom activities process. However, different teachers design different classroom activities to support their teaching strategy, curriculum and teaching aids.

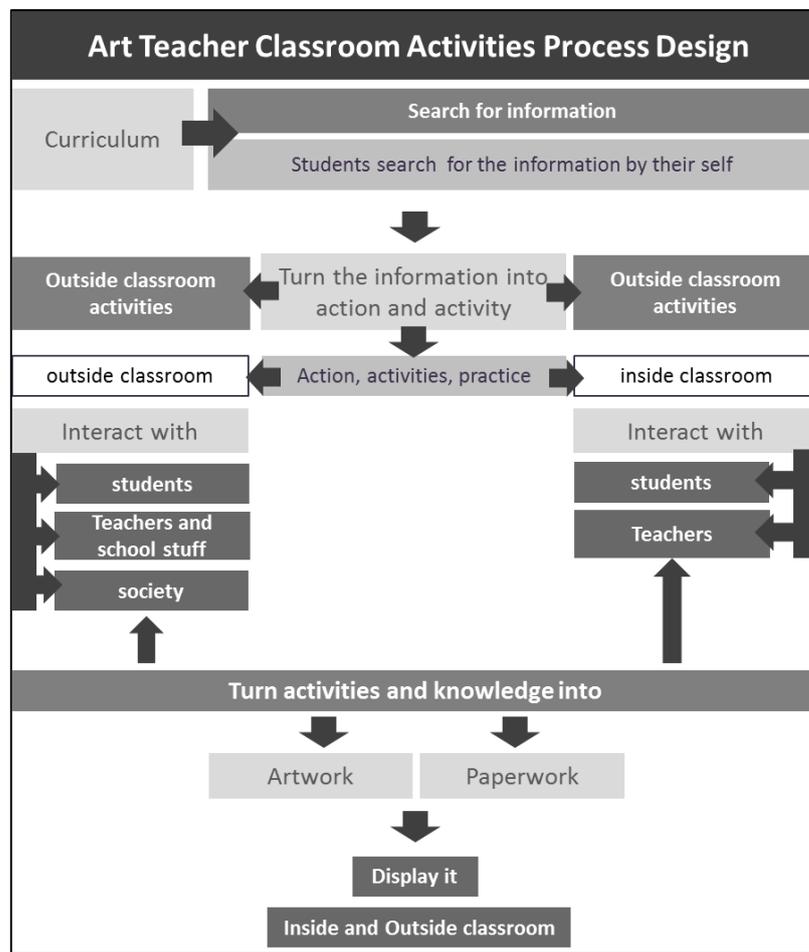


Figure 214: Art Teacher Classroom Activities Process

4.2.2.3 How Classrooms Effect Users?

There is a strong relationship between classroom design elements and the way that they affect users. However, teachers and students said that everything designers design in classrooms affects them differently, for instance: elements such as lighting, air quality and acoustical issues affect users' health in term of their vision and comfort. Besides,

elements such as classroom size affect users' performance, because they shape their movements inside classroom hence their choice of activities, and teaching strategy. Also, classroom displays affect users' stimulation, and classroom colours effect emotions, as does display of positive words such as 'I am strong' or 'I am clever' which have had a positive impact on students' attitudes. Moreover, overlooking some design elements can affect users, for example overlooking storage cabinets in the planning stage make users add storage cabinets after architects finish their work. This effect users' movement and circulation, because they have to add these elements. Anything that could help teachers' in teaching and creating a valuable learning experience is considered a classroom resource and a teaching aid for example: computers, projectors, library and educational posters.

4.2.3 Classroom Space Design Elements

This section summarises classroom space design elements from the users' point of view; Figure 215 shows the green section how design elements facilitate teaching and learning not only comfort, aesthetics and health. This section answers a question raised in the contextual review chapter: "What do we need to design in a classroom to ensure that learning space is effective and what are the learning design space elements, from the users' point of view?"

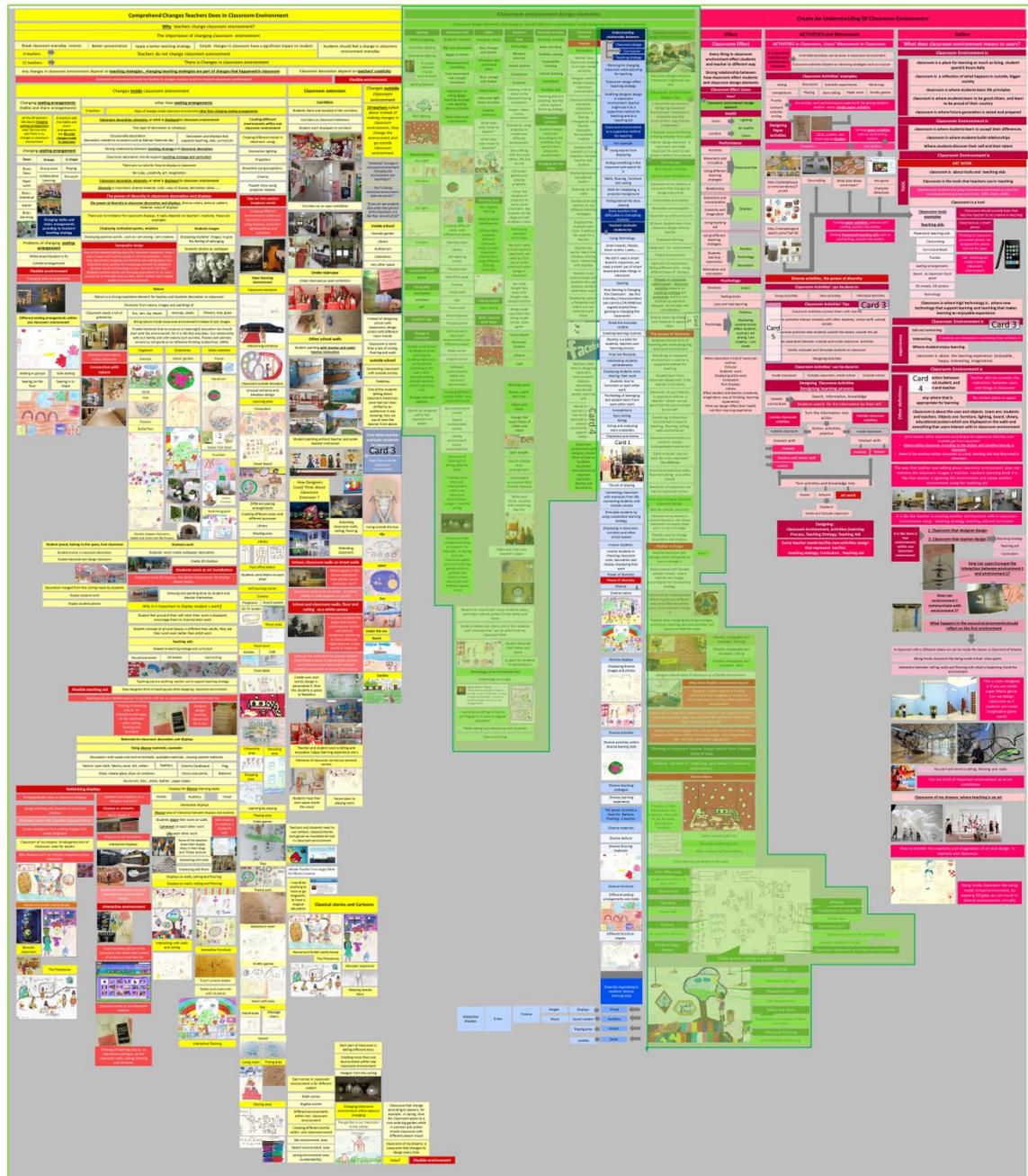


Figure 215: Classroom Space Design Elements in Finding Sheet

This section reports on design elements that were not mentioned in the contextual review. These design elements were added to the classroom space design elements framework developed in the first phase.

According to classroom users, design elements that designers should take into consideration for classroom environments include: Lighting, Windows, Sound, and Air Quality. Users gave examples of how to exploit them.

4.2.3.1 Lighting

According to classroom users, there are two main types of lighting in classroom spaces: artificial and natural.

i. Artificial Lighting

There are different types of artificial lighting. Controlled lighting can be controlled during lessons (especially when using projectors). Decorative lighting, which stimulates students' senses, Figure 216 shows an example of using wall lighting in a student's drawing.



Figure 216: Example Of Using Wall Lighting in Student's drawing

Some students suggested changing usual shapes of lighting feature, examples in Figure 217 and Figure 218.



Figure 217: Lighting Features Designed As Flowers

In Figure 217, the flower light suspended from the ceiling, is an example of a natural element that inspires. In Figure 218, a lighting feature looks like painting brushes suspended from the ceiling in the art classroom.



Figure 218; Lighting Features Are Designed As A Watercolour Brush

ii. *Natural Lighting*

Natural lighting is sun light that comes through windows in the walls or skylights from the ceiling. Figure 219 shows sun light from the windows in students' drawings. Figure 220 shows a skylight in students' drawings.

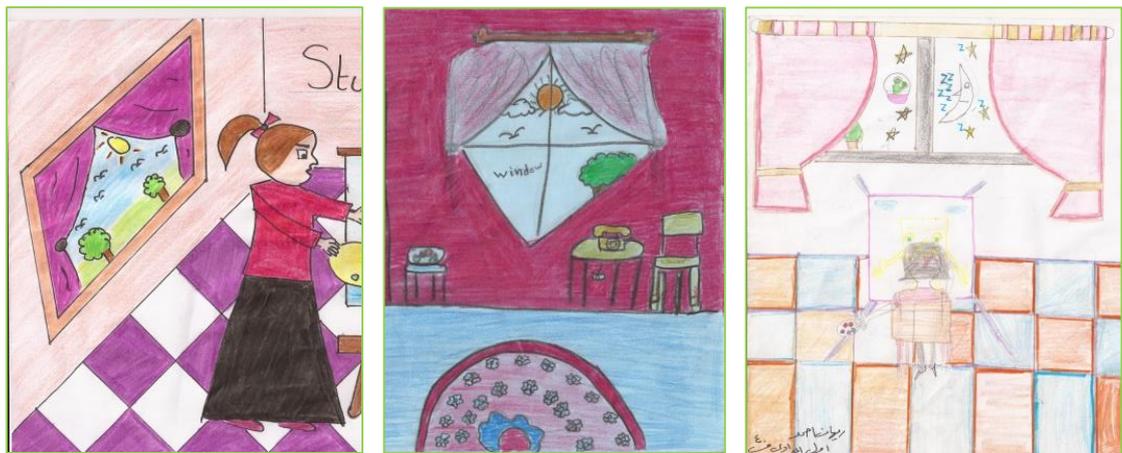


Figure 219: Sun Light From the Windows in Students' Drawings



Figure 220: Skylight in Students' Drawings

4.2.3.2 Windows

In students' drawings, windows are not only a source for natural light and ventilation, but provide visual access to wonderful things happening outside classrooms. Students draw imaginary worlds' classroom window; Figure 221 -Figure 222. In Figure 221, students look from the window at aliens in their spaceship surrounded by a sleeping moon and stars.



Figure 221: Aliens' Spaceship Window

In Figure 222 a student paints a tree in the garden, which she is looking at through the window.

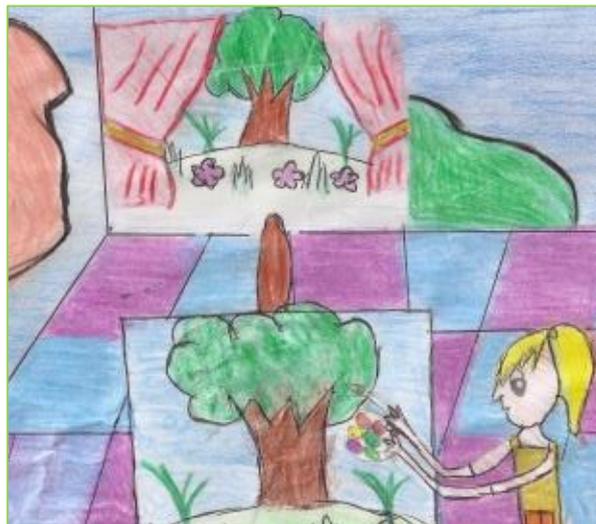


Figure 222: Tree in the Garden Window

4.2.3.3 Sound

In the interview, teachers emphasised the importance of sound in the classroom and issues related to it, such as noise and echo, which affect their ability to talk and explain the curriculum.

4.2.3.4 Air Quality:

Some teachers' in the interview highlighted ventilation as an important design element, especially in warm weather countries, with windows and air conditioning being the two main ventilation sources.

4.2.3.5 Classroom Size

From the data analysis, classroom users prefer bigger classrooms because it makes their movement in the space easier and enables better circulation between classroom furniture and users. In addition, a big classroom supports teachers in applying more diverse teaching strategies and activities. Furthermore, both teachers and students have been noted to prefer open learning space designs which require more space in the classroom. Different users had different view about what is in an open learning space. In Figure 223 the researcher combines different students' drawings with different teachers' photos. The reason for putting these different views on a classroom plan is to show the potential of rethinking learning space design elements.



Figure 223: Users' Open Learning Space

Open Learning Space

In an open learning space, users divide the space into areas with different purposes to achieve different activities (Figure 223). Some users divide the space according to

activities such as: reading in the library area, self-learning area, playing area, swimming area, post office, cinema, living room, spa, food court, recycling area and shopping area. Figure 224 and Figure 225 show examples of open learning space in students' drawings and how they divided classroom into different activity areas.

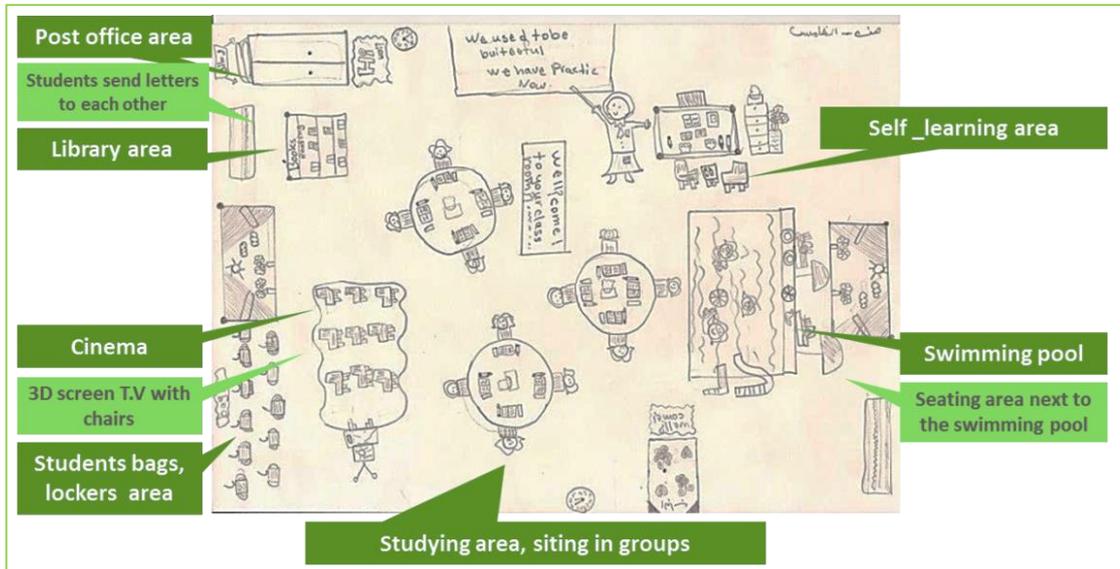


Figure 224: Dividing Classroom Space to Different Functions Areas in Students' Drawings



Figure 225: Dividing Classroom Space to Different Functions Areas in Students' Drawings

Figure 226 shows examples of teachers' open learning spaces and how they are divided into different activities areas.



Figure 226: Dividing Classroom Space to Different Functions Areas in Teachers' Classroom

Source: <http://classroomsimple.blogspot.co.uk/>

Sometimes walls were divided and allocated to different subjects, such as: Maths, English and science. Figure 227 shows classroom walls divided into different sections for different subjects, while in Figure 228, classroom walls are divided into different science subject topics.



Figure 227: Classroom Walls Divided Into Different Sections for Different Subjects



Figure 228: Classroom Wall Is Divided Into Different Science Subject Topics

Source: <http://www.pinterest.com/pin/264023596875712585/>

Finally some teachers suggested another way of creating an open plan learning space by creating different worlds inside a classroom space such as: sea, desert, farm or garden (Figure 229).



Figure 229: Garden World in Classroom Space

Source: <http://www.sparklebox.co.uk/gallery/gal766-770/gal769.html#.UrNspPRdXPZ>

4.2.3.6 Colours

Every user perceives colour differently. Some teachers prefer energetic colours such as red, yellow and orange, others mentioned motivating colours such as blue, orange and yellow. Some teachers ask for pastel colours (light and calm tones). Figure 230 shows an example of a teacher's classroom makeover.



Figure 230: Teacher's Chosen Colour in A Classroom Makeover

Source: <http://missklohnclassroom.blogspot.co.uk/search/label/back%20to%20school>

Also, students' drawings show a strong passion for colourful space. Figure 231 shows examples students' drawings with colourful walls, furniture and flooring.



Figure 231: Examples for Classroom Colours in Students' Drawings

4.2.3.7 Flooring Type

Flooring is an important design element. The chosen flooring should be of non-slip materials, easy to clean and easy to move furniture over. Users also suggest differentiating between different classroom areas in open learning space using different flooring materials. Figure 232 shows an example for using different flooring materials in a student's drawing, with a fluffy rug in the reading area and tiles in the studying area.



Figure 232: Example Different Flooring Materials in Student's drawing

4.2.3.8 Ceiling

Teachers in the interview mentioned that ceiling height and material should be considered as a classroom design element.

4.2.3.9 Walls

Users suggest using diverse types of materials, colour, texture and lighting features on the walls. Figure 233 shows a wall covered with fabric with lighting features hung on the wall.

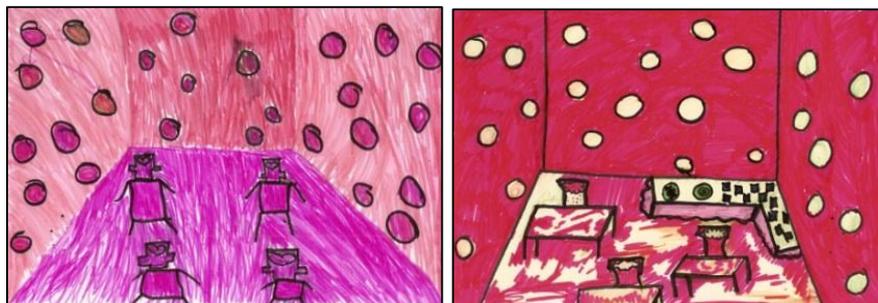


Figure 233: Wall Covered With Fabric and Lighting Features Hanging On the Wall

4.2.3.10 Classroom Furniture and Fittings

Users referred to different furniture types that need to be included in classroom space.

1) Technology

Users mentioned different types of technology that are essential in the classroom space: Wireless internet, sound system, computers, projectors, smart boards and I-pads.

2) Washing Basin

Many teachers mentioned that a wash basin is an important design element in the learning space, because it helps them to apply creative teaching and learning methods that need water to be applied such as: cooking, watercolour painting, or modelling with clay.

3) Socket Distribution

Teachers stated that socket distribution is very important for applying teaching and learning strategies require information and audio visual technology, because elements such as sound systems, computers and projectors all need sockets.

4) Tables and Chairs

Users mentioned that tables and chairs should be comfortable, made from lightweight materials, and flexible in order to change arrangements in order to facilitate different teaching strategies. Students suggested changing the usual design of tables and chairs with different exciting designs. Figure 234 shows table and chairs in heart shape. Figure 235 shows a table designed as watercolour brush shape for art classroom.



Figure 234: Table and Chairs in Hart Shape



Figure 235: A Table Designed As Watercolour Brush Shape for Art Classroom

5) Storage Area

Teachers wanted storage areas to be designed in during planning for building, because adding storage cabinets later can degrade the classroom aesthetic (Figure 236, storage not designed during planning) Storage added randomly after architects finish their work can caused clutter.



Figure 236: Cluttering Storage in Classroom Space

In Figure 237, storage designed during planning results in good space aesthetic, function and more (Figure 237, storage cabinets designed as a playful slide)



Figure 237: Designed Storage in Classroom Space

Source: <http://archinea.pl/wnetrza-siedziby-allegro-group-w-poznaniu-ultra-architects/>

4.2.3.11 Classroom Displays

According to teachers, classroom displays are a major design element that mediate between teachers and students. Teachers can communicate with their students through what is displayed. In addition, students can learn from displays without the need for a teacher. However, it is important for classroom displays to be interactive, changeable, enjoyable, learning tools that allow students to share their work that students can personalise. Teachers stated that with all the elements involved they would benefit from help in designing classroom displays in order to create an interesting space.

4.2.3.12 Variety

Variety is a key to designing classroom space. Figure 238-Figure 239 show examples of variety in students' drawings. In Figure 238, a student has designed a space using diverse rainbow colours in the wall and colourful flooring pattern. In Figure 239, a student has designed a space using varied floral patterns on the wall and apple pattern in floor. In Figure 240 students depict different flooring material textures.



Figure 238: Variety Rainbow Colours in the Wall and Colourful Flooring Pattern



Figure 239: Variety Floral Pattern in Wall and Apple Pattern in Floor

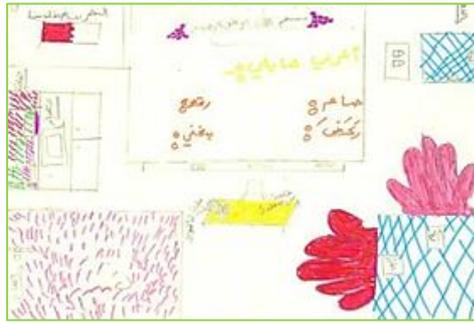


Figure 240: Different Flooring Material Textures

Furthermore, diversity is also apparent in classroom displays; Figure 241 shows examples of diverse displays in students' classroom design. Figure 242 shows diverse ways of displaying students' work.



Figure 241: Diverse Displays in Students' Classroom Design



Figure 242: Diverse Ways of Displaying Students Work In Classroom Space

Figure 243 shows diverse seating arrangements in classroom space. Figure 244 shows seating arranged in diverse flowers sizes and shapes.



Figure 243: Diverse Seating Arrangements in Classroom Space

Source: <http://thekennedykorralblog.blogspot.co.uk/p/my-classroom.html>



Figure 244: Seating Arranged In Diverse Flowers Sizes and Shapes

4.2.3.13 Personalising

Users state that tables and chairs are student’s islands. Additionally, students talk about personalizing their tables and chairs as one of their best memories about classroom space, one student said “*I discover that I am an artist from my classroom table*”. Figure 245 shows examples of students’ tables. Furthermore, students ask for personal space in the classroom which they could design and personalize by them self. One student said while talking about her best memories of classroom: “*we had our personal corners, a corner that we design it by ourselves without teacher’s supervision*”.



Figure 245: examples of students’ tables

4.2.4 The Relationship between Design and Teaching Strategy

Figure 246 shows the blue section in the finding sheet (understanding the relationship between classroom space design and teaching strategy) And it has been inserted within the green classroom design elements section because users claimed that any changes made in a classroom space design depends on teachers' teaching strategy (which depends on curriculum). Teaching strategies should be considered while designing classroom space. All changes to classroom space relate directly to the curriculum and teaching strategy. The way the space is arranged indicates the learning strategy that the teacher using. As an example from the literature review, a single focal point at the front of the space sends a strong message about what learning strategy will be used (Oblinger, 2006). However, current literature does not explain how the relationship classroom space and teaching strategy can be more generally designed.

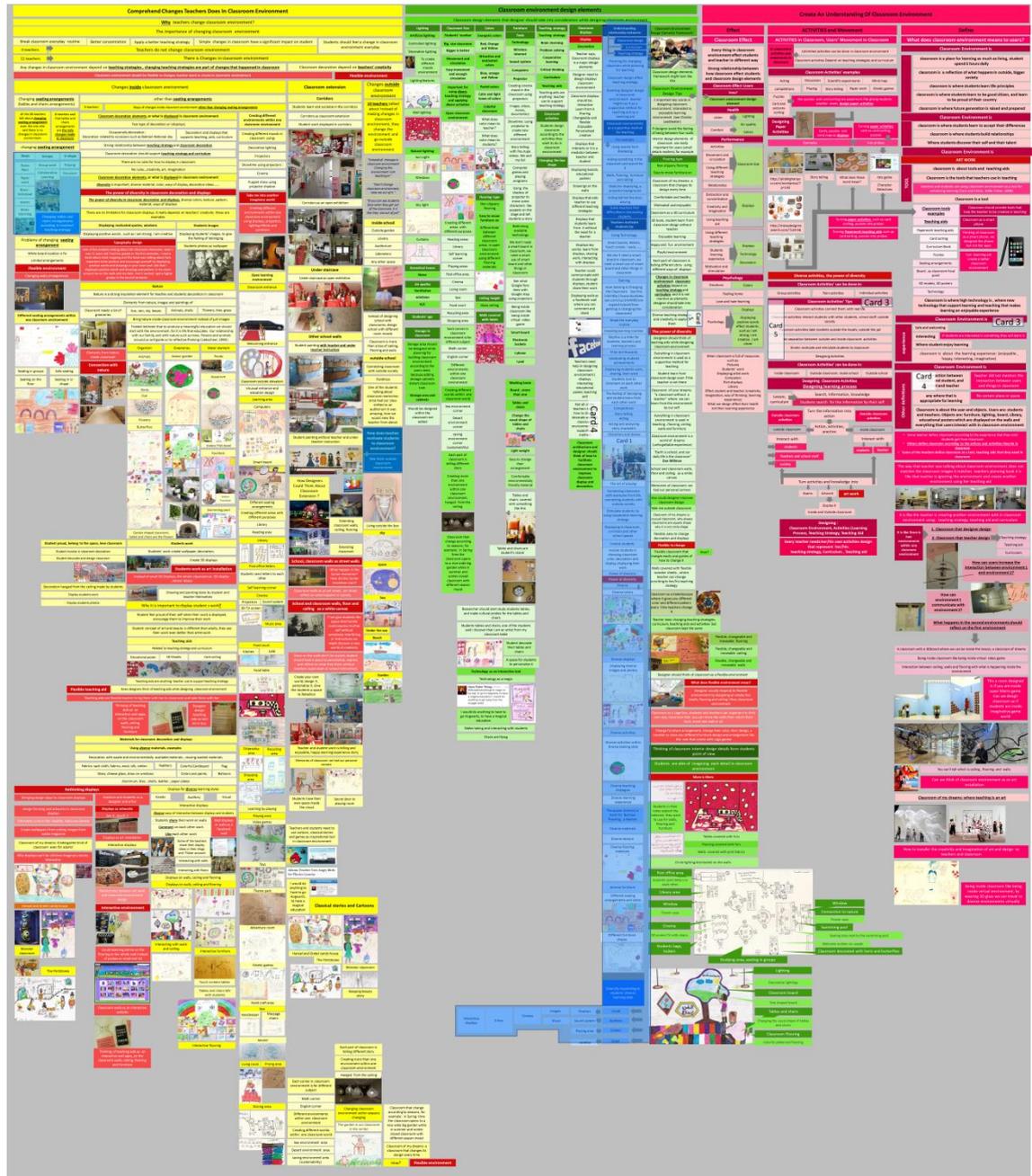


Figure 246: The Relationship between Classroom Design and Teaching Strategy (blue section) in the finding sheet

Teachers said that they plan for changing classroom space while planning for teaching strategy which depends on curriculum. There are different methods of teaching strategy that teachers use, for example: critical thinking, brainstorming, cooperative learning and problem solving. The teaching strategy that they choose for example fixed tables and chairs subtract arrangements, therefore with fixed furniture they could not apply teaching strategies that need changing tables and chairs arrangements. In addition, anything the designer designs in the classroom space the teacher might use it as a supportive method for teaching or as a teaching tool. for example: Using boards for teaching, walls as a projector background, using ceiling to display students' work, walls and flooring for

displaying, windows to explain lessons like shade and shadows. According to teachers, teaching tools are anything the teacher uses to support their teaching strategy, so architects should think of teaching tools while designing space because they could add learning and teaching value by designing elements that is usually designed for health and comfort purpose such as windows.

4.2.4.1.1 How Do Teachers Stimulate Students in the Classroom space

Teachers said they motivate students by:

- Using Technology such as smart boards, robots, touch screen and I-pads.
- Playing games as a tool for teaching and learning
- Breaking everyday routine because “Routine is a killer for students, teachers and learning process”
- Prize and Rewards
- Displaying students’ work, which is an important motivation for students in classroom because they like to share their work and comment on each other’s work
- Competitions
- Storytelling
- Acting
- Playing
- Engage students with real life problems and connect them with outside society
- Using cooperative learning strategy
- Involve students in choosing classroom colours, decorations and display
- Using diverse teaching strategies which respond to students’ diverse learning style

4.3 Framework of Learning Space Design Elements

The framework of learning space design elements had new elements added, and description of existing design elements added too. The framework was divided into three parts, each in one image. The green lines are elements were added to the framework after the second stage findings (Figure 247- Figure 248- Figure 249) shows Framework of Learning Space Design Elements.

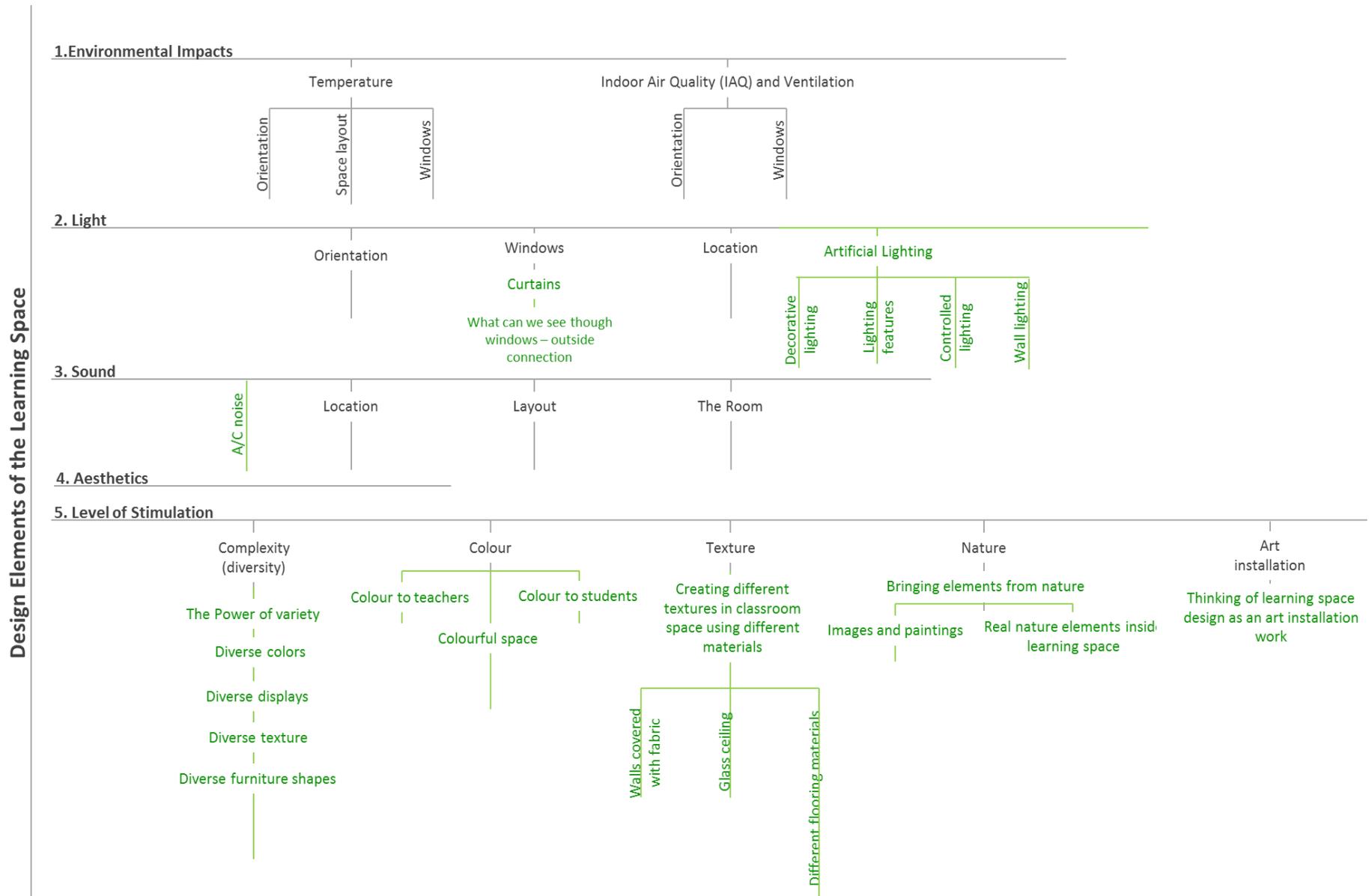


Figure 247: Framework of Learning Space Design Elements- Part 1

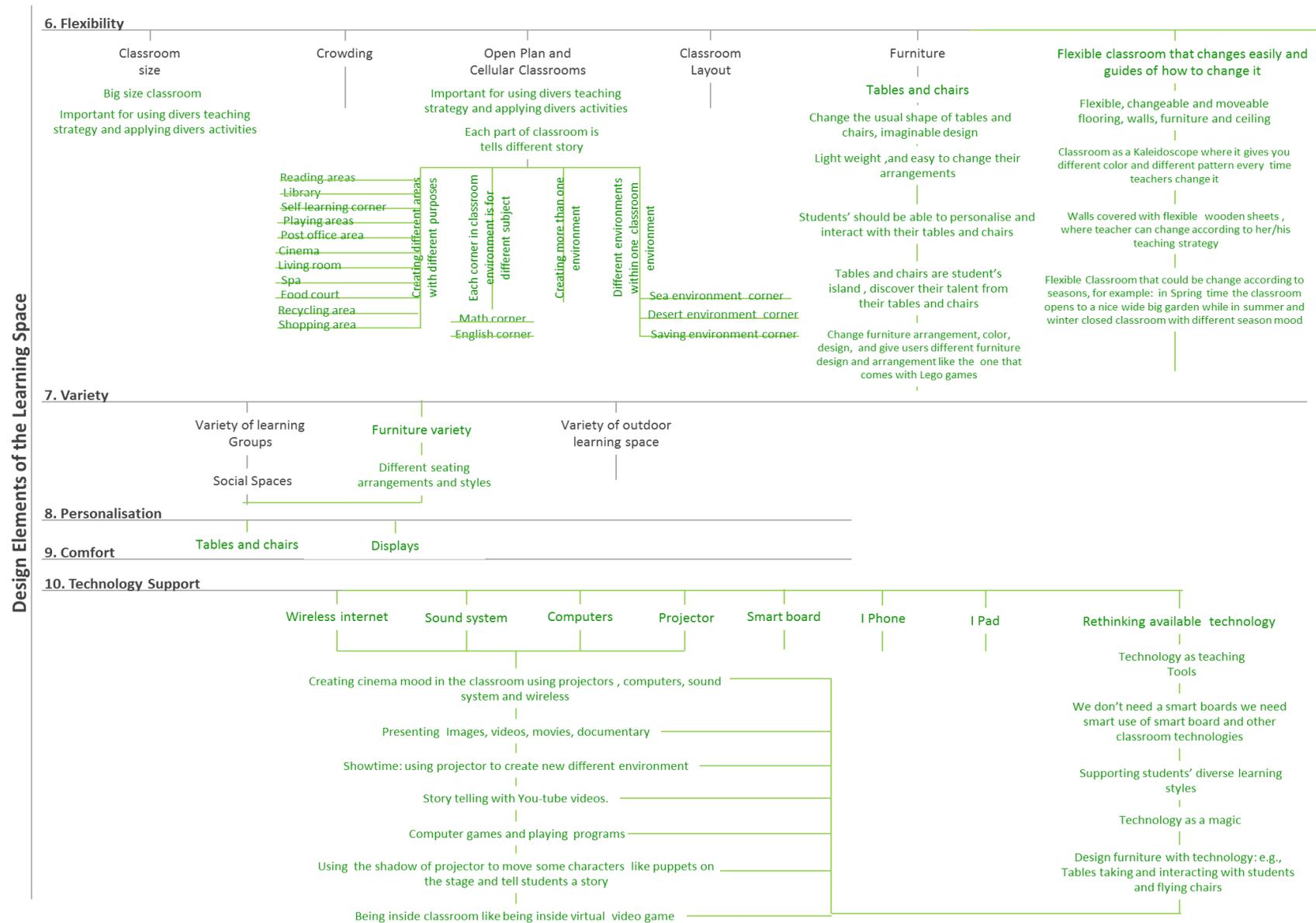


Figure 248: Framework of Learning Space Design Elements- part 2

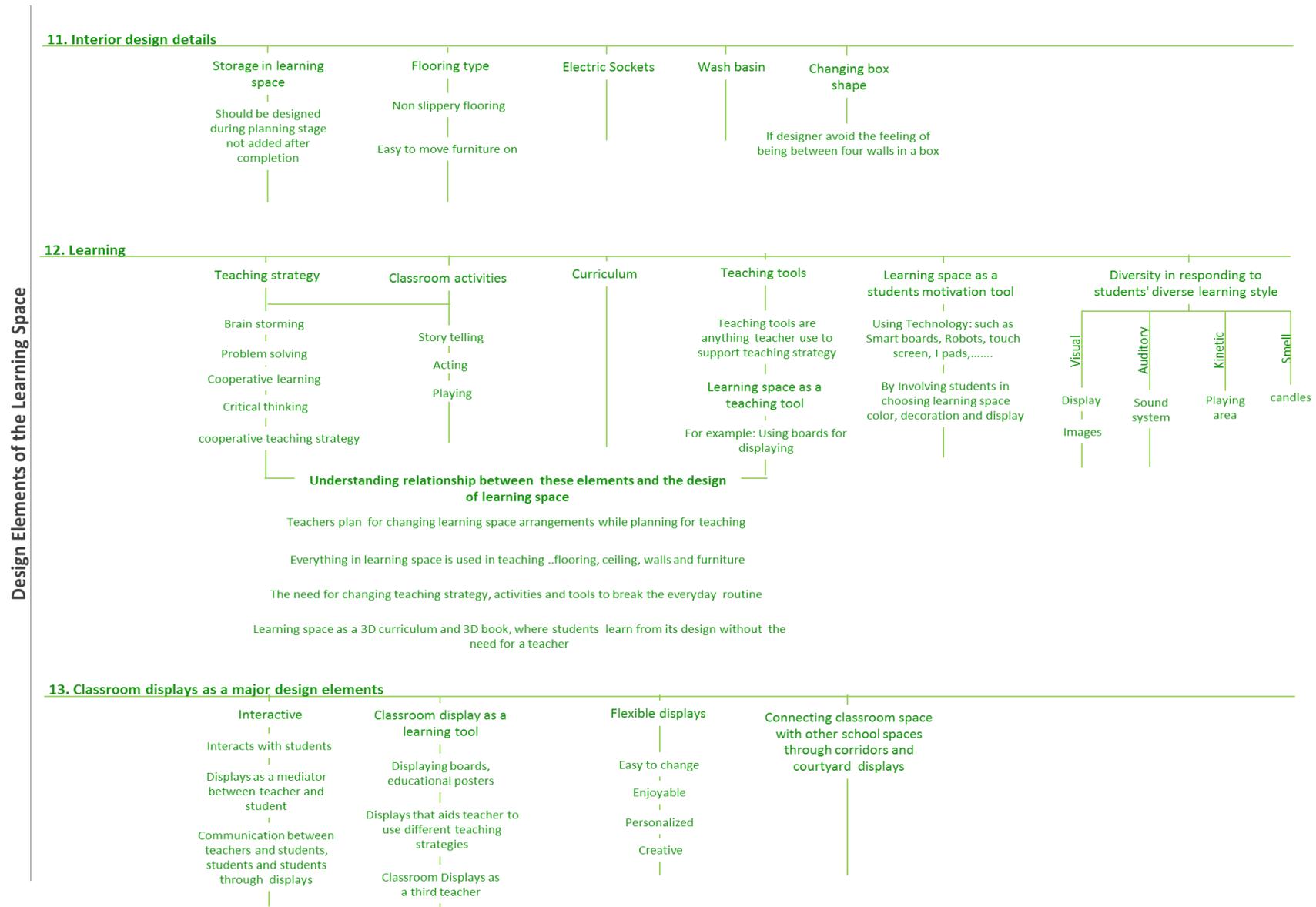


Figure 249: Framework of Learning Space Design Elements- part 3

4.4 Summary of the Four Sections

4.4.1 Comprehend Changes in Classroom Space

It is very important to change learning space design and to facilitate this in order to respond to different learning methods. Both the literature and users highlighted and explained benefits users can gain. Yet, how users facilitate learning space design and change it to respond to different learning methods is not something that the current literature answers. Also most teachers find it difficult to change space because they don't know how to do that or they are not aware of the changes that can be achieved. How users' adopt space depended on teachers' awareness of space which was usually limited to changing tables and chair arrangements. Although there were good examples for teachers changed space in an interesting way, these examples were limited. There are opportunities that users are not aware. Observation of classroom space shows that there are many overlooked design solutions that could be copied by learning space users immediately with available resources. Additionally, students' drawings offer inspirational solutions, because students were more creative than teachers. Students' drawings illustrated radical changes that they wish to happen in classroom space. Some of these ideas seemed to be impossible but it could be achieved using available technology such classroom under the sea, this idea could be achieved using projector, computer and sound system.

Classroom display is a powerful design element in learning space because of its flexibility responds to users' changes, and for being a mediator between users and space walls, ceiling and walls. Therefore, display design can encourage users to interact with space. Display in classroom space is overlooked by architects and designers during planning for building learning space. Current learning space design does not support flexible and creative display, and teachers argue that they need help in designing classroom space displays in order to stimulate and motivate students.

Users' learning space design and how elements such as nature, texture and colour are used by students and teachers can inspire rethinking learning space design. Users use these design elements as a teaching and learning resource, while designers design these elements as aesthetic elements. For users the whole classroom space including walls, ceiling, flooring and everything designed in the space is learning and teaching resource while it is not designed by architects to work as a teaching resource.

This section explained how users change space and redesign it to facilitate different learning methods that showed different ways of exploiting learning theories through space design. The current literature does not report how teachers and students adapt learning space after architect finish their work. This section has presented different user responses to their classroom that helps us to understand learning space design from different angles. Firstly, this understanding provides suggestions for how to rethink the initial design of learning space. Secondly, this understanding shows different opportunities to improve current learning spaces, and take action now. Users' movements, interaction and adaptation within a space gives meaning to space design elements.

4.4.2 Create Understanding of Classroom Space

Classroom space users' have different perspectives. For some the focus is on what students learn, it is on the experience students receive. For most teachers, classroom space is a tool that aids them in teaching. However, some users describe classroom space as the interaction that happens there. Therefore, the best way to support these various perspectives is to design a space that can change frequently. A classroom space is where future generation is raised. It can be seen as a space where students learn how to socialise, build relationships, accept their differences, identify their self and discover their talents. However, how an architect can embrace these values through space design a question remains without an answer.

Users give different meanings to classroom space. Some teachers claimed that classroom space is about students' learning experience, which should be enjoyable, happy, interesting and imaginative. However, current classroom design does not serve these meanings. Additionally, how a classroom can change its design to express different changing learning experience desired by users is a question that will be answered in the third stage of this research. Additionally, Teachers do not look at classroom space as the only space that is designed for learning, they emphasised that the classroom is anywhere that is appropriate for learning which encourage architects rethink the old concept of building a school with classrooms.

Classroom space can be understood as an interaction that accrues from users' actions, activities and movements between classroom users (student and student, student and teacher, users and space). Understanding space activities and movements can inspire

designers to design for interaction in a learning space during planning. Nevertheless, the way classroom space is designed currently is impractical because it does not respond to users need for interactive space, and it does not empower users to change it in order to facilitate different teaching and learning methods it is a fixed empty box.

Different perceptions informed the tool design stage, where the researcher thought of designing a tool that responds to both users’ perceptions and needs. For example classroom purpose for teachers is learning, while for students it acts as playful means of learning, therefore the tool design should be able to deliver a playful learning experience. Table 3 presents users’ different perceptions of classroom space.

Table 3: Users Different Perceptions of classroom Space

| Teachers’ Perception Of Classroom Space | Students’ Perception Of Classroom Space |
|--|--|
| The main purpose of classroom space is learning | The main purpose of classroom space is to have fun, enjoy their time and have an adventure. For students having fun and enjoying their time is more important than structured/curriculum learning. |
| Teachers think how to improve classroom space in a way that fits their teaching strategy and they experience space design limitations. | Students do not limit their way of thinking about classroom space design, according to them there is nothing impossible in classroom space design. |
| Some teachers think it is better not to connect students with outside classroom space because it might distract them. | Students like to be connected to outside classroom space |
| Teachers ask for space design solutions | Students give space design solutions |

4.4.3 Classroom Space Design Elements

When users were asked directly to identify learning space design elements, they mentioned elements that affect health and comfort such as Lighting, Windows, Sound, and Air Quality. However, in contrast their ways of changing and occupying built learning space revealed different design elements that users did not mention and architects are not aware of. Also users were aware of minor details related to the interior design of space such as flooring materials, wash basins and power socket distribution. The way users adapt the built space gives new meaning to design elements beyond the research literature. For example, users did not only explain lighting as a design element

supports visual perception. They also explained lighting as a decorative element that enhances space aesthetics by creating variety of forms and colours in space.

Users add new meanings to learning space design elements. For example, users explained design elements such as windows as a connection between inside and outside classroom space. Thus it is important that architects design what users see through the window, and more generally understand how learning space design elements interact in space through use. Understanding classroom movement not only suggests a variety of seating arrangements, but also a variety of activities for users to do in classroom space.

Finally, many research studies discuss the effect of learning space design elements on pupils' outcomes and achievements, but they do not necessarily relate these impacts to the way learning spaces should be designed. This section relates designed elements to how way space can be designed from the users' point of view. Designers and architects can learn from how users translate ideas into design elements to facilitate teaching and learning.

4.4.4 The Relationship between Design and Teaching Strategy

The aim of this section was to understand the relationship between classroom design and teaching strategy. This section attempt to translate the theoretical relationship between classroom space design and teaching strategy into design value added by design elements. Finally, this section has showed that although users highlighted the importance of using and changing learning space to support their teaching strategy, their use of learning space as a teaching tool is very limited.

4.5 Summary

This chapter improved our understanding of learning space design. It provides answers for some questions from the literature review. The findings have clarified what happens to learning space design after architects finish their work and how did users occupy and respond to the designed space. Additionally, it has illustrated how teachers currently exploit learning space design elements, and reports on how teachers prepare space to engage with their teaching strategies. However, teachers lack awareness of space design, so many teachers found it difficult to change space. Classroom space affects

teachers' ability to teach and some currently adapt their space to support different learning activities. The findings exposed the nature of the relationship between users, learning and space design elements, how it is through interaction, and how this relationship can be reflected in the design of the space. The findings highlighted problems mentioned by users about learning space such as:

- Most teachers find it difficult to change space because they don't know how to. They lack space awareness, although observing current learning space showed that there are many opportunities to change space with its available resources, yet teachers do not change their space. Therefore, users need to know how to redesign space using available design elements such as texture, colour and technology.
- Changing and using space to facilitate learning and teaching is a key problem, how to change space is the question that needs an answer.
- Teachers stated that they need help in designing classroom space displays in order to stimulate and motivate students in the classroom space; they want to design interactive and playful displays. However, the findings showed that many teachers did not know how to display students' work.
- The classroom is where students learn how to socialise, build relationships, accept their differences, identify their self and discover their talents. Teachers wanted to know how to support these values through space design
- Limited interaction with space and space objects such as furniture, wall and flooring
- Limited interaction and communication between students, teachers and space (weak communication)
- Current classroom space lack interactivity
- Lack of students socialising (variety of learning groups is not a solution)
- Students do not feel they belong to the classroom space (it is not our space, no space to personalise)
- Students are not involved in the space design
- Classroom space respond only to students with a visual learning style
- Limited teaching aids
- Teachers are not aware of diverse ways of using available technology
- Difficulties in going outside classroom space
- Classroom space lacks students voice
- Students are not active learner in space they are passive

- Limited learning experiences
- Limited changes in classroom arrangements
- Many teachers find it difficult to stimulate students to learn in classroom space

The findings emphasise on the importance of teachers using classroom space to support different teaching and learning methods.

To sum up at the end of this phase (users' perception of learning space), a better understanding of learning space was constructed. Additionally, more problems emerged. The main question of this research which was posed in the literature review chapter and refined in this chapter, but remains without answer: this question is how to empower teachers to use and design current learning space in order to facilitate teaching and learning. Therefore, the next chapter provides an answer for this question through design practice.



Development of a Supportive Tool for Participatory
Learning Space Design

CHAPTER 5: TOOL AND EXEMPLAR DEVELOPMENT

Making Tools offer users the ability to make ‘things’ which can help define future objects or opportunities, and elicit insights on future experiences and ways of living (Sanders and Stappers, 2014)

CHAPTER 5: TOOL AND EXEMPLAR DEVELOPMENT

Introduction

Previous chapters presented the first two phases of the research process (Contextual Review, Users' Perception of Learning Space). "Contextual Review" was a critical exploration of the current learning space design literature. At the end of this phase, the researcher found that design guidance is missing in current literature of learning space design. Two "How" questions were without answers: how could architects design space that will benefit its users; and how could teachers use the learning space to obtain these benefits? Therefore, this research aims to help both who are going to design learning space before building (*architects*) and who are going to continue designing learning space after space is built (*teachers*).

The second phase "Users' perception of learning space" answered the questions raised in the first phase. Additionally, at the end of this phase and the first section of action phase researcher was able to rethink the current design of learning space and achieve the first research aim. Furthermore, this phase emphasised the problem found in the first phase, which is teachers' need to be empowered to use space to support learning and teaching, additionally this phase has revealed other learning space problems. However, this phase did not provide a solution to empower teachers to use space. This chapter concerns the third *action* phase of research, and outlines and evaluates a design(ed) solution.

The action phase begins with rethinking learning space design elements where design researcher suggests to architects design solutions that adds new meaning to elements in space, after that the tool design and development section with an explanation of the thinking process behind a design tool's conception, design and conceptualisation of the problem, through reflecting back on the previous two phases of research. It then goes on to explain the inspiration of the tool design concept. Later, the chapter describes the tool's design, critically reflecting on the thinking behind its visual appearance and selected content, and its various cultural influences. Finally, the chapter reports the evaluation of the tool's use.

5.1 Rethinking Learning Space Design Elements

Current literature concentrates on the health and comfort value of design elements, most architects do not integrate teaching and learning to design elements of space, while most of teachers are not aware of using design elements as a teaching tool. However,

understanding users' perception in chapter four inspired me using interior design skills to add learning and teaching value to design elements which aid teachers to integrate their teaching strategies with design elements and use them as a teaching tool.

Understanding the results of previous phases inspires different design solutions, in the next researcher would give design examples for how could architects add teaching and learning values to usual health and comfort design elements. These examples need to be design during planning for building classroom space, therefore these examples help architects but not teachers.

5.1.1 Windows

This research showed that a window for learning space users a connection to what is happening outside. What users can see through the window is as important as the window itself. Nevertheless, in students' drawings the windows were connecting them to an inspiring and stimulating world. In Figure 250 student can look at the sun, birds, cloud and tree throughout the window and what she can see throughout the window is reflecting in her drawing.



Figure 250: Windows in Students' Drawings

Teachers used windows as a display surface (Figure 251-Figure 252). In Figure 251, the teacher has used the window as a book display. In Figure 252 the teacher asked students to draw their portrait and display it on the window.

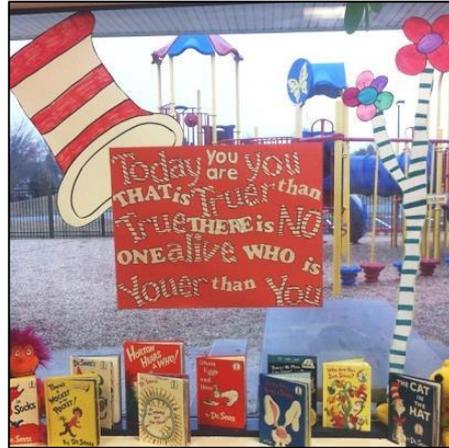


Figure 251: Window's Displays in the Learning Space

Source: <http://www.pinterest.com/pin/40602834110749708/>



Figure 252: Window's Displays in the Learning Space

Source: <http://www.pinterest.com/pin/356769601701326159/>

These different ways of looking at windows and understanding users' way of using and adopting with space explained previously inspire the researcher to suggest different ways of adding learning and teaching values to the window through design, for example designing a window that supports teachers' different ways of display and designing what students can see through out the window while designing the window. For example in Figure 253 researcher suggesting a window design, this design suggests window with a seating area, display board and book shelves, to enable use of the window as a reading area, with colourful storage cabinets. This design adds learning value as well as wellbeing value and transform this design element in classroom space as a teaching and learning tool.



Figure 253: Learning Space Window Design

Windows can be designed to be interesting interior design elements that support different teaching and learning approaches. In Figure 254 the researcher presents a window design with interactive buttons where students can record their voices and listen to different music sounds by pushing these buttons. This can stimulate students' hearing and encourage interactivity. Additionally, this window is designed with a magnetic board that lets students and teachers post quotes and notes, ask questions and display classroom activity photos. This design can support teacher and student communication through the interactive board. The window has a shelf that can be used to hold baskets with different teaching tools to encourage students' communication and interaction (e.g., different emotional faces, speech bubble and numbers). Students can comment on each other using speech bubbles express their feelings using faces and rank their work using numbers. This window design can be a strong stimulation element because of varied textures, materials, colours and shapes such as the window wooden frame, colourful Aluminium frame, glass, fabric basket, and magnet board, colourful speech bubble and ranking numbers. Figure 255 shows this interactive window design in a classroom context.

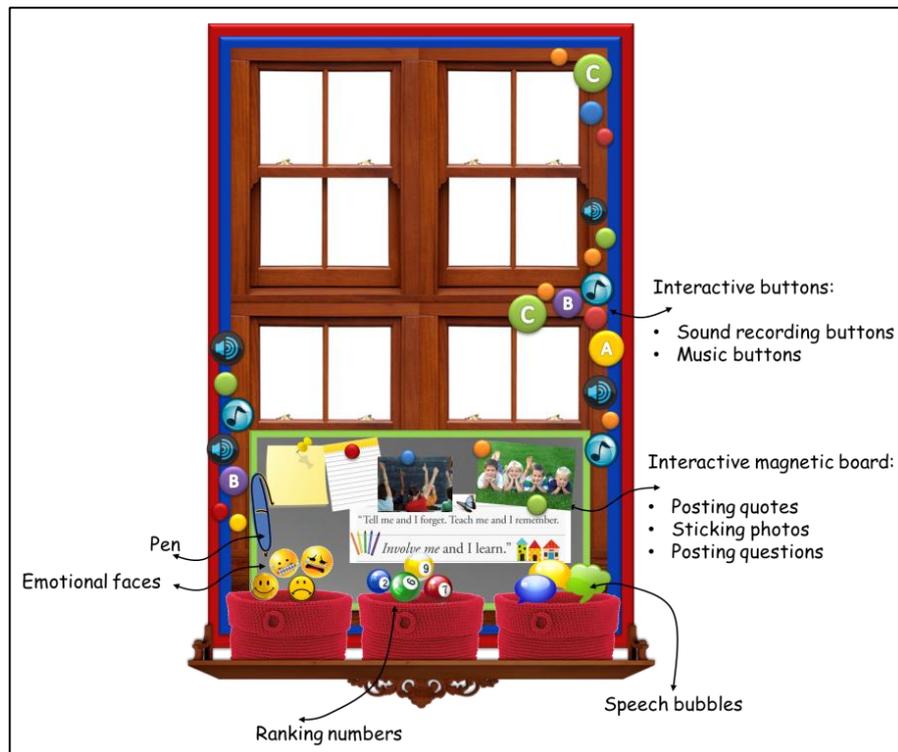


Figure 254: Interactive window design



Figure 255: Interactive Window Design in the Classroom Space

Another design concept to add teaching and learning value to windows shown in Figure 257 shows a window designed with a Lego frame. Teachers can use this frame for storytelling or teaching three dimensional shapes in a learning by playing approach. Figure 257 shows the Lego Frame window in a classroom space context.

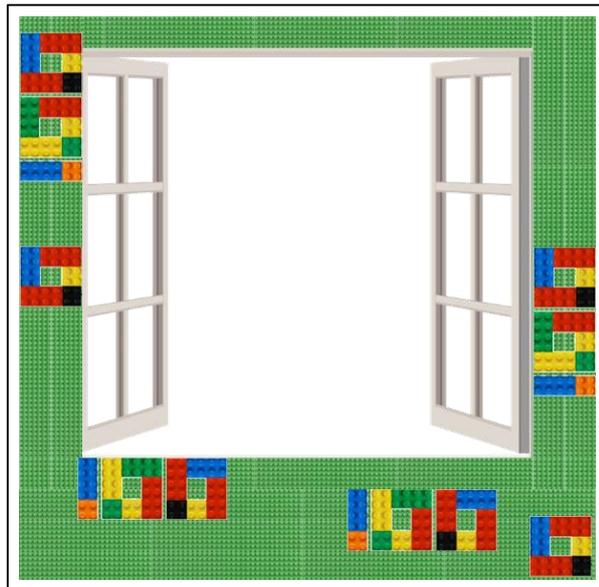


Figure 256: Lego Frame window

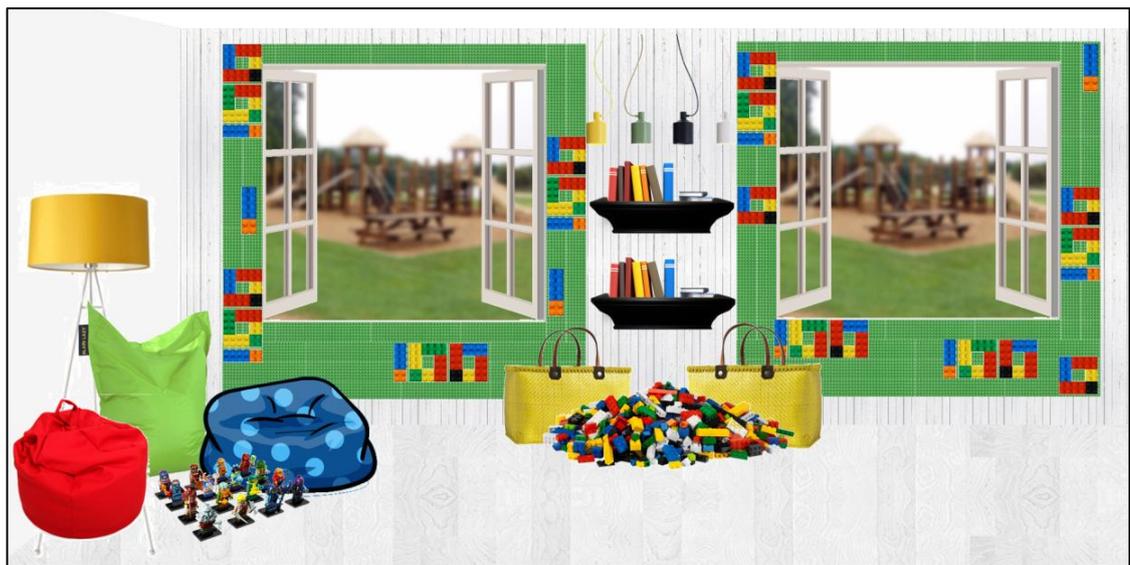


Figure 257: Lego Frame Window in Classroom Space

5.1.2 Flexibility

Flexibility is defined as the ability to change a space (Wardlaw, 2011). Although literature emphasizes the importance of flexibility, it does not explain how to design a flexible learning space. There is much on the problem of inflexible learning space, and how important it is for a learning space to be flexible, but no solutions for this problem. According to classroom users because these teaching methods change, there is a clear need for flexibility in such learning spaces.

The fieldwork findings showed that most classroom spaces are designed as a white empty box. According to users this empty box is not flexible because it's not flexible to changes users need to do for different teaching strategy. Users complain about limited seating arrangements options and the problems when changing seating arrangements due to a fixed board location. Teacher asked for flexible furniture to support specific seating arrangements for specific teaching strategies, but students went beyond teachers with for example, furniture as flexible as LEGO that could be arranged differently each time to offer flexible and new ways for seating and learning. Based on users' suggestions, classroom space can be designed as a LEGO box with general guideline where users have different options to reorganize their learning space and they can rearrange their walls, flooring, ceiling and furniture. In classroom as a LEGO box, students and teachers can organize classroom and move one wall or all the walls and return them back, also they can change furniture arrangement, colour and design. This LEGO box classroom comes with a booklet that shows users different furniture design, wall and flooring arrangements to support teacher' different teaching strategies. Flexibility in learning space can go beyond changing seating arrangements.

Flexibility can add learning and teaching values to different design elements to support different teaching and learning approaches. For example, a flexible desk can respond to different teaching strategy, Figure 258 proposes a desk design that allows students to choose flexible frame with different colours, in addition this design provides a flexible desk front that allow students to personalize it, and allow teachers to communicate with students through their table front and write different messages to each student. In addition, this table front allows students to identify her/his self to other students. Figure 259 shows this different flexible desk front that allows students to draw or write on it, and teachers to apply different teaching strategies.

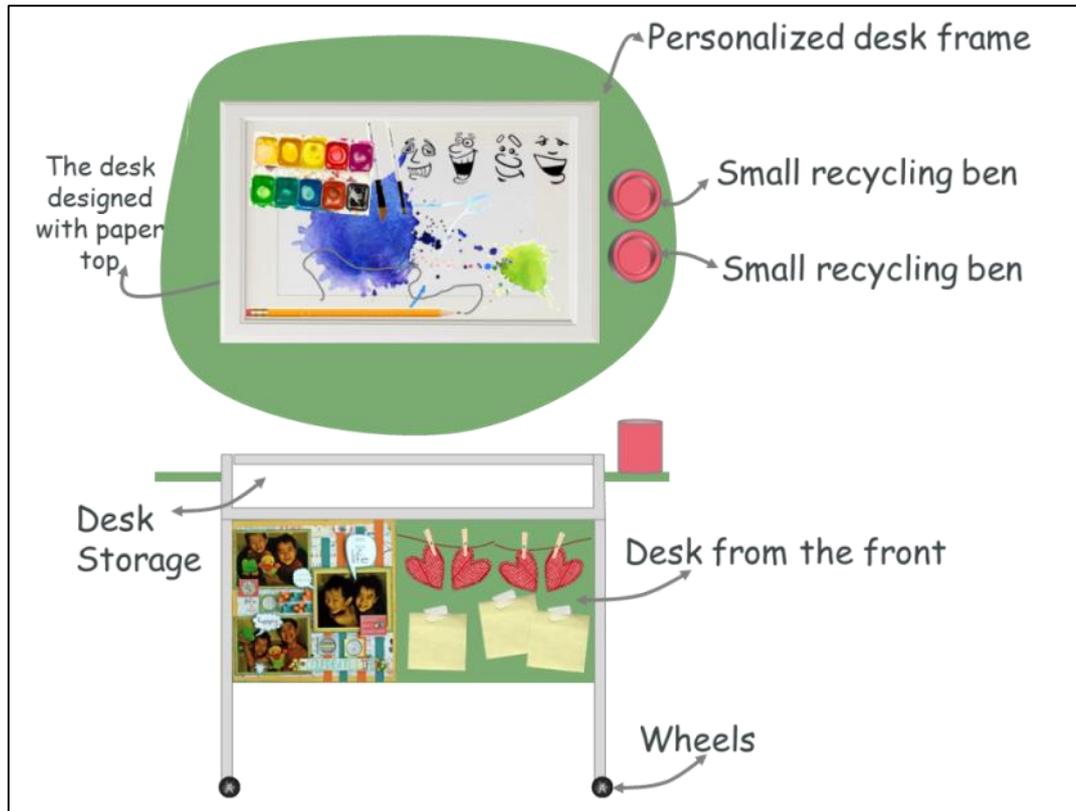


Figure 258: Desk Design

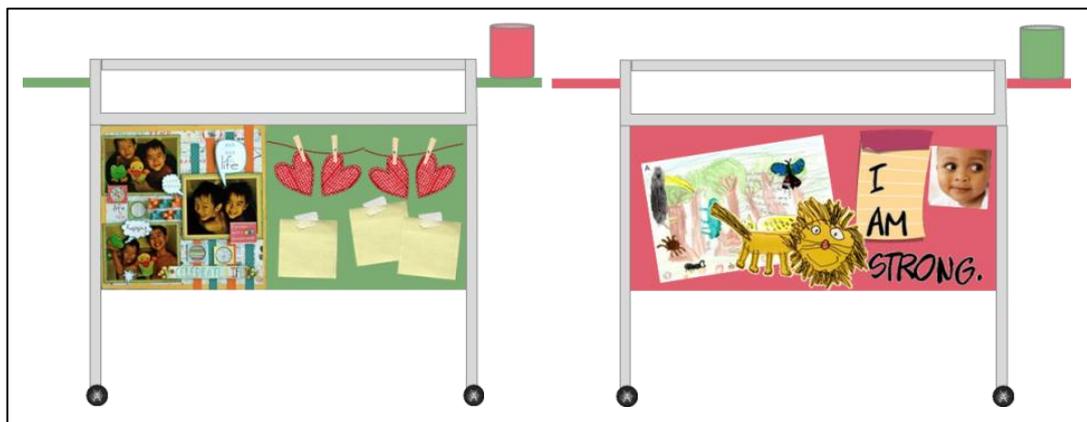


Figure 259: Different Flexible Desk Front

Desktop paper can be removed and displayed on a wall. Teachers can change the learning space by changing the desktop paper, and use these papers as a teaching aid because most of teachers teaching aids are papers as mentioned previously (Figure 260). Figure 261 shows these desks in classroom space.



Figure 260: Different Desk Tops



Figure 261: Desks in Classroom Space

Another example is flexible walls. Walls can be designed with flexible built-in storage covered with wooden sheets or display boards that teachers can use for storing, displaying and changing what is on the board according to their teaching strategy. Another example is light weight partitions where teachers can create different wall arrangements within the same box design. Another example for flexible walls can be seen in Clemens Vogel's flexible wall. He designed a wall that allows users to add or remove items from it according to their needs. Vogel's wooden wall is simply designed with a grid of metal points that allow users to attach different items to it, which enables easy changes responding to different functions and uses. Figure 262 shows Clemens Vogel's flexible wall.



Figure 262: Clemens Vogel Flexible Wall

Source: <http://www.prettyunexpected.com/flexible-wall-by-clemens-vogel/>

Flooring can be flexible too. For example, designing a classroom with movable circle colourful rugs where teachers and students can change their arrangement, and store them rolled in a basket when they don't need them. Figure 263 shows flexible circle colourful rugs. Teachers can use these rugs to support different teaching and learning approaches, such as supporting cooperative by groups of students who can sit on them and work together. In addition these colourful rugs can stimulate students through their diverse colours.



Figure 263: Flexible flooring Colourful Rugs

However, there are more design solutions could be presented by reconnecting concepts in chapters two and four but these ideas will benefit architects and not teachers,

and this research is aiming to empower teachers as well therefore the second section will design a solution to empower teachers.

5.2 Tool Design and Development

5.2.1 The Chosen Problem

As outlined in previous chapters, the current literature does not explain how learning space design can encourage users to explore and learn, or how teachers might redesign and change learning space to facilitate teaching and learning methods via benefits of learning spaces mentioned in the literature. It does not show teachers how to continue designing classroom space after architects finish their work.

In the second phase of research, users claimed that they are aware of the importance of using learning space to facilitate different teaching methods and benefits. However, this awareness did not translate into effective use as teachers did not know how to use the space, with many of them lacking awareness of their learning space design opportunities. It was apparent that teachers found it difficult to change and redesign classroom space in order to better support and facilitate learning. Therefore, teachers need to be supported themselves and be empowered with knowledge on how they might go about this. While the first two phases of the research generated better understanding and a rethinking of learning space design, further problems were revealed but no solutions. This chapter then seeks to develop a design a solution to address the question and in turn the second aim of this research “How could teachers be empowered to redesign and use learning space to facilitate different teaching and learning strategies?”

Teachers could be empowered by using a tool with practical examples of the design of classroom space with the aim of supporting learning. The tool should empower teachers to continue to design space left behind by the departed architect in manageable but imaginative and empowering ways that do not require any sort of architect supervision.

5.2.2 Tool Design Inspiration

The concept of designing a tool to empower teachers was inspired by educators, researchers, participatory design and the notion of users’ “thoughtless acts” as explained below.

5.2.2.1 Educators and Researchers

Some researchers have claimed that teachers and students use the learning space as a tool to enhance learning outcomes (Care and Chiles, 2006, Fisher, 2008), and that for many teachers, space is a tool that they use to facilitate teaching and learning. One educational inspiration for the tool design came from Montessori learning concepts; Montessori made space a main part of her learning concepts, integrating space with the educational tools that she developed. Montessori developed educational methods and tools to stimulate children's sensory skills (Lippman, 2010), preparing an environment to facilitate this. Her notion of a 'prepared environment' involved the teacher preparing the learning space design as part of the overall learning process, by designing materials and tools as a learning resource, (Chapter 2). Concepts based on Montessori's tools and methods, which allow teachers with different budgets and resources to facilitate different learning spaces to support their teaching approaches, are still widely used in different parts of the world without the need for specialist Montessori supervision. However, the Montessori way of redesigning space is limited to those teachers who are knowingly applying Montessori learning concepts.

5.2.2.2 Participatory Design

Another inspiration for designing a tool that empowers learning space users came from the Make Tool concept in participatory design which gives 'ordinary people' the language with which to create and express their own ideas (Sanders et al., 2001) which comprises "a design language for users, not just for designers; a design language built upon an aesthetics of experience rather than an aesthetics of form (Sanders and Rim, 2002)." These methods and tools for making offer users the ability to make 'things' which can help define future objects or opportunities, and elicit insights on future experiences and ways of living (Sanders and Stappers, 2014). Participatory design aims to empower the end user by making him/her an active participant in the design process (Sanders and Rim, 2002). The Make Tools are particularly designed for the generative, phase of the design development process (Sanders and Rim, 2002). Participatory design uses a broad range of methods from anthropological research underpin Make Tools in combination with methods and techniques from design (Stappers and Sanders, 2003). The aim is to support participants' understanding of the topic being researched, using visual and making processes such as collages and models, encouraging their initiative and supporting their *active* participation, as *experts* about their personal experiences. Participatory design was successfully used in many design projects to give a direction for

further design process (Laurel, 2003). The Make Tools concept was a key inspiration of this research, in providing examples for empowering users through the generation of designed tools and clear explanation on how making helps to transform passive users into active participants. However, such tools are usually used at the beginning of the design process, as a way of informing designers about users. The use and influence of these tools then, usually ends when the necessary user-data and other information are collected.

5.2.2.3 Users' 'Thoughtless Acts'

The third tool inspiration came from revisiting the data collected in the first and second research stages to reflect back on: users' perceptions of learning space; observation of their everyday responses to the designed objects in the learning space, and; interactions with learning space users through their social networks, This reflective process was inspired by Jane Fulton Suri's concept of 'Thoughtless Acts' (Suri and IDEO, 2005). Suri recalls snapping a photograph of a young boy playing with friends:

“Taking turns riding on top of the building's boiler room door while the others were pushing it open and closed with varying degrees of vigor....Looking at the picture, I wondered about how designers might be influenced by images like it: visual evidence of the realities of everyday behaviour, of design in use. Might reference to such images help designers to be more sensitive to people's experience and needs?...Things used in unintended ways, in this case the boiler room door, usually indicate something about people's needs, and needs often translate into design opportunities” (Suri and IDEO, 2005).

Accordingly, thoughtless acts could be a significant source of insight for designers. The notion of 'Thoughtless Acts' was employed to reflect back on the visual materials collected in previous chapters. Observing users' ways of changing the designed space have informed the tool design. For example: users' way of moving and responding to space design, also the way they interact with space objects such as furniture, walls and floor, the relationship between space designed by architects and the space created by users. Users' unintended ways of using learning space and their everyday response to the designed space revealed different ways of understanding the design of the space and inspired the tool concept and content.

5.2.3 The Tool's Main Influences

While the purpose of the proposed tool to empower teachers was clear, how to design the tool and its content was still to be decided. I used knowledge elicitation techniques with people who are related to this research problem, through professional or academic experience, to inform particular categories, keywords and constructs that can form the

basis of the tool design, This was inspired by Suri who wrote: “Radical innovation requires both evidence and intuition: evidence to become informed, and intuition to inspire us in imagining and creating new and better possibilities (Suri, 2008).” The tool design concept is then, built on both evidence and intuition. The evidence came from the earlier stages of research. The intuition came from a range of different disciplines and practices. For example: the concept of convivial tools mentioned in (Sanders, 2006) and (Sanders and Stappers, 2012); Finland schools; documentary; understanding teachers’ teaching tools shared in social network; teachers’ successful experience shared in Ted talks; artworks; design thinking and; different learning space projects and books that empowered users in diverse ways. Some intuitions inspired tool design while others inspired the tool content. The following sections explore these in more detail.

5.2.3.1 The Concept of Convivial Tools

Illich (1975) explained the difference between two basic types of tools. “*Convivial tools allow users to invest the world with their meaning, to enrich the environment with the fruits of their visions, and to use them for the accomplishment of a purpose they have chosen. Industrial tools deny this possibility to those who use them and they allow their designers to determine the meaning and expectations of others (Illich, 1975).*”

As the tool aims to empower teachers to redesign and create their own learning experience using space, the concept of **Convivial Tools** was adopted, supported by Sanders (2006) who notes that the concept of Convivial tools requires consideration of users’ creative mindset which have different characteristics such as: doing, adapting, making and creating (Sanders, 2006). Designers must thus ask a range of different questions before designing, to ensure that a **Convivial Tool** fulfils multiple needs. Informed by this, these questions were asked while designing the tool:

- “How can we use design to make people’s productive activities more fulfilling? ” (Sanders, 2006), reflecting this question on the tool design: how can the researcher use design skills to make teachers’ teaching and students’ learning more fulfilling using the design of learning space.
- “Can we learn to ‘underdesign’ so that everyday people can continue the design process and make the product, artefact, or space suit their needs?” (Sanders, 2006). Can the design of this tool ‘underdesign’ so that teachers can continue designing

classroom space after architects finish their work, and make the learning space suit their different teaching and learning strategies?

- “How can we encourage everyday people to move to higher levels of creativity? Will they need to be encouraged to do so?” (Sanders, 2006). How could the design of the tool encourage teachers and students to move to higher levels of creativity while changing their space?
- “How do we build scaffolds or frameworks on which people can make their own experiences? What is a scaffold? What does it look like?” (Sanders, 2006). How do we build scaffolds or frameworks on which both the teacher and students can design their own learning experience? With the scaffold here intended to be the designed tool, what does it look like?
- “Will new technology be used in the creation of convivial tools? How? ” (Sanders, 2006). This research tool is not about using new technologies but rather, showing options on how to use available technologies ‘smarter’; as one learning space user on Facebook stated “*we don’t need smart technology, we need smart ways of using the available technologies.*”
- “What will everyday people come up with when convivial tools are put in their hands? ” (Sanders, 2006). What will teachers and students come up with when they are using this tool?

5.2.3.2 The Finland Phenomenon

The second intuition built on the Finland schools’ teaching concept, explained in ‘The Finland Phenomenon’ film, which looks inside the world’s most surprising school system. The Finland schools’ system ranks highest of any country in the world and by any education standard. In the film Tony Wagner* (see <https://www.youtube.com/watch?v=c2JGeGNxlh4>) analyses what makes Finland Schools the highest ranked and notes any lessons that could be learned, explaining how teachers teach. In Finland, lessons start with explanations of thoughtful concepts, which teachers ask students to apply to their experiences in real life, which then inform the generation of artwork. For example, in a primary school lesson about different resources of energy introduces students to both renewable and non-renewable energy (thoughtful concepts), which become a source material for the production of a puppet show (artwork),

based on the scenario of a domestic power-cut and representing what would happen (Real life experience). This translated learning into representational artwork (e.g. Puppets, drawings, collage) and facilitated different ways of interacting with space, integrating this space within the learning process. Presenting teachers' lessons as artwork (for example collage artwork on the walls) can empower teachers' use of space as well as students' ideas that the tool should be able to enable. Figure 264 relates Finland school teaching in relation to the tool design concept. This figure shows how presenting lessons as artwork can create an opportunity for users to use space and interact with it.

*Tony Wagner is an Innovation Education Fellow at the Technology & Entrepreneurship Centre at Harvard, and the founder and co-director of the Change Leadership Group at the Harvard Graduate School of Education.

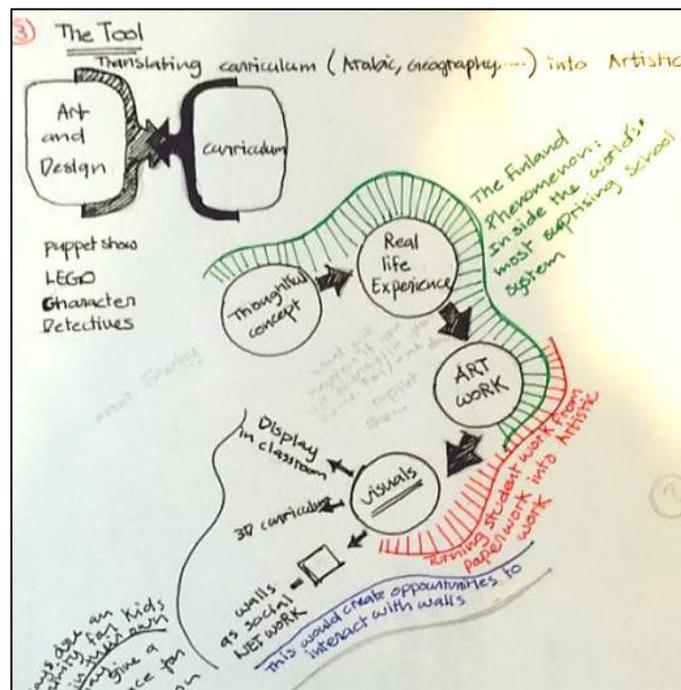


Figure 264: Tool Design Concept- from researcher sketch book

5.2.3.3 Understanding Teachers' Teaching Tools

It is necessary to understand teachers' teaching tools before designing a tool for them. This section reviews some teachers' teaching tools to help to comprehend their ways of designing tools, and how space design changed through teachers' use of these tools. Understanding teaching tools helped to inform the design of a tool that is compatible with teachers' existing ways of using teaching tools, which could be utilised in available space

resources, and which is designed using design language which is already familiar to teachers. As explained in Chapter 4, many teaching tools are paper-based (like exam papers), although some teachers create tools using visuals, modules and food. In Figure 265, teachers used OREO cookies and the “Magic School Bus Takes a Moonwalk” book to explain different phases of the moon, combining familiar objects (e.g. a student’s favourite cookie) in an imaginative way to create a new teaching tool.



Figure 265: Using OREO cookies to explain space lesson

Source: <http://lunsslha.blogspot.co.uk/>

In another creative example, the teacher created a ‘word wall’ inspired by the McDonald fast food restaurant logo concept and used its French fries to teach students different vocabularies (Figure 266). In this teaching tool, the teacher was able to encourage students to interact with walls while learning, where usually there is limited interaction between learning space and students.



Figure 266: McDonald's Word Wall

Source: <http://www.mpmschoolsupplies.com/ideas/1226/mcdonalds-inspired-interactive-word-wall/>

The final example shows another interesting teaching tool, which was called ‘angry verbs’ (Figure 267). In this example, the teacher used the famous angry bird game characters to teach students different angry verbs. However, most teachers’ tools outlined here have limited and very specific lesson relevance that cannot be applied more widely to learning more generally.

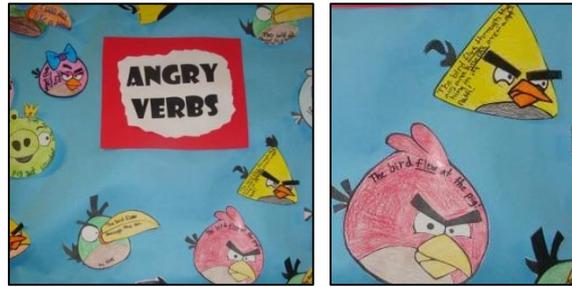


Figure 267: Angry Verbs

Source: <http://blog.maketaketeach.com/2012/09/page/2/>

5.2.3.4 Empowering Users Books and Projects

Furthermore, intuitions for the tool came from reviewing projects and books that aimed to empower and involve users in designing learning space. Only examples that have particular relevance to the tool vision are now presented:

- ***Spaces and places*** is a book written by teacher Debbie Diller (Diller, 2008) to empower teachers and explain to them how to prepare and arrange the classroom space for literacy sessions. While Diller gives different examples for different classroom spaces that have been rearranged by teachers under her supervision, she does not explain how to continue rearranging the classroom space after her departure. Additionally, this arrangement is done by the teacher *for* her/his students rather than *with* students. One problem mentioned by teachers in the second stage of research was that, while they claimed that it is important to involve students in the space design, they did not know how to do this. This book is more about organizing classroom space to facilitate literacy curriculum than empowering teacher in redesigning space to facilitate different learning methods. However, when discussing classroom space design, teachers usually think how to organize space, but this research aims to empower teachers to integrate space design with teaching methods. Teachers are expert on their teaching methods, but they need help to know how to translate these methods into design in space, and how to add learning value to objects in space. Diller's (2008) book provided detailed explanation with much instruction for how classroom space could be prepared for teaching, and provided practical solutions using available low cost materials such as "using laundry basket for big book storage" (Diller, 2008).

- ***Joined up design for schools*** by John and Frances Sorrell (Sorrell and Sorrell, 2005) documented the result of collaboration projects between the Sorrell Foundation and more than sixty schools involving seven hundred students to identify the things that matter to them about their learning space, such as colour, dinner halls and canteens. The *Joined up design for schools* projects' had four stages: (1) **The Challenge** stage where students decided which problem they want the designers to solve (2) **The Brief** stage where students work as clients to prepare the details of the learning space problem, then present it to the designers. (3) **The Conversation** stage where students' and designers discuss the problem and the solution (4) **The Concept** when designers present their solution to the students and discuss it with them. Such projects produce specific solutions for specific learning space problem chosen by students under designers' supervision, but is usually *not* in the classroom space.
- ***Primary ideas*** (Care et al., 2006), documents projects aimed to enhance primary learning space design as part of 'Classrooms for the Future' programme; a result of the collaborative partnerships between the Bureau of Design Research (B+DR), the University of Sheffield, the local education authority, teachers and pupils. As part of the project, architecture students worked with children to address parts of existing learning spaces with the aim of building classrooms at an affordable cost, and to investigate opportunities to enhance other spaces in the learning spaces (Chiles, 2003b). Before designing solutions in these projects, users were involved in a variety of workshops, site visits, surveys and drawings where they expressed their opinions about the ideal learning space and revealed different problems about their learning (Care et al., 2006). *Joined up design for schools* projects and this program also present specific design solutions for specific space problems chosen by users under architects' supervision. Although these projects empower and involve users in the design process, it does not empower users to continue designing space after architects finish their work.
- ***Tell Them I Built This*** (Pilloton, 2012): Emily Pilloton succeeded in transforming rural Bertie County in North Carolina using an experiment of design-led community transformation. Though Studio H, which is a program aimed to bring design-based instruction into the high school classroom, students were trained to change their learning spaces. Pilloton explained her experiment in a Ted talk, (Ted link:

(http://www.ted.com/talks/emily_pilloton_teaching_design_for_change#t-35296), and documented her projects in a book (Pilloton, 2012). Pilloton explains that they have used design as a vehicle to build creativity, citizenship and critical thinking through architecture projects designed and built by students (Pilloton, 2012). Pilloton have showed examples of changing different learning spaces such as computer lab and playground and how the redesign projects had integrated these spaces with teaching methods. However, these projects are specifically designed to solve specific problems in specific locations, which make their wider application limited. Further, these projects were under architect supervision.

- ***The third teacher*** (OWP/PArchitects et al., 2011): this book is a collaborative work between OWP/P Architects, VS Furniture and Bruce Mau Design with students and teachers from schools around the world asking the question: if you could design your ideal learning environment, what it would look like? (OWP/PArchitects et al., 2011). Through several student workshops led by VS furniture, OWP/P Architects and Bruce Mau, students raised different space problems and generated space design inspirations in the form of drawings, photos and words (OWP/PArchitects et al., 2011). However, this book conceptualises learning space design needs as a third teacher and identifies problems that use of space faces. While providing examples for different successful learning space design projects, in most, users are involved only at the beginning of design process, working with designers with the principal aim of informing architects on space design problems. While, these participatory works create the beginning of the learning space story, it is the users who will finish the space story. The book provides strong arguments about how learning space design should be experienced, for example it claims that learning space should be “fun, respectful, inspire wonder, diversity enable creative play individually and in groups (OWP/PArchitects et al., 2011).” Yet, it does not explain how teachers could achieve these principles through space design in order to benefit from.
- ***Make Space*** (Doorley et al., 2012): is a book designed to be “a tool for using space to shape the culture and habits of a creative community”. Based on work at the Stanford University d.school and its Environments Collaborative Initiative, this book shows “how space can be intentionally manipulated to ignite creativity” (Doorley et al., 2012). It covers different types of content: Tools, Situations, Design, Template,

Space Studies, and Insights (Doorley et al., 2012). While the book aims to empower designer or anyone interested in “revamping an existing space to design and build a space that can encourage them to be creative” (Doorley et al., 2012), its insights are quite generally concerned with facilitating creativity. It leaves a wide room for users’ creativity.

- ***Our School Building Matters*** (Broderick, 2010) is a report written to be a toolkit resource for teachers. It aims to help them make the most of the learning opportunities created by building (Broderick, 2010). *Our School Building Matters* is organized in five stages: (1) getting started, (2) looking closely, (3) development and design, (4) construction and (5) moving in. In stage one (getting started), the writer gives ideas for involving the whole school staff in the design process for building a new school (for example inspire users by running visionary days, and make large mood boards). Stage two (Looking closely) stage aims to help users understand their current school building using architectural concepts and methods. After that, comes Stage 3 (development and design) which focus on users making design decisions. Stage 4 (construction) helps users to understand the construction process. Stage 5 (Moving in) suggests that users celebrate the process and compare their building it with other architects’ work. However, this document focuses on informing and inspiring school users about design and architects in order to involve them in the design process of building schools. *Our School Building Matters* is a resource that helps teachers to be a better client and gain awareness of their space in the building process, but it does not help them to continue designing space and use space to facilitate teaching and learning.

There are thus different ways of empowering users by making them decide which problem to solve and then helping them to solve it (Sorrell and Sorrell, 2005, Care et al., 2006, Broderick, 2010). Some projects have presented different learning space design solutions (Nair et al., 2009). However, in these examples, while users are usually empowered to identify problems and inspire designers with solution insights, learning space users do not actually design the solutions by themselves. This make users a better client for architects but not better designers for themselves. These resources help the teachers to design like architects, but the research here aims to empower teachers to design as a teacher, using teaching vision and facilitating student design in space.

In other examples meanwhile (Pilloton, 2012), users are empowered by acquiring design knowledge and skills to design tools to change their own space. However, these examples inevitably require designer supervision. Additionally, there is an emphasis on user involvement at the beginning of the design process, usually led and supervised by architects and designers. So while participatory, this work is only involved with the beginning of the learning space story, *before* the space is given over to users, who will finish their own space story through use. This research aims to empower these users in this process of finishing their own story of their own designed space.

In the other examples outlined above, teachers are given detailed guidelines to prepare and organize space (Diller, 2008). This approach usually involves teachers' empowering other teachers in specific contexts, which allows little room for wider applicability or creative adaptation. Contrariwise, designers approaches reveal very general insights, leaving wide room for users' creativity to reshape their space (Doorley et al., 2012); (OWP/PArchitects et al., 2011). While teachers think of a white empty space as a box with rigid fixed walls, designers think of it as flexible and full of design opportunities. Teachers then, need to be made aware of these design opportunities, which usually designers don't even mention. While teachers usually think of immediate, practical solutions constrained by what they call space limitations and obstacles, designers think of solutions from what they call space design opportunities, which usually involves more time, money and building skills. However, these different examples for empowering users don't mention continued use over time and the frequent modifications required by users to remain responsive to their needs to facilitate changeable teaching and learning methods. Furthermore, current projects show very limited integration between space design and learning and teaching methods, or how to translate learning and teaching values to the design in and of the learning space.

How could we pack the power of design to change space in a tool that is available to users to use without designers' supervision? How could we help teachers to implement immediate change, using their current space situation, with the available resources? Most learning space projects are specifically designed for solving specific problems for specific users' cases; how about the rest of the users, how about their common everyday problems? Furthermore, in the projects that required designers' supervision, this only caused a temporary change. The existing literature and reports on practice do not

empower teachers to continue designing space, and do not explain how to integrate learning with space and in the process add learning and teaching value to the space. Additionally, many of these projects overlook classroom space.

However, teachers who spent many years in teaching knows very well how to organize and tidy space. They are expert in adapting to space obstacles. Integrating learning and teaching with space, continuing to design space to facilitate teaching and learning, encouraging students to interact with space and involve them in designing space. Design ends in these projects when designers leave, while in reality another level of design starts when users start to adapt and respond to what has been designed. This research aims to empower to continue designing after architects leave, integrating teaching and learning methods with space design.

5.2.4 Tool Vision

There is need for a tool that can empower teachers to use the space continually without the need for designer or architect supervision, a tool that learning space users can use immediately with the available resources, a tool that can be extended by teachers and students themselves, a tool that is available for use by the largest number of teachers possible, a tool that can solve common teaching problem while solving the major problem, and a tool that shows the space design possibilities through users' way of teaching and learning.

5.2.5 Tool Purpose

The main purpose of the tool is to empower teachers to change, use and redesign classroom space to support and facilitate learning and teaching. Additionally, this tool aims to create awareness about space design opportunities and inform teachers with different ways to integrate learning and teaching methods with the objects designed in the space. The tool aims to help teachers to solve other common problems while solving the main problems. Common problems mentioned by learning space users in the second stage of research:

- Most teachers find it difficult to change space because they don't know how to. They lack space awareness, although observing current learning space showed that there are many opportunities to change space with its available resources, yet teachers do not change their space. Therefore, users need to know how to redesign space using available design elements such as texture, colour and technology.

- Changing and using space to facilitate learning and teaching is a key problem, how to change space is the question that needs an answer.
- Teachers stated that they need help in designing classroom space displays in order to stimulate and motivate students in the classroom space; they want to design interactive and playful displays. However, the findings showed that many teachers did not know how to display students' work.
- The classroom is where students learn how to socialise, build relationships, accept their differences, identify their self and discover their talents. Teachers wanted to know how to support these values through space design
- Limited interaction with space and space objects such as furniture, wall and flooring
- Limited interaction and communication between students, teachers and space (weak communication)
- Current classroom space lack interactivity
- Lack of students socialising (variety of learning groups is not a solution)
- Students do not feel they belong to the classroom space (it is not our space, no space to personalise)
- Students are not involved in the space design
- Classroom space respond only to students with a visual learning style
- Limited teaching aids
- Teachers are not aware of diverse ways of using available technology
- Difficulties in going outside classroom space
- Classroom space lacks students voice
- Students are not active learner in space they are passive
- Limited learning experiences
- Limited changes in classroom arrangements
- Many teachers find it difficult to stimulate students to learn in classroom space

After understanding the tool vision and purpose, effective tool design involves knowing about and learning from existing designs to identify possible features for proposed designed tool.

5.2.6 Reviewing Tools Design and Concept

Reviewing teachers' teaching tools helped to understand what was important for empowering teachers. An additional review of other tool design and concepts further

inspired the design of this tool. The next paragraphs set out examples for tool concept and design to illustrate the wide range of influences from the extended review,

- “501 TV-Free Activities” is a popular book designed to be a ‘parents’ tool’, which presents adult-child learning activities (Figure 268: 501 TV-Free Activities Book). The book is divided into sections, with each one explaining an activity and required but low-cost materials, which can be easily followed.



Figure 268: 501 TV-Free Activities Book

- “IDEO method cards” are a set of cards (Figure 269) designed to help practicing and aspiring designers with in project planning. The cards are divided into four categories (Learn, Look, Ask and Try) supported by visuals to clarify written concepts.



Figure 269: IDEO Method Cards

- “Tenants’ Rights Flash Cards” were designed with a specific self-explanatory purpose as a simple and accessible way of disseminating vital information using a card method. Each card presents one legal right and is supported with simple visual iconography (Figure 270).

- “Everything is connected” comprises fifty postcards; each postcard sends the user on a quest that aims to encourage him/her to ‘reimagine the world around’ to change the way they enact or react to everyday simple tasks. The cards have been used in many school curricula to foster creative exploration, (Figure 273).



Figure 273: Everything Is Connected Postcards

Source: <http://katyat34.typepad.com/blog/2014/04/the-postcard-project.html>

5.2.7 Design Prototypes and Development

Prototypes are versions of designs that are created before the final artefact exists, and used to inform both the design process and design decisions. Prototypes, which can comprise on-paper sketches or more developed models, help designers to explore and communicate suggestions about a proposed design and its context of production and use (Buchenau and Suri, 2000). Similarly, within this research, starting to think about how to design the tool and what it might look like, the design thinking process included prototyping. Through sketching and modelling, designers suggest and explore rather than confirm (Marquardt, 2013), and think through ... visualize how things, come together, communicate ideas to others to inspire new designs, and active brainstorming” (Marquardt, 2013).

The initial design idea was to design a booklet that connected teachers with the space around them; a booklet that inspired teachers in different ways, to use the space, and support users to interact with it. (Figure 274) However, reflecting on this concept and anticipating potential reactions to the booklet, the concern was that it might be perceived as ‘another boring curriculum book’ that would overload teachers with more instructions. The booklet idea then was deemed to not sufficiently encourage teachers’ use of a tool.

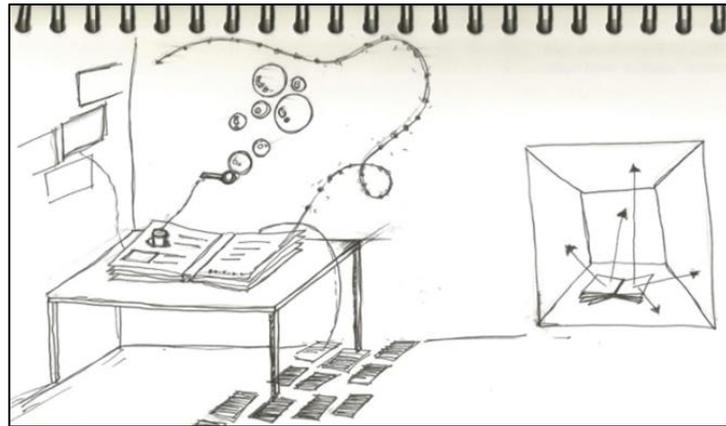


Figure 274: Sketches of the Booklet Idea

However, what emerged through sketching was the idea to develop a three dimensional box, inspired by observation sketches, Liz Sanders' make tools, and a children's school house game. Observation sketching showed that classroom design usually shares the same box shape, similar layout plan and same basic resources (whiteboard, tables, chairs, computer and projector); yet, while this white empty box provides many design opportunities, teachers are not aware of them. Therefore the question was how could teachers be made more aware of the design potential of this box? Figure 275 shows sketches and images of different classrooms from the observation.



Figure 275: Sketches and Images of Different Classrooms from the Observation

The second inspiration came from participatory design, specifically Make Tools by Liz Sanders. These tools enhance creativity for non-designers (Kolko, 2012), and usually contain pieces and parts where contributors with no craft-based experience can arrange to make their own rudimentary design solutions. These tools are known as Generative Tools (Sanders, 2000), and can contain two-dimensional parts such as paper shapes and photos or three-dimensional parts such as buttons and dolls (Sanders, 2000), Figure 276 shows an example of Make Tools use in the context of a hospital setting.



Figure 276: Sanders Tool Used in Hospital Sitting

The third inspiration was a school house game; designed as three-dimensional foldable boxes, each with a different school space (e.g. classroom, canteen), and with props for children to play with the school space box as a toy (Figure 277).



Figure 277: School House Game

Inspired by these, a classroom model was designed. Figure 278 shows initial sketches of this idea. The classroom model contains a box with drawers; the box represents a classroom model containing miniatures of basic classroom furniture. In the drawers are two envelopes, one contained guiding cards which explain to different ways to change

and redesign classroom space; the other envelope contains of props, to help teachers apply ideas from in the guiding cards within the classroom model box, before applying in the real classroom space.

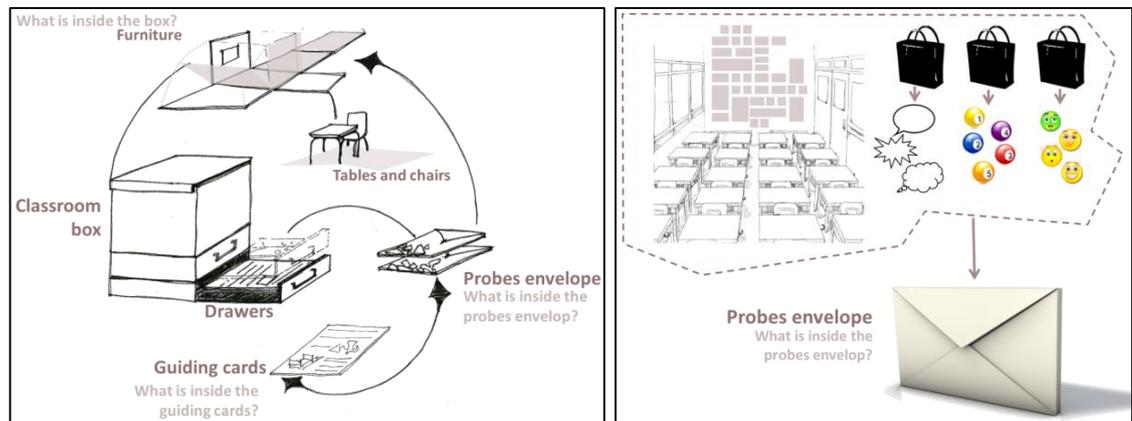


Figure 278: Sketches of the Classroom Model Idea

This concept aimed to empower teachers to redesign and rethink classroom space by making a classroom model using the miniature props. Each guiding cards card presented a different idea that teachers could apply in the classroom model to explore ‘what works’ using envelop of props, envisioning how the space would look in real life. After sketching the idea, a model was created, (Figure 279), which shows the model of the classroom box tool. Figure 280 shows classroom model box with props.



Figure 279: The Model of the Classroom Box Tool

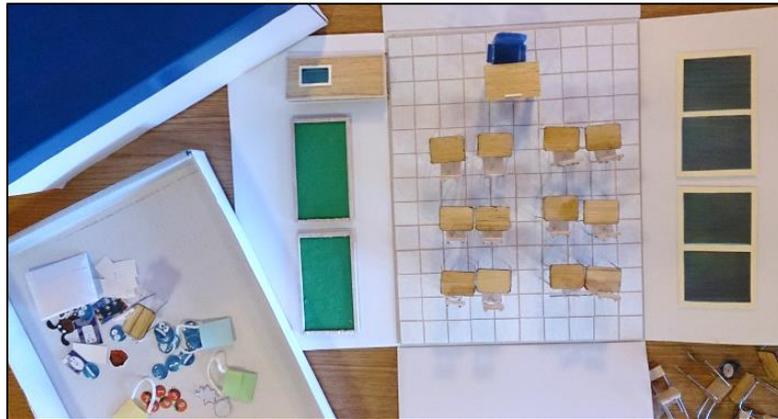


Figure 280: Classroom Model Box with Props

However, experimentation revealed some problems. The main one related to the size of the model in comparison to the size of the props which were very small and difficult to place in order to see how an idea worked. Figure 281 shows examples of the props. There was a need for larger props (props here are what were inside envelopes) and increasing the size of the classroom model, which in turn would make it difficult to carry and move. In addition, as it was expensive and difficult to make for batch production, to enable dissemination among teachers.



Figure 281: The Tool's Props

To overcome these design problems, the researcher replaced the idea of the classroom box with a set of cards. Easily and inexpensive to reproduce, the cards could empower a large number of teachers by offering ideas that show opportunities to redesign classroom space to use it support different teaching methods. These cards still supported a three dimensional perspective using visuals (instead of three dimensional models), and explaining to teachers how to apply the ideas and helping them envision how the space would look when applying the ideas. The final tool format was several sets of cards in a box; each set of cards presents a ‘recipe’ for using classroom space differently. The set of cards was named “Classroom Design Recipes”, and are detailed below.

5.2.8 Classroom Design Recipes

The tool name was inspired by the idea of cooking recipes, because recipes are not fixed guidelines and could be changed by users. Teachers' uses would be informed by the cards' content but also readily modified according to each teacher's teaching method, curriculum, particular needs and available resources. The Classroom Design Recipes do not comprise a bundle of fixed rules; rather teachers can create their own recipe using his/her own resources in response to tool inspirations. The set of cards is reminiscent of traditional playing cards and considered more attractive than a book or booklet; each set provides different recipes that can be applied directly to classroom space using available materials and tools. Each set of cards communicates a solution for its main problem, empowering teachers to change and use space and solve some of the other common problems that was mentioned by teachers during the second phase of the research. The tool is packaged as a box that contains all the card sets; (Figure 282) is showing the tool logo, boxes, and the tool box with set of cards.

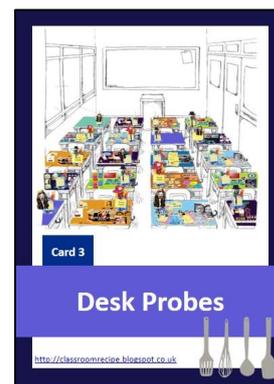
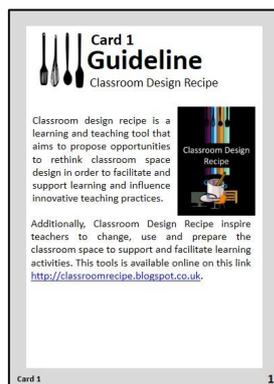


Figure 282: From the Left Tool Logo, Tool Boxes and Tool Box with Set of Cards

The recipes are flexible in terms of their application because teachers can customize each recipe depending on what is suitable for them. Furthermore, the tool provides template cards for teachers to add, save and share their own recipes for classroom space. This will teachers to share their ideas and experiences with other teachers (e.g., using social network hashtags). However, it is important to mention that the tool design kept developing and improving beyond the teachers' application phase, (explained below in evaluation section). The tool *Classroom Design Recipe* consists of 11 sets of cards (Figure 283), (APPENDIX 6):

- Set of Cards 1: Guideline Cards
- Set of Cards 2: Our Classroom Story

- Set of Cards 3: Desk Probes Cards
- Set of Cards 4: Outside the Classroom Virtually
- Set of Cards 5: Student's P.O. Box
- Set of Cards 6: Physically outside the Classroom
- Set of Cards 7: Classroom Timeline
- Set of Cards 8: Flooring Story Telling
- Set of Cards 9: Classroom Café
- Set of Cards 10: Interior Design Tips
- Set of Cards 11: Templates Create Your Own



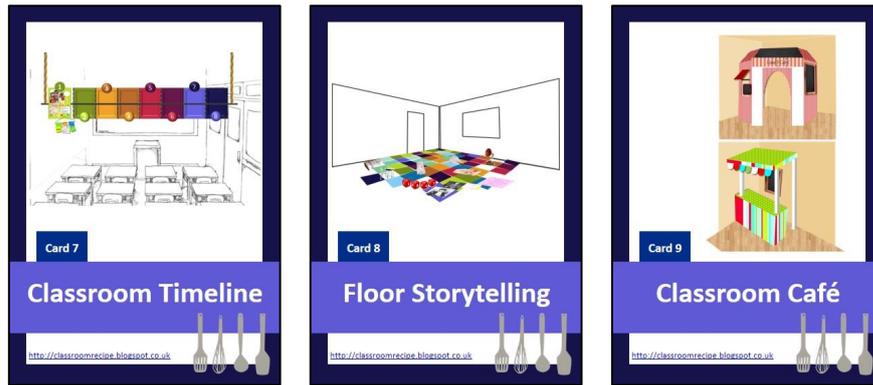


Figure 283: Sets of Cards Titles



5.2.9 Tool Content

This tool consists of different sets of cards that communicates a separate idea that could be applied in or beyond classroom space in order to facilitate and utilise the classroom to support different teaching and learning approaches. Each set of card addresses a main problem to empower teachers. While the design of some sets of cards focused on a problem, others were driven by users’ needs, others by theoretical concerns, and still others by users’ ‘thoughtless acts’. Three example set of cards are explained in details below, with the rest explained in APPENDIX 7. All sets share the same four sections:

1. Section 1 is **WHY**: It encourages teachers to apply the set of cards by explaining benefits that they can get, challenges they can overcome, problems they solve.
2. Section 2 is **HOW**: Earlier research showed that teachers prefer detail on how to apply ideas, which is usually not found in designers’ tools, this section has detailed guidelines supported by visual resources that explain how to apply this card, describes what teachers need to do in order to apply it, and provides inspiration for teachers to modify the cards according to their needs and available materials.

3. Section 3 is **WHAT**: teachers found it difficult to imagine three dimensional space and recognising design opportunities, so this section uses a visual image to suggest idea application in three dimensional space, and what to expect when they apply this card set.
4. Section 4 is **APPLY AND SHARE**: This section concerns users’ applications and sharing of their implementations with others. When users employ this card they can take a photo of their application and share it on social networks such as: Facebook, Twitter, Instagram and Pinterest. Also, by using the hashtags #Classroom_Design_Recipes and #the_name_of_the_card, users can look at other users’ cards and applications. Additional card templates are provided that let users add their own ideas and participate with the tool design.



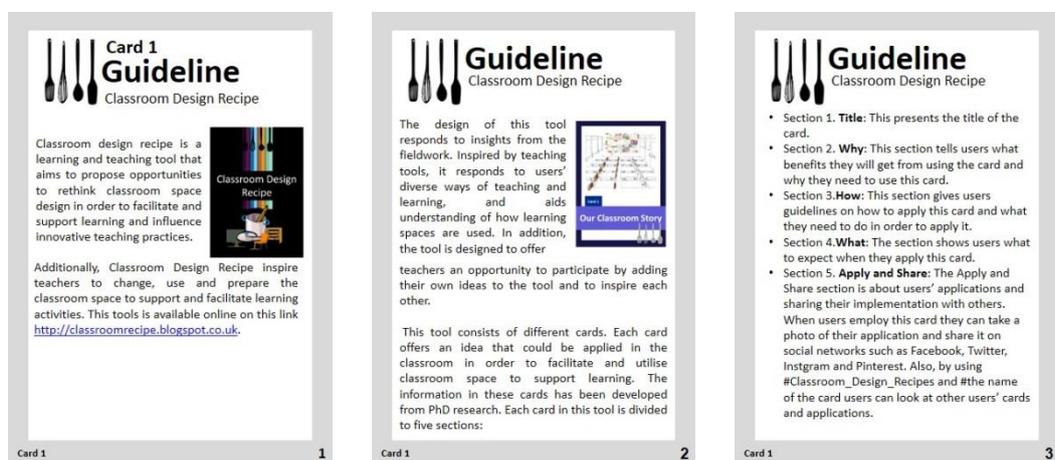
Figure 284: Tool Card Layout

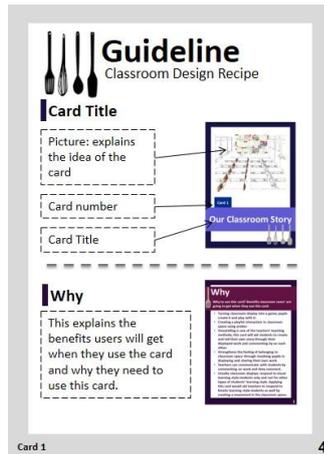
Figure 284 shows the layouts for each section of a card set. The first three sets of cards are presented. The other sets are explained in APPENDIX 7.

1) Set of Cards 1 “Guidelines”

The first set of cards provides the guidelines, explaining how to use this tool and how to apply this set of cards.

Final Set of Cards 1 “Guidelines”





The design thinking behind each set of cards was not a linear process, but an overlap of conceptual spaces and ideas that interacted with each other to connect problems, users' needs, theoretical information and users' 'thoughtless acts' from across the first and second phases of research. To explain this complex process of design thinking, a thinking map was created for each set of cards to show the various solution sources. Before designing each set of cards, the researcher revisited and reflected upon earlier research stages to help identify and inspire possible solutions. The resulting design solution for each set of cards was built upon five main elements.

1. **Literature Review:** to identify potential solutions the contextual review chapter was revisited to identify particular benefits associated with different actions in space. For example, learning should be interactive to facilitate development of higher-level learning and social skills, and personalised meanings (Ally, 2003), and to create a sense of presence and community for learners (Murphy and Cifuentes, 2001). When learners interact with the curriculum, other learners and instructors, this relationship

between instructor, learners and curriculum enhances learning experiences (Garrison, 1999). However, thinking of how to design an interactive *space* to benefit users with these values inspired many cards ideas. In addition, the literature explained the value of using space design elements such as colour and texture diversity. Also, thinking about how teachers design space elements to promote particular values inspired many cards. Additionally, thinking of design translation from theoretical knowledge and asking how learning values can be designed in space (such as interaction and communication), influenced the design ideas of some of the sets of cards.

2. **Fieldwork findings** (teachers' interview, observation, and students' drawings): Revisiting the fieldwork findings once again involved looking for solutions rather than problems. Revisiting the data analysis suggested a different design solution each time the researcher revisited it for each card set. By reconnecting concepts and thoughts emerged in the findings in new ways different solution accrued.
3. **Social network:** social networks were an important solution source for designing each set of cards. They provided insights into teachers' teaching tools. Online discussions between teachers about classroom space were especially helpful.
4. **Inspiration:** Inspiration for a designer can come from anywhere, for example: artworks, children picture books, children games and users' thoughtless acts. However, each set of cards had its own inspiration sources.
5. **Creative Practice:** Creative practice found solution inspirations in the context of where problems was framed and understood, connecting with inspirations from other disciplines to design a solution. Every time knowledge gained from the first and second phase was revisited, it produced different connections to the other inspirations, resulting in a range of different sets of cards. It is in making those connections between theoretical values and the various benefits of practical design from different disciplines that resulted in ideas and inspiration. Moreover, the value of creative practice here was in offering seemingly simple design solutions that are rich in benefits. In fact, creative practice for many of the card sets involved identifying and asking the right question; it is in *framing the problem* that making links across knowledge gained from the different research stages proved vitally important. Creative practice in this tool then, is more about its content, than its physical and aesthetic box design.

However, these five elements above do not necessarily combine the above for order in the thinking map which was produced for each set of cards. Some thinking maps begin with the theoretical knowledge, while others build upon users’ thoughtless acts, or, are led by an artwork inspiration.

2) Set of Cards 2 “Our Classroom Story”

Table 6 below shows influences for of Set of Cards 2 “Our Classroom Story”. Figure 285 shows its thinking map.

Table 4: shows thinking elements of Set of Cards 2 “Our Classroom Story”

| 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice |
|---|---|------------------|---|---|
| <p>Importance and benefits of interactive learning (Ally, 2003) (Murphy and Cifuentes, 2001)</p> <p>Students learn most effectively by engaging in cooperative activities (Vygotsky, 1978a)</p> | <p>Users’ thoughtless acts (observation)</p> <p>Observed users interactions with space</p> <p>No evidence for interaction between students and displays on walls</p> <p>Current displays are not achieving teachers’ claims</p> <p>Students should comment on displays and criticise each other’s work</p> <p>Analysing users space adaptation express users’ stories about their relationship with space</p> | | <p>super Mario art installation work Figure 287</p> <p>Interesting interaction on Facebook virtual walls (time lines)</p> <p>Comic strips</p> | <p>How to turn virtual world of a game into a physical space</p> <p>People interaction with Art installations, which can be served while in classroom interaction not</p> <p>comparing interaction on classroom physical walls with Facebook virtual walls</p> <p>Facebook virtual interaction tools</p> <p>turning Facebook virtual interaction tools to physical tools</p> <p>embracing classroom values which teachers asked for in the findings through its physical design</p> |

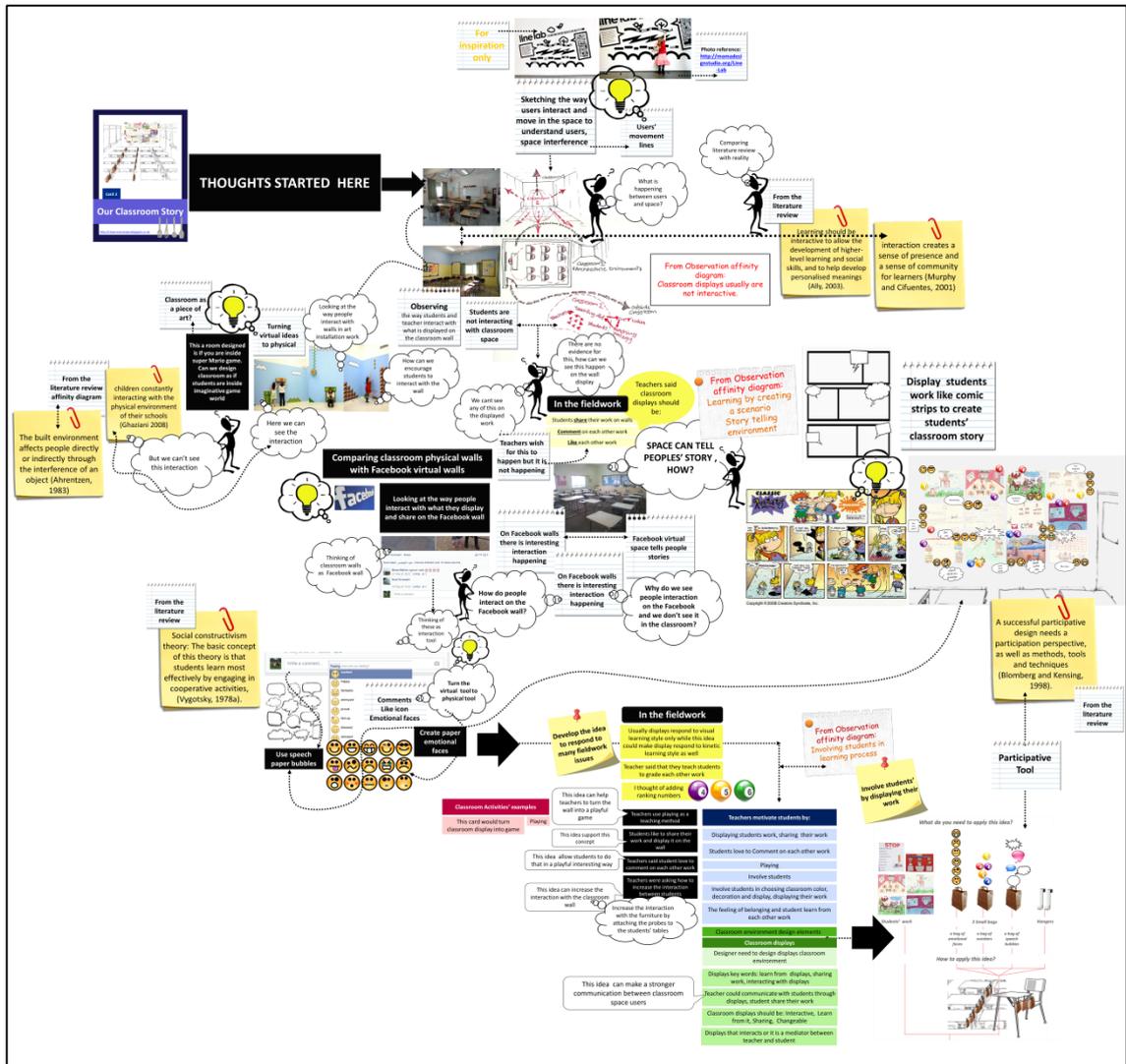


Figure 285: The Thinking Map of "Our Classroom Story"

The thinking behind this set of cards started with observations of users' thoughtless acts, and sketches created to track users' interaction with the space. It was apparent that although teachers mention the importance of interaction between displays in the classroom space and individual students, there is no evidence of any interaction. On other hand, other literature puts emphasis on the importance of interactive learning space. According to Ally (2003) it should be interactive to allow the development of higher-level learning and social skills, and to help develop personalised meanings; additionally, interaction creates a sense of presence and community for learners (Murphy and Cifuentes, 2001). However, in observation, such interaction between users and classroom space was not seen. Figure 286 shows the beginning thoughts of this set of cards, which started from users' thoughtless act and theoretical knowledge found in literature review.

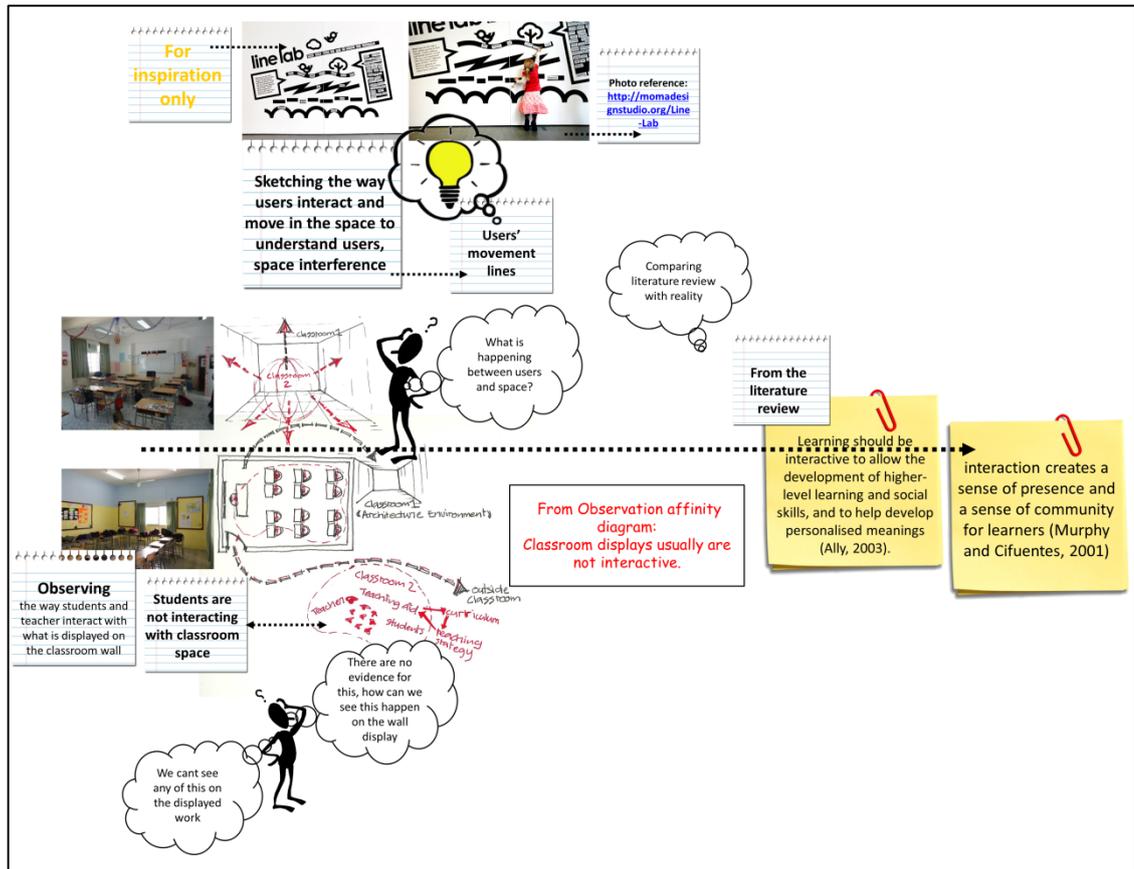


Figure 286: Beginning Thoughts of "Our Classroom Story" Set Of Cards

While thinking about how to encourage students to interact with displays, inspirations from different fields were seen. The first inspiration came from art installation work the artist designed a room as if its users are inside a super Mario game (Figure 287). Looking at the way users interact with walls in this art installation work, and how the interaction can be observed in the space, different questions were raised such as: how can we turn the virtual world of a game into a physical space; can we design a classroom as if students are inside an imaginative game world? Additionally, in this artwork, the interaction can be seen and traced. Figure 288 explains the first inspiration.



Figure 287: "Mario's World Brought To Life in Real Room" Art Installation Work by Artist Antoinette J. Citizen

Source: http://fooyoh.com/geekapolis_gadgets_camcorders/763377

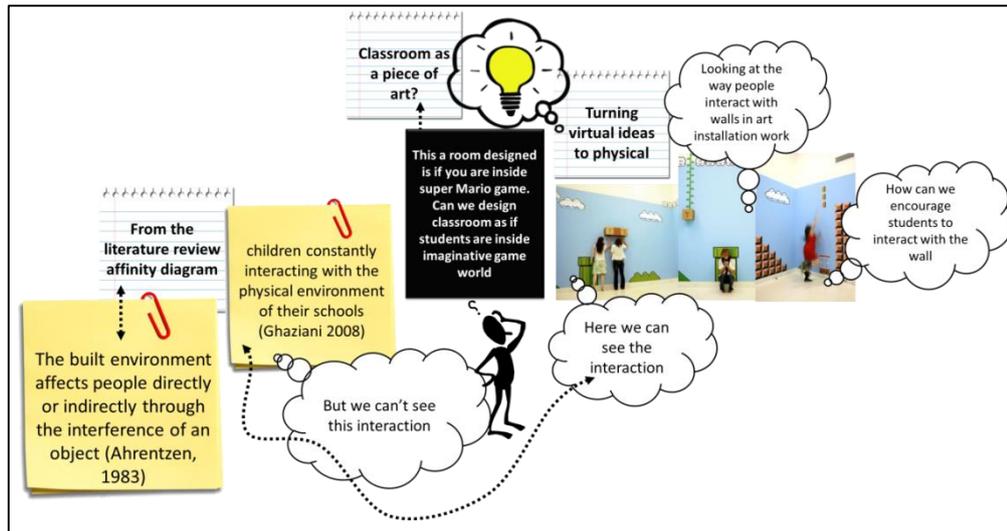


Figure 288: The First Inspiration

The second inspiration came from comparing classroom physical walls with Facebook virtual walls, as explained in Figure 289. In the fieldwork, teachers claimed that students should comment on what is displayed on the wall, share their work on the classroom walls and criticise each other’s work, yet these claims are not seen in classroom space (evidence of this in photos observed in the fieldwork). However, comparing teachers’ claims about classroom physical walls with Facebook virtual walls, the way users interact, comment on each other’s postings and share them on the Facebook wall, shows that interesting interactions happen on Facebook virtual walls that do not happen in a physical learning space. Although educators talked in the literature review of learning theories as though this physical interaction was happening, this research found otherwise.

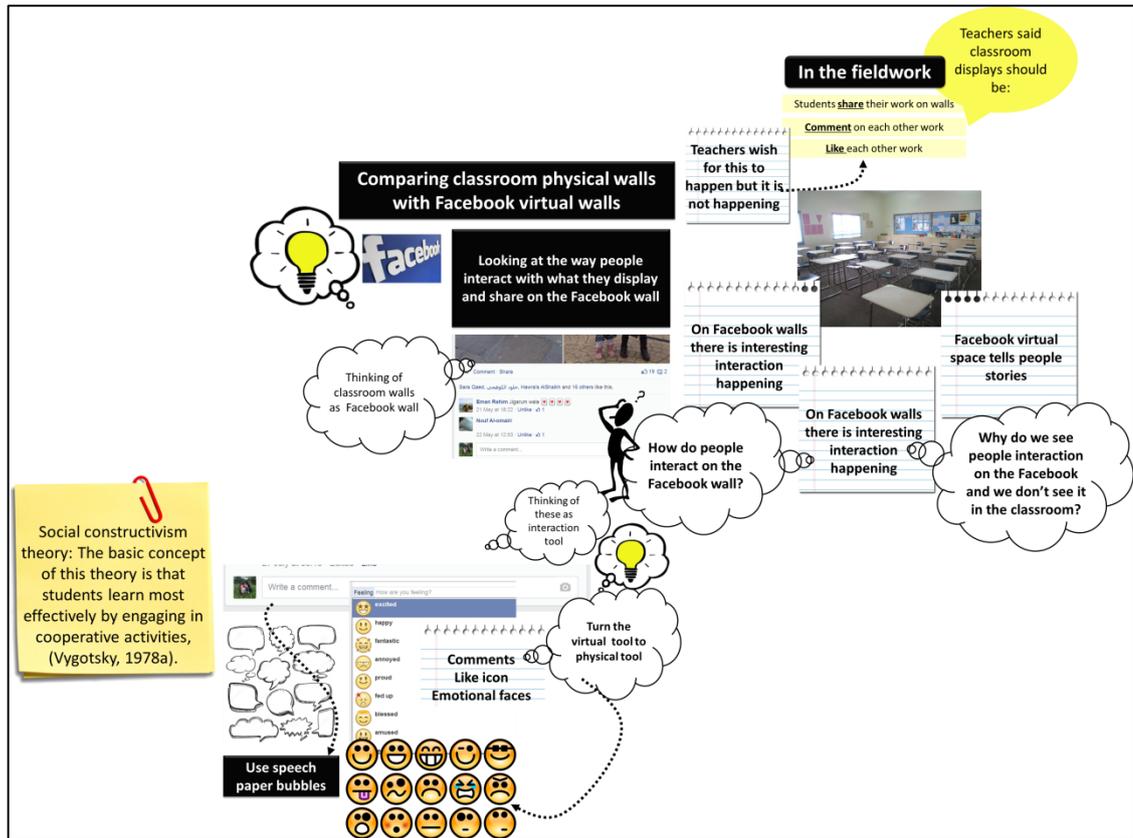


Figure 289: Comparing Classroom Physical Walls with Facebook Virtual Walls

The question arises as to why users on the virtual wall of Facebook interact with each other while they don't interact with each other on classroom physical walls. The answer is because Facebook offers its users tools that encourage them to interact with each other, share different things, and comment on each other's postings using the comment space, and like or dislike buttons. Additionally, users can express their feelings using emotional faces or emoticons. However, the classroom space doesn't offer these tools to students. This seemed to present a design opportunity to give these tools to students to encourage interaction with what teachers display on the wall, and to communicate with each other, to create a rich cooperative environment. This exploits the social constructivism theory, in that students learn most effectively by engaging in cooperative activities (Vygotsky, 1978a).

Further inspiration came from the observation affinity diagram (see APPENDIX 5), where users said that they use storytelling as a teaching method, and that classroom space can express users' story. However, this inspiration raised a question about how a space can tell the users' story. The answer here came from another inspiration, the comic strip.

This inspired the idea of displaying students' work as a comic strip or storyboard. Figure 290 shows a classroom space that tells its users' story.

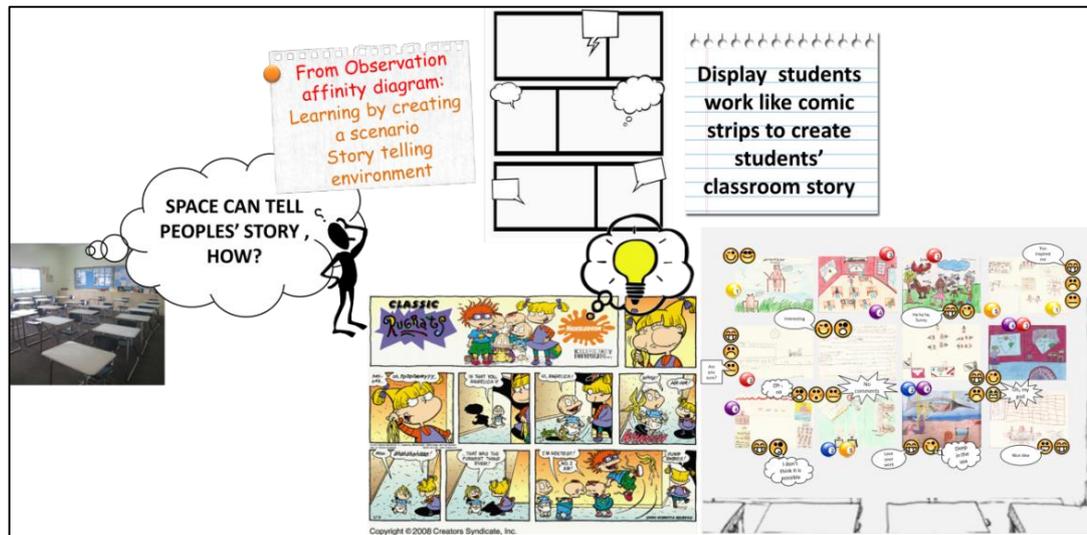


Figure 290: Classroom Space That Tells Its Users' Story

These inspirations guided card set two, with the principle idea of empowering teachers to design displays in space in a way that encourages students' to interact and communicate with each other on a wall. Other common problems mentioned by users in the second stage of research; are addressed in the following Why section.

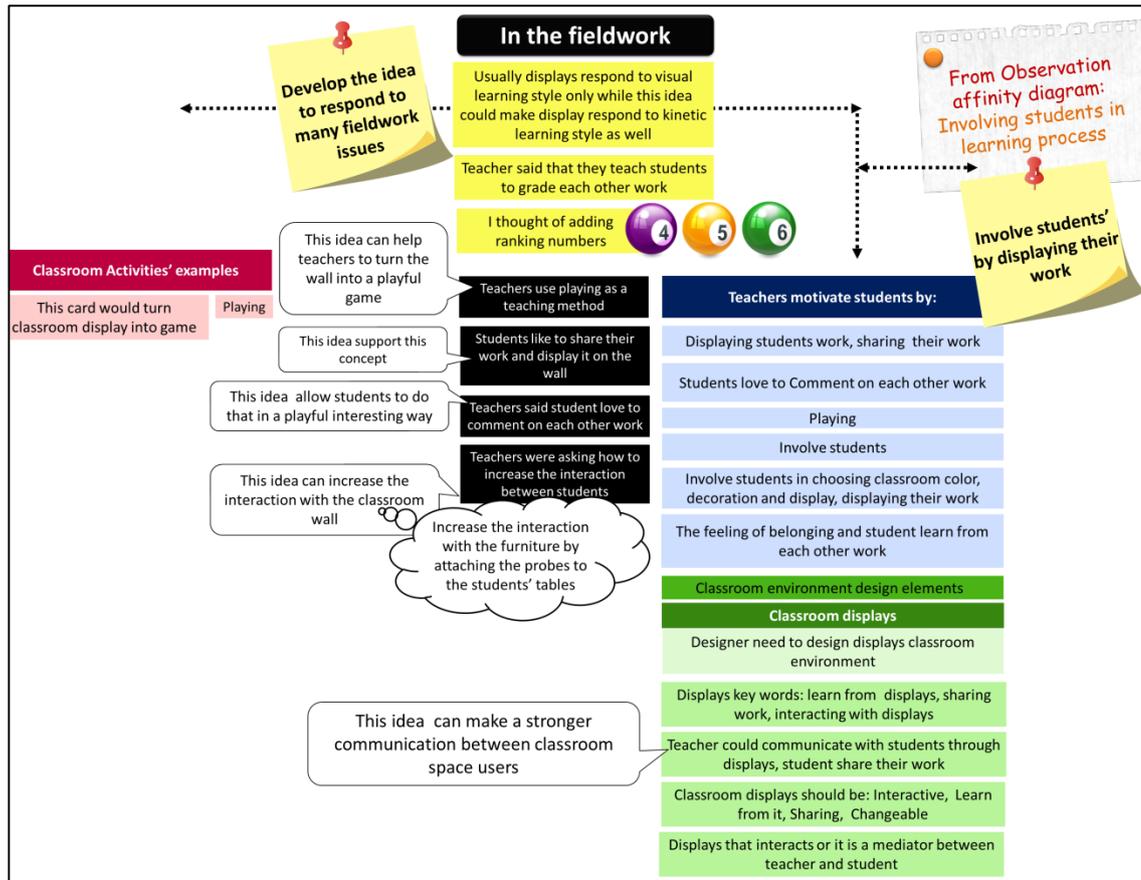


Figure 291: Set of Cards Ideas with Common Problems Raised In the Second Stage Findings

Why

This section of the cards encourages use by explaining the benefits they will receive, challenges they are going to encounter, and likely problems to solve while using the card set. In addition to the main empowerment purpose of the tool, there were other common problems mentioned by users that the cards could address. Teachers stated that they needed help in making classroom space interactive and playful displays of student work, with the findings showing that many teachers did not know how to go about this. Responding to that, the **Why** section of in this set of card is:

- Turning a classroom display into a game; pupils create it, interact and play with it.
- Creating a playful interaction in the classroom space using students' playful props that encourage students to interact with classroom displays.
- Storytelling is a teaching method; this card set will help students to create and tell their own story through their displayed work; they can also comment on each other's work using speech bubbles props.

- Strengthening the feeling of belonging to the classroom space by involving pupils in displaying and sharing their own work.
- Teachers can communicate with students by commenting on their work.
- Usually, classroom displays are responded to only by visual learning style students. Using this card will help teachers to respond to students with a kinaesthetic learning style, by giving students props to comment on each other's work and encourage them to move in the space.

How

What do teachers need to know in order to apply this card set; Figure 292 shows How to apply “*Our Classroom Story*” set of cards. What teachers need in order to apply this set of cards are:

- Students' work.
- Three small bags: a bag of numbers, a bag of emotional faces and a bag of speech bubbles.
- Hangers.

Secondly, how to apply this set of cards?

1. Give each student three small bags (a bag of numbers, a bag of emotional faces, and a bag of speech bubbles).
2. Stick the three bags on each student's desk using the hangers.
3. Display students' everyday work on the wall.
4. Ask students to comment on each other's work using the bubbles and emotional faces.
5. Finally, ask students to rank each other's work using the numbers.
6. Teachers can participate as well. They can comment on students' work using the same speech bubbles and emotional faces.

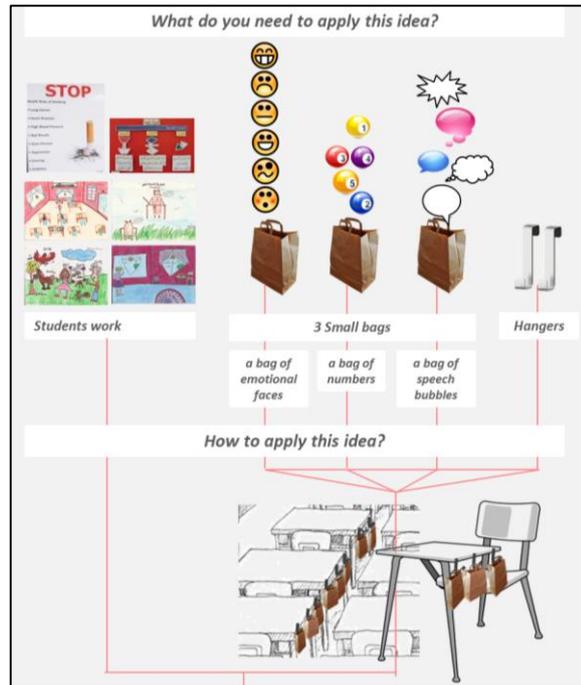


Figure 292: How to apply Card 2 “Our Classroom Story”

What

This section shows possible outcome examples; what does the teacher expect when she/he is applying this card; what would the learning space look like? Figure 293 (a card from the set) shows what the classroom space could look like when the teacher applies set of Cards 2 “Our Classroom Story”.

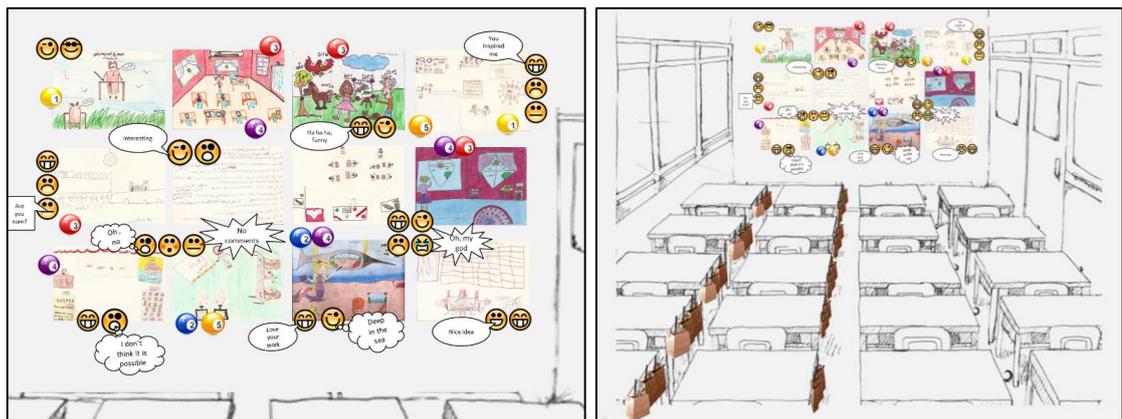


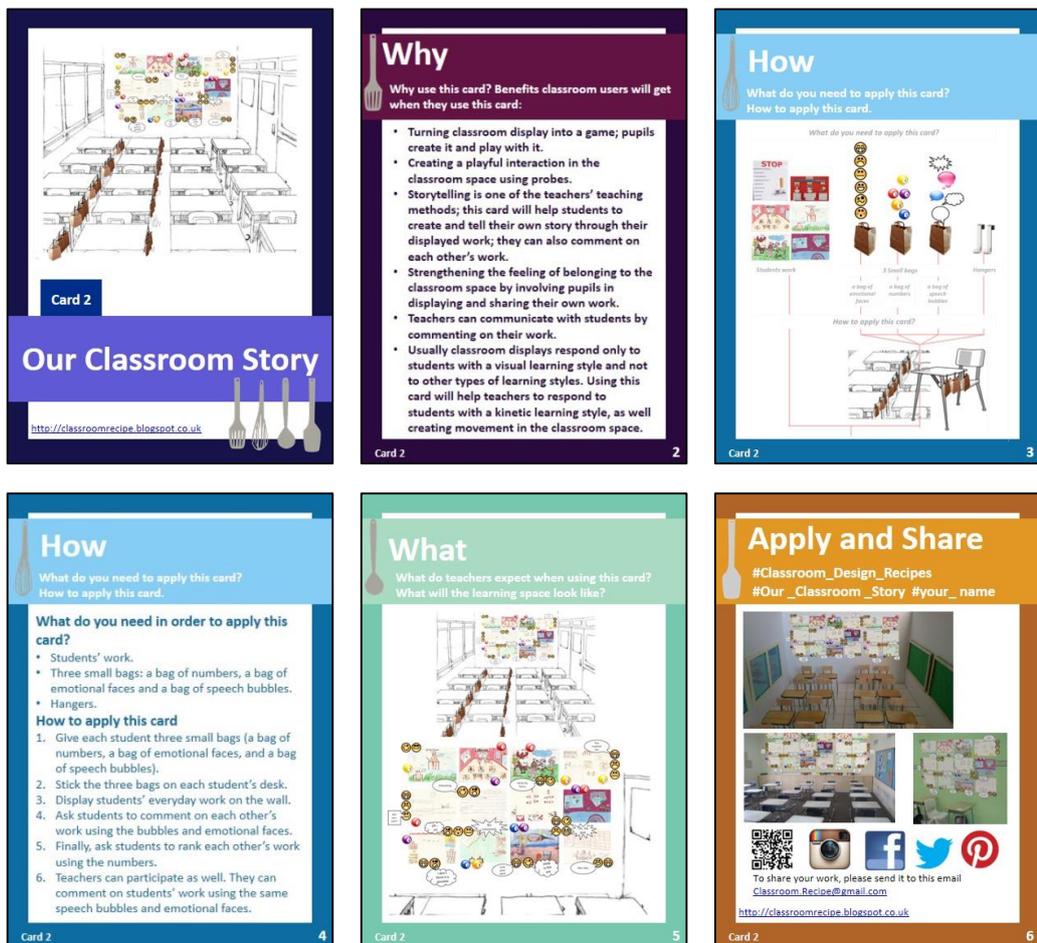
Figure 293: What the classroom space could look like after using Card 2

Apply and Share

After applying this card, the user takes a photo of their card application in the classroom and shares it on Facebook, Instagram, Twitter or Pinterest, identifying it with hash tags combining the name of the tool and the name of the set of cards, for example:

“#Classroom_Design_Recipes and #Our_Classroom_Story”. This simple device enables teachers to search for the hash tag name and see examples of other teachers’ applications of this card. It is important to note that apply and share section is the same in every set, therefore it would not be explained in other sets.

Final Set of Cards 2: Our Classroom Story



3) Set of Cards 3 “Desk’s Probes”

Figure 294 (below) shows the thinking map of the “Desk’s Probes,” set of cards. The thinking behind this set of cards began with observation of students’ thoughtless acts in space, to generate insights into how they interact with their desks. Although students are not allowed to draw or stick pictures on the tables (because according to teachers they will damage the furniture) students do in fact personalise them by drawing, writing and sticking pictures to them, and which they shared as images on the online social network as representing the best of classroom memories.

CHAPTER 5: TOOL AND EXEMPLAR DEVELOPMENT

Table 5: Shows Thinking Elements of Set of Cards 3 “Desk’s Probes”

| 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice |
|--|---|--|--|---|
| <p>Constructivist theory claims that learners learn better when they depend on themselves and discover things by themselves (Lin and Hsieh, 2001)</p> <p>Technical information about colours and space in literature</p> <p>Froebel believed that all students learn by being active</p> | <p>Teachers claimed that tables and chairs are students’ island</p> <p>A space where students discover their self and their talents</p> <p>Students’ drawings illustrate rich ideas about table design</p> <p>students’ drawings design classroom space using colours</p> | <p>Thoughtless acts: the relationship between students and their tables</p> <p>Students personalize their tables</p> <p>students’ memories of classroom space</p> <p>Students were identifying their selves through personalizing their tables</p> <p>Discovering talents through tables</p> | <p>Writable wallpaper</p> <p>LEGO Learning Institute and Project Synthesis children were asked what they wanted from robot school. They described robots as a friend that they express their feelings to (Latitude^o et al., 2012)</p> | <p>Understanding interaction between users and furniture, to enhance users’ use of furniture and add learning and teaching value to the furniture through design</p> <p>adding constructivist theory value to table design to encourage students discover things by themselves while interacting with tables</p> <p>Adding colours to space using available resources</p> <p>Adding more teaching and learning value by designing table probes</p> <p>The theoretical learning concept of Froebel into design</p> |

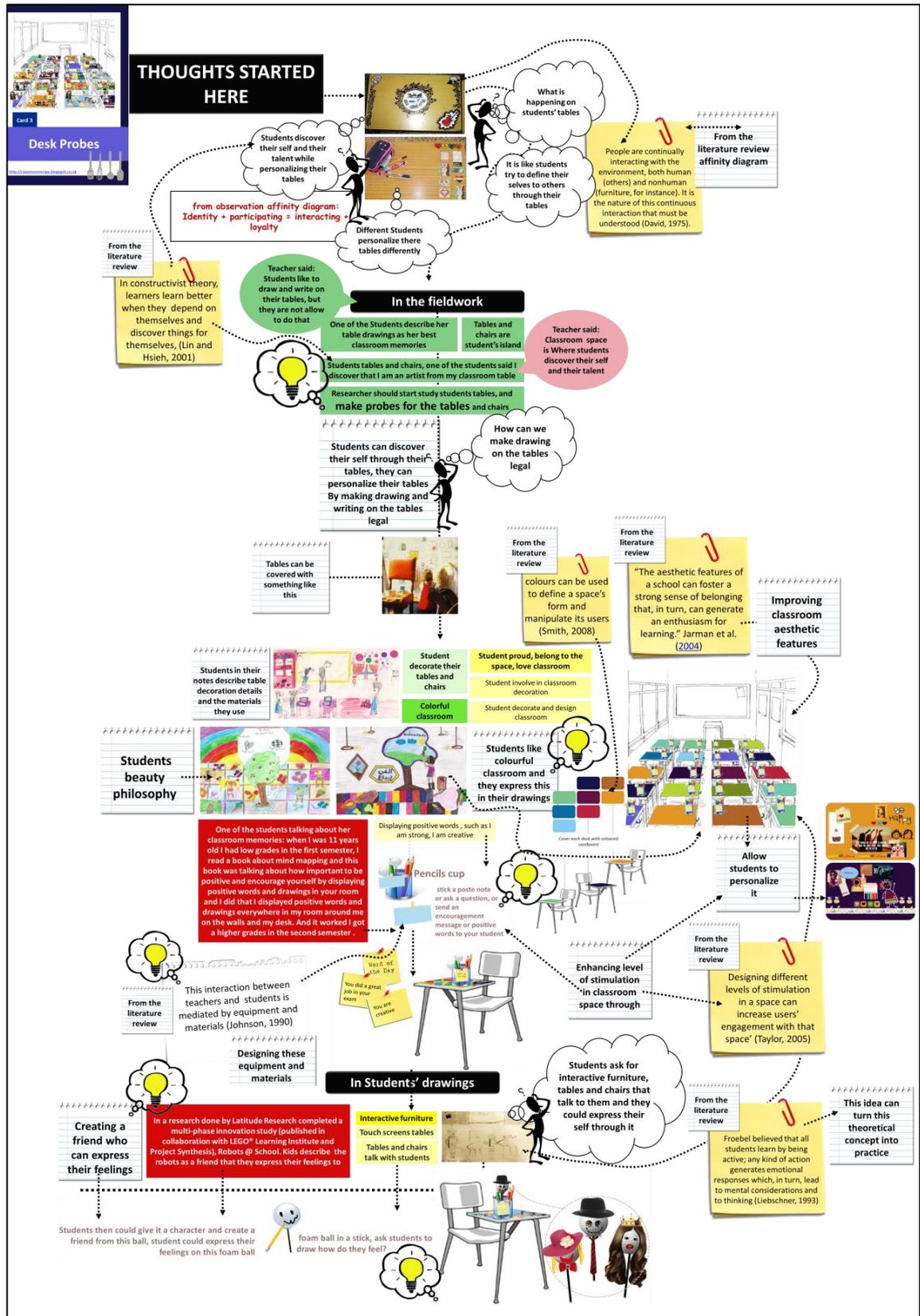


Figure 294: Thinking Map of "Desk's Probes" Set Of Cards Number Three

Figure 295 shows some images of students' tables, which they shared on Facebook during the discussion about memories of classroom space in the second stage of research.

Students were identifying themselves to others through personalizing their tables and how they wanted others to see them. Additionally, one student claimed that she discovered her passion for art from what she used to draw on the table. Relating these to the literature review, according to David (1975) users are continually interacting with both human and non-human space, the nature of which must be understood to help designers to enhance users' use of, and to add learning value to, classroom furniture through design.

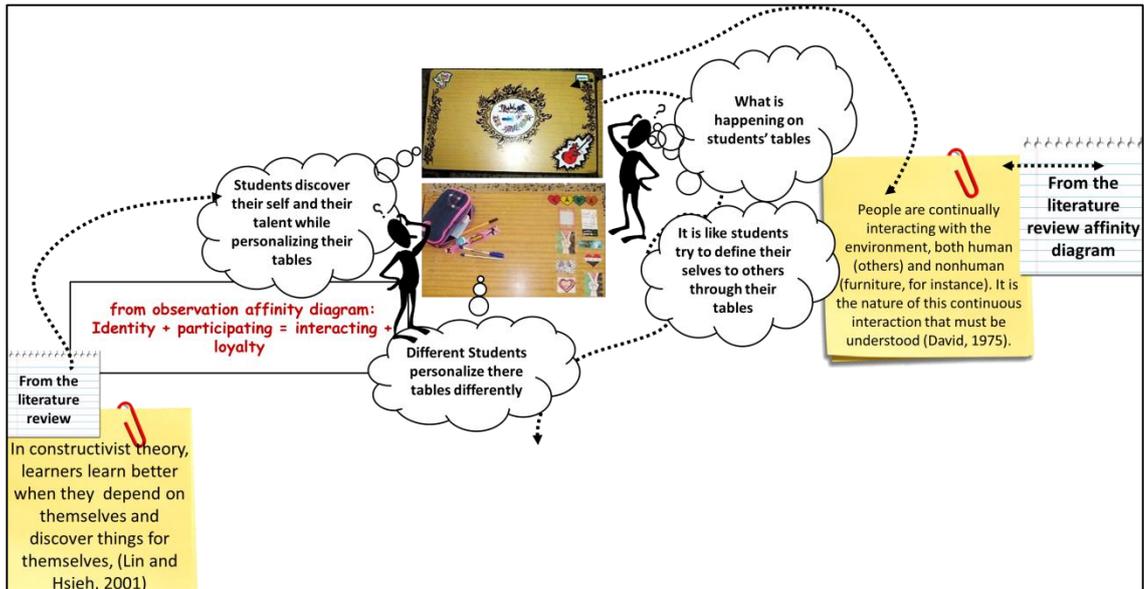


Figure 295: Students' Tables and Beginning Thoughts of Set Number Three

Relating users thoughtless acts to learning theories such as constructivist theory, which claims that learners learn better when they depend on themselves and discover things by themselves (Lin and Hsieh, 2001), inspired the creation of a table that adds constructivist theory value to table design to help students to discover things by themselves while interacting (Figure 295). Furthermore, teachers claimed that tables and chairs are the students' islands, and classroom space where students discover their self and their talents. Informed by the idea of facilitating students' personalisation of their desks with the aim of benefitting students and adding learning value to the tables, different design inspirations (shown in Figure 296) were collected. The question was raised: "How can we make drawing on the tables legal?" Figure 296 shows the thought development behind the set of cards number three.

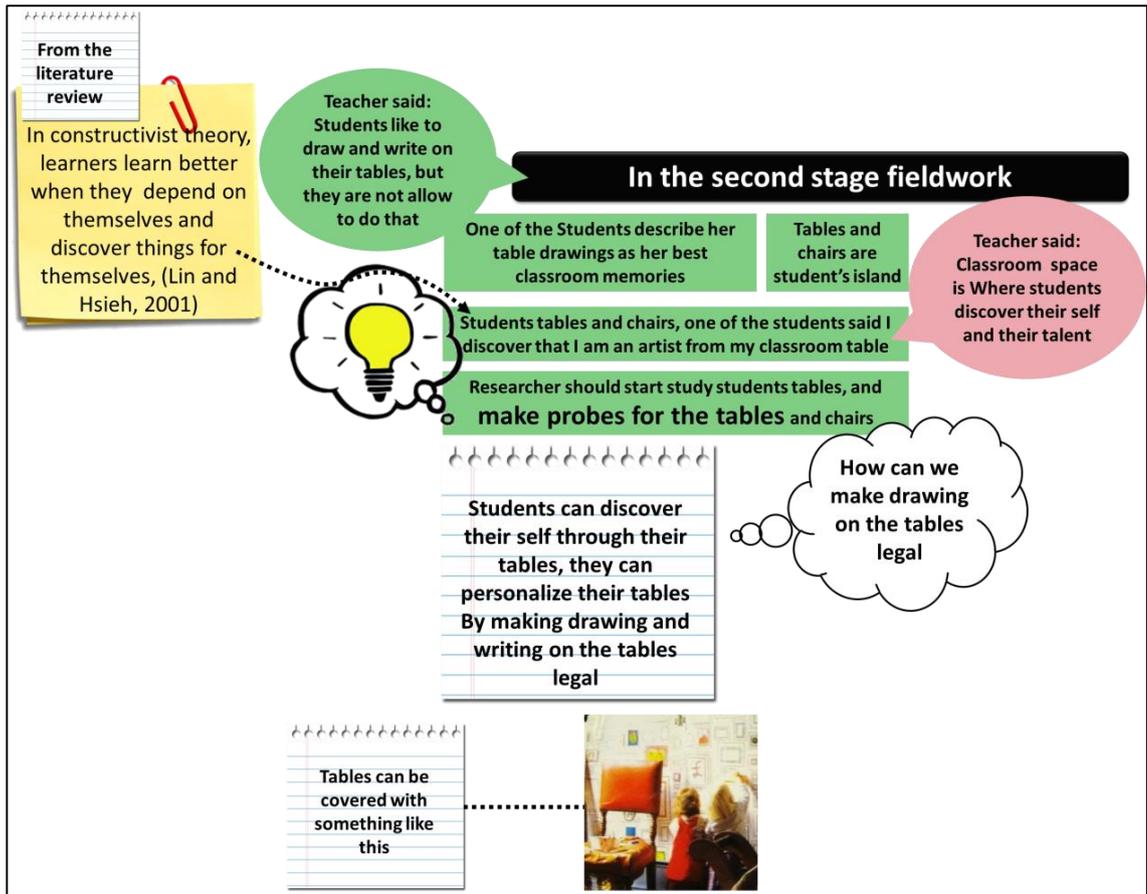


Figure 296: The Thinking Development of Set Number Three

In addition this card inspired by the table design illustrated in students' drawings, shown in Figure 297. Students' drawings showed how to design colour in space practically and how to design classroom space using colours. Figure 297 relates students' drawing related to the literature review and second stage results.

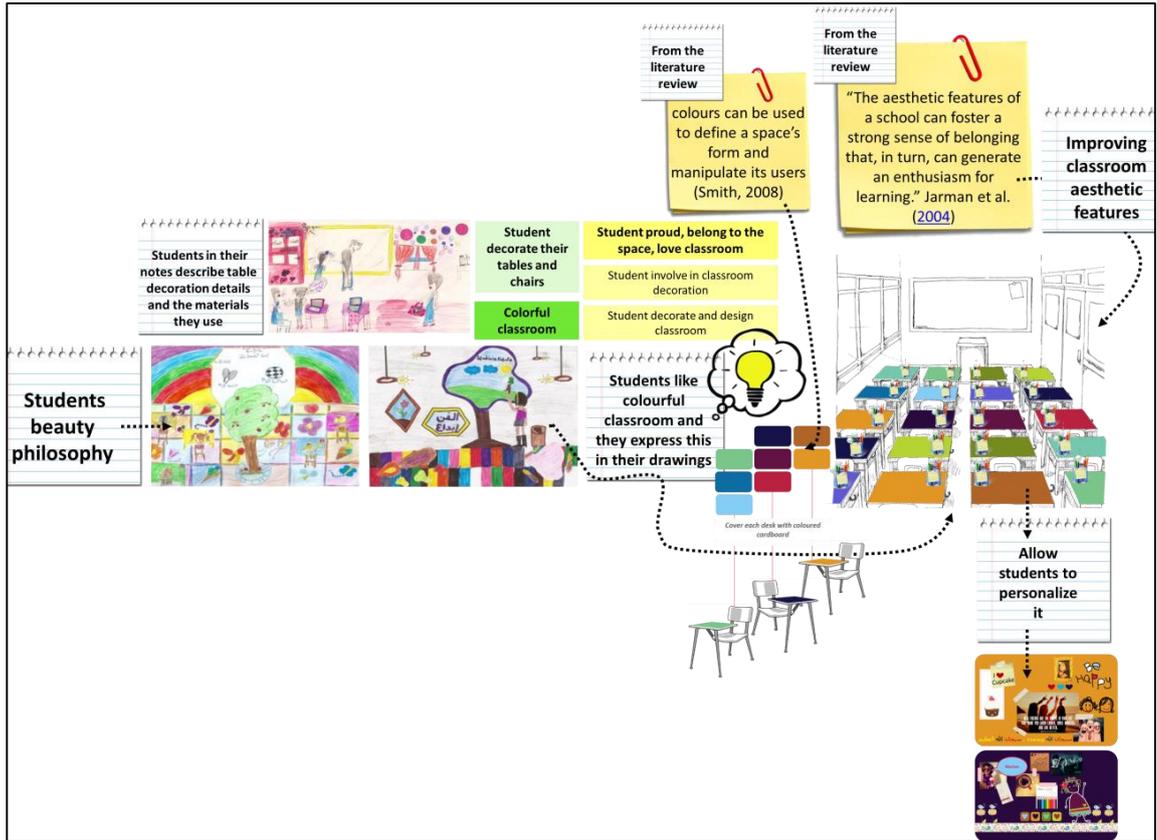


Figure 297: Students' Drawing Related To Literature Review and Second Stage Results

Informed by the concepts and thoughts outlined above, the main idea of the third card set was developed to allow students to cover their tables with their choice of colourful cardboard and personalize it (Figure 297) with the aim of promoting self-awareness, discovery of talents and students' interaction with the space furniture. In order to add more teaching value, the cards suggest that, a pencil cup be given to each student and placed on his/her desk. Sticky notes can be attached to the cup and used as a mechanism to facilitate personalised student-teacher interaction through written questions or puzzles. This simple but novel teaching aid addresses the perceived problem identified by teachers having access to limited teaching aids in the classroom space. Also, personalised post-it note can be stacked, one on top of the other, on the pencil cup (see Figure 298) to increase communication between teachers and students through.

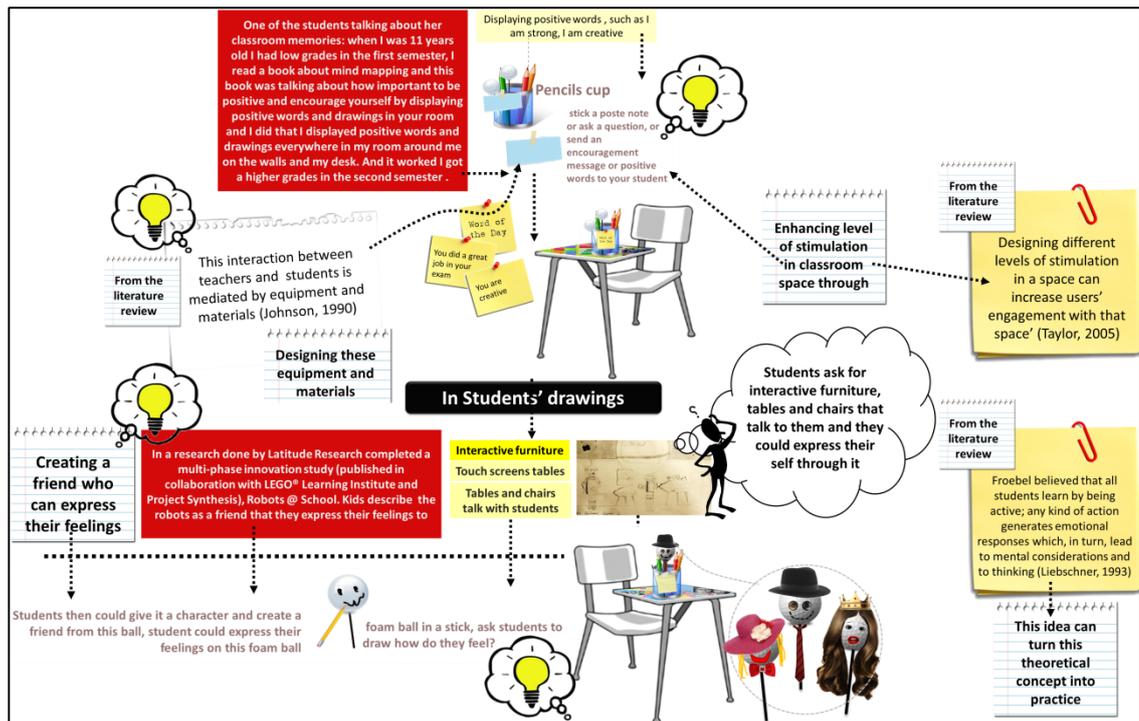


Figure 298: Adding Learning and Teaching Value to third set of cards

A foam ball on a stick can be added to the pencil cup on which students are invited to draw their feelings as expressed as a character, with the aim of creating a ‘friend’ (Figure 298). This idea borrows from the theoretical learning concept of Froebel who believed that all students learn by being active; and that action generates emotional responses and mental considerations that lead to thinking (Liebschner, 1993). Additionally, different levels of stimulation in a classroom space can increase user’s engagement with that space (Taylor, 2005a). In addition, the idea of the foam ball was inspired from research by Latitude^o Research and others (Latitude^o et al., 2012) which reported on a study of students’ drawings depicting tables as robots that communicate with them. Students described robots as a friend to whom they express their feelings. The colourful cardboard cover, pencil case with foam ball, and sticky notes were named Desk Probes.

Why?

Why use this card? The benefits classroom users’ can get from Card 3 Set “Desk’s Probes” include:

- Involving students in designing and decorating the classroom space.
- Turning desks into a mediator between teachers and pupils, where teachers can communicate indirectly with pupils. For example, teachers can display motivational quotes and wisdom, or send an indirect message to students through their desks using

this card. This can overcome the interaction and communication limitation between students, teachers and space.

- Making the classroom desk an interactive piece of furniture that can represent a student's identity, because currently students do not feel a sense of belonging to the classroom space as there is no space for them to personalise.
- According to teachers, the classroom is where students accept their differences, identify their self and discover their talents; however, teachers wanted to know how to embrace these values through space design. This set of cards offer students an opportunity to personalise their tables and express themselves through their tables.
- Students can learn from each other's desks, which allow teachers to use space furniture as a teaching tool, and turning the classroom space into a colourful and inspirational space.
- It helps teachers to apply different teaching methods: for example, writing the questions on paper and sticking it on the pencil case, hiding questions under the pencil case and asking students to look for it, or creating a competition among students for the most creative desk cover.
- Turning the classroom desk into a surface where students and teachers can create displays.
- Using this card will turn students' desks into reflects of their identity, which will allow teachers to know more about their students.

How

What do teachers need in order to apply this card, and how to apply it? Figure 299 explains how to apply "Desk's Probes". Teachers need:

- Different coloured cardboard, of desk size, to cover each desk.
- Pencil cases for each student's desk with a sticky note on it and a foam ball on a stick.

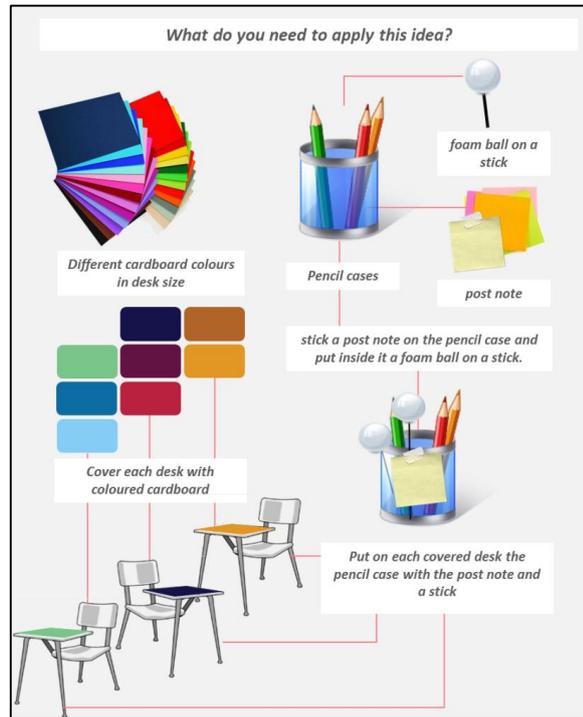


Figure 299: what do you need in order to apply card 3 “Desk’s Probes”

To apply this set of cards:

1. Cover each student’s desk with different coloured cardboard and ask them to personalise their desk cover (Figure 300). Tell students ‘your desk is your identity, personalise it how you would like others to see you’. Teachers can give students some examples: stick on your favourite photos, your motivational wisdom, words and quotes, or write on interesting information. Figure 301 shows different examples of how students’ can personalize their desks.
2. On the desk, give each student a pencil cup, stick a sticky note on it and put inside the pencil case a foam ball on a stick. Use the post-it note to send messages to your students or use it as part of your teaching strategy: for example, write a question. Figure 302 shows examples of the post-it note and the characterised foam ball. Ask students to draw their feelings on the foam ball: for example, how they feel in school, or they can give a character to this foam ball.
3. You can hold a competition for the most creative desk cover, or you can take a photo of student’s desk covers and display them outside the classroom.

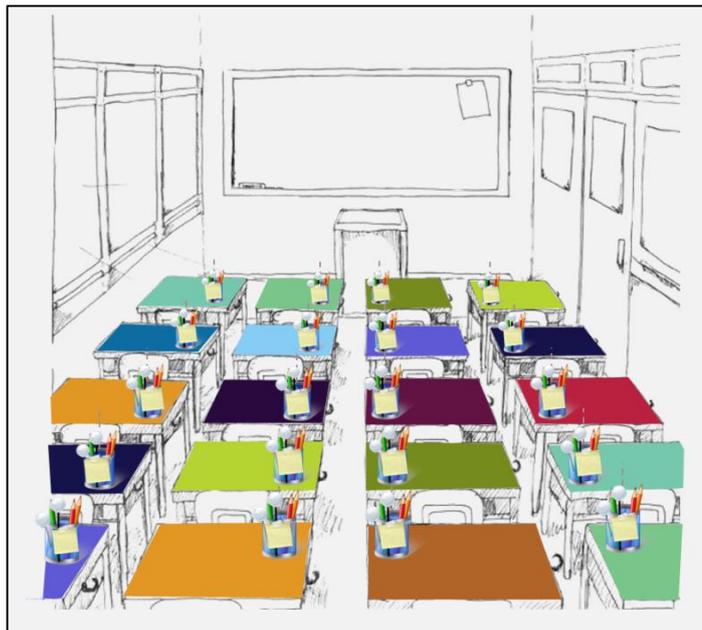


Figure 300: Students' desks covered with coloured cardboard



Figure 301: Examples of how students can personalize their desks



Figure 302: Examples of the post note and the characterised foam ball

What

What does the teacher expect when she/he is using this card, what would the learning space look like? Figure 303 illustrates how the classroom space could look after the teacher has used “Desk’s Probes”.

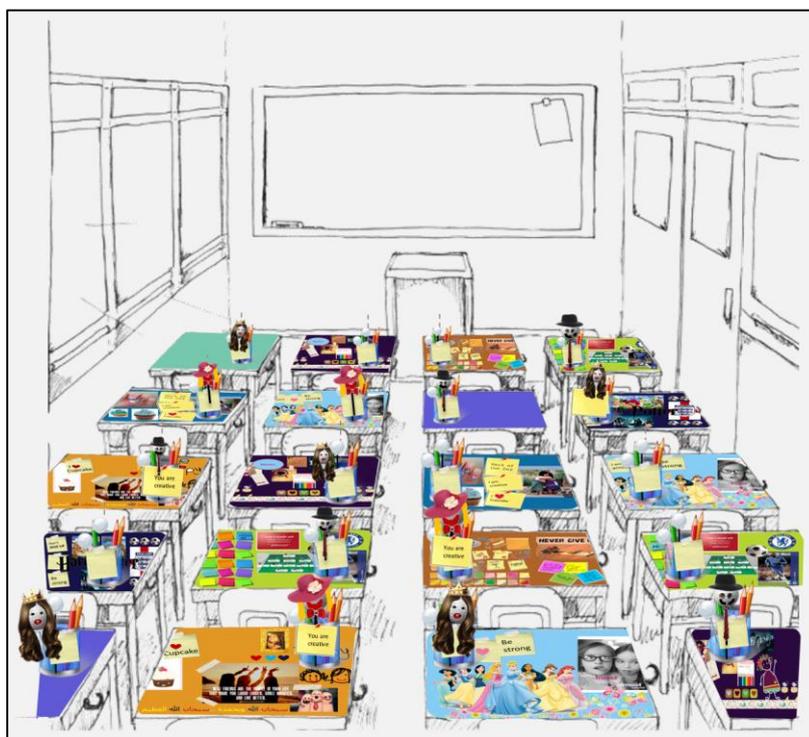


Figure 303: How the Classroom Space Would Look likes When Teacher Use Card 3 “Desk’s Probes”

Set of Cards 3: Desk Probe's



Card 3

Desk Probes

<http://classroomrecine.blogspot.co.uk>



Why

Why use this card? Benefits classroom users' will get when they use this card:

- Involving students in designing and decorating classroom space.
- Turning desks into a mediator between teachers and pupils where teachers can communicate indirectly with pupils through their desks. For example, teachers can display motivational quotes and wisdom, or send an indirect message to students through their desks using this card.
- Making the classroom desk an interactive piece of furniture which can represent a student's identity.
- Offering students an opportunity to personalise their tables and express themselves through their tables. For example, they can stick their favourite photos on the desk, or write motivational words, quotes and pieces of wisdom.

Card 3 2

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Students can learn from each other's desks, turning the classroom space into a colourful and inspirational space.
- It helps teachers to apply different teaching strategies: for example, writing the questions on paper and sticking it on the pencil case and asking students to look for it, or creating a competition among students for the most creative desk cover.
- Turning the classroom desk into a surface where students and teachers can create displays.
- Using this card will turn students' desks into part of their identity, which will allow teachers to know more about their students.

Card 3 3

How

What do you need to apply this card?
How to apply this card.

What do you need to apply this idea?



Different cardboard colours in desk size

Pencil cases

post note

foam ball on a stick

stick a post note on the pencil case and post inside it foam ball on a stick.

Cover each desk with coloured cardboard

Put on each covered desk the pencil case with the post note and a stick

Card 3 4

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this idea?

- Different cardboard colours of desk size to cover each desk.
- Pencil cases for each student's desk with a post note on it and a foam ball on a stick.

How to apply this idea

- Cover each student's desk with different cardboard colours and ask them to personalise their desk cover to identify themselves through their desks. Your desk is your identity, how you would like others to see you. Teachers can give students some examples: stick on your favourite photos, your motivational wisdom, words and quotes, or write on interesting information.

Card 3 5

How

What do you need to apply this card?
How to apply this card.



Students' desks covered with coloured cardboard



Card 3 6

How

What do you need to apply this card?
How to apply this card.

Examples of how students can personalise their desks



- On the desk, give each student a pencil case, stick a post note on it and put inside the pencil case a foam ball on a stick. Use the post note to send messages to your students or use it as part of your teaching strategy: for example, write a question.

Card 3 7

How

What do you need to apply this card?
How to apply this card.

Ask students to draw their feelings on the foam ball: for example, how they feel in school, or they can give a character to this foam ball.



Examples of the post note and the characterised foam ball.

- You can make a competition for the most creative desk cover, or you can take a photo of student's desk covers and display them outside the classroom.

Card 3 8

What

What do teachers expect when using this card?
What would the learning space look like?



Card 3 9



The remaining cards sets are presented in APPENDIX 6.

5.2.10 Tool's Website and Social Network

A website was created for this tool *Classroom Design Recipes* (<http://classroomrecipe.blogspot.co.uk>, Figure 304). The website makes freely available of all the information about this tool and the sets of cards in both English and Arabic.

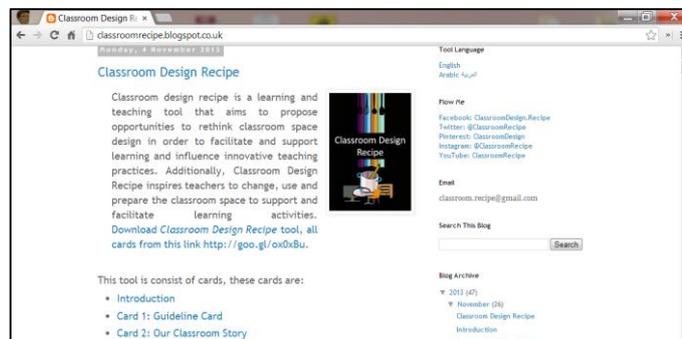


Figure 304: Classroom Design Recipe Website

The researcher used social networking (Facebook, Pinterest, YouTube, Instagram, Twitter) to promote this tool within the teacher community for use around the world, helping to overcome the geographical boundaries and limitations, by connecting and communicating with interested teachers and engage in dialogue with them, answering their questions remotely. Questions and comments helped to develop and improve the tool. The social network created a community of tool users who could share their photos of tool use. Furthermore, some social networks allow users to post videos, which can show how to apply the tool in practice. Finally most social network supports hashtags that allows users to easily search for and see each other's applications. Figure 305 shows

pictures of Facebook and Pinterest pages for the tool. Table 6 lists links of tool websites and social networking accounts that were set up to promote the tool among potential users, communicate directly with them, and collect rich data on their individual applications as posted in comments, photographs and videos.

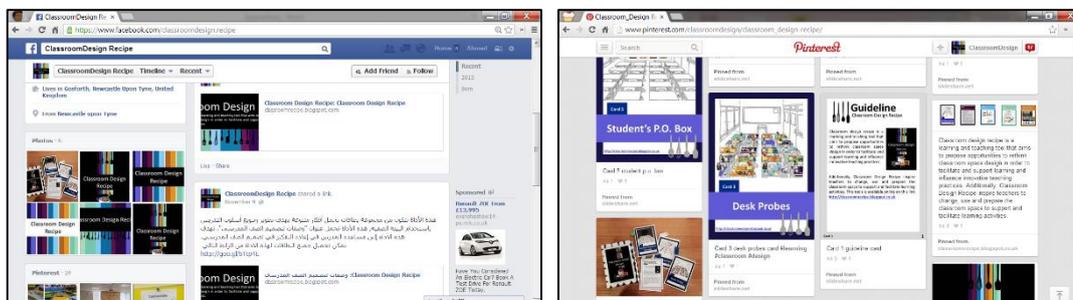


Figure 305: Tool's Social Network

Table 6: Tool Website and Social Network Links

| Services | Links |
|-----------|---|
| Website | http://classroomrecipe.blogspot.co.uk |
| Facebook | https://www.facebook.com/classroomdesign.recipe |
| Twitter | https://twitter.com/ClassroomRecipe |
| Instagram | http://instagram.com/classroomrecipe |
| Pinterest | http://www.pinterest.com/classroomdesign |
| YouTube | http://www.youtube.com/classroomrecipe |

5.2.11 Arabic Version

During the tool pilot study phase, some teachers ask for an Arabic version which was then created. Figure 306–Figure 307 show examples of the Arabic version of the tool.



Figure 306: Arabic Version of the Tool



Figure 307: Arabic Version of the Tool

5.2.12 Tool Contributions

The researcher's emphasis has been on the importance of learning space as a powerful teaching instrument at the disposal of the teacher (Prashnig, 2004, Martin, 2002b) and as a meaningful educational experience (Heiss, 2004). However, previous literature has not been able to explain to teachers how to use classroom space as an instrument to support learning. The main contribution of the tool is addressing this omission by presenting different approaches to use space to support and facilitate learning. In addition, the literature showed that there is a lack of awareness among teachers about space and its importance to learning (Martin, 2002a, Lackney, 2008). Therefore, this tool serves to create an awareness of different classroom space design elements that can be used by teachers to support their diverse teaching strategies. Moreover, teachers could use this tool without designer supervision. It aids continuous change to learning space design. In addition, this tool creates links between space design and different educational values. Also this tool builds a community of teachers who can communicate and share their ideas of learning space design using the 'Apply and Share'. Furthermore, each set of cards in this tool has its own contributions. Table 7 presents each set of cards' contributions.

Table 7: Card's Contributions by set number

| Card Number | Contributions |
|--|--|
| Card 2: Our Classroom Story | <ul style="list-style-type: none"> ● Creating a playful interaction wall in classroom space. ● Using learning space wall as a mediator for communication between teachers, students and students with each other. |
| Card 3: Desk Probes Card | <ul style="list-style-type: none"> ● Turning classroom desks into a mediator between teachers and pupils where teachers can communicate indirectly with pupils through their desks. ● Making the classroom desk an interactive piece of furniture, which can represent a student's identity. |
| Card 4: Outside the Classroom Virtually | <ul style="list-style-type: none"> ● Taking students outside the classroom space virtually, which offers different learning experience. ● Thinking out of the box inside the box. |
| Card 5: Student's P.O. Box | <ul style="list-style-type: none"> ● Enhancing classroom users' interaction with the space. ● Encouraging students to define and express themselves to others through space design. |
| Card 6: Physically Outside the Classroom | <ul style="list-style-type: none"> ● Extending classroom space and connecting students with outside the classroom. |
| Card 7: Classroom Timeline | <ul style="list-style-type: none"> ● Creating an interactive wall or ceiling. ● Using space design in recording and visualising students' learning experience. |
| Card 8: Flooring Story Telling | <ul style="list-style-type: none"> ● Creating an interactive floor that supports teachers' teaching strategy. ● Turning classroom flooring into a 3D curriculum. |
| Card 9: Classroom Café | <ul style="list-style-type: none"> ● Creating another place within the classroom space. ● Connecting students with the outside classroom space. |
| Card 10: Interior Design Tips | <ul style="list-style-type: none"> ● Improving teachers' awareness of interior design elements in a space. ● Stimulating students' five senses through space design. |
| Card 11: Template Create Your Own | <ul style="list-style-type: none"> ● Enabling tool extension by allowing the users to publish their own ideas of using space to support learning. ● Provide an opportunity for users to network with others based on their own ideas. |

5.3 Evaluation

We now focus on evaluation of the designed tool, starting with the pilot study as a direct response to teachers' comments and requests. Next, a description of tool distribution and the evaluation methods is explained. Finally, before presenting the evaluation results, four different examples for teachers' applications are described.

5.3.1 Pilot Study Test

It is important to pilot any new tool to improve its effectiveness and to check that it works as intended. A further aim of a pilot test is to help the research to further develop the tool so that users do not face basic problems in using it. In this research, three pilot studies were carried out before distributing the tool. In general, the pilot studies showed a positive response to the tool concept, design and content. Teachers admired the easy application of ideas using available low budget materials. Additionally, teachers commented that the tool had an attractive form, illustrations, and was easy to apply in the classroom space. On the other hand, the pilot highlighted a number of problems which were:

1. **Numbering:** the card numbers were confusing.
2. **Email Address:** Some teachers are not familiar with online social networking but are more familiar with emails; they asked for email addresses to enable contact with the researcher for any further questions and comments.
3. **Guideline Card:** teachers asked for extra explanation details in the guideline card about how this tool work, (Card Set 1).
4. **Webpage Reference:** teachers have suggested a webpage which they can refer to as an online cards reference (the cards were added to the blog).
5. **Arabic Translation:** Some teachers asked for Arabic Translation.
6. **Limited Awareness:** teachers mentioned that they need to know more about interior design elements in space and how to use them for learning (in addition to the current cards).

7. **Understanding the Whole Tool Concept:** There was a problem in understanding the whole tool concept as individual sets of cards, before reading all of them. Therefore, there is a need to provide *Introduction* cards that explain the use of all sets of cards.

To respond to users' comments and requests the researcher initially redesigned the card numbers, provided an *email address* where teachers can correspond and send their comments and feedback. In addition, extra explanation and details were added to the *guiding card*, and a *webpage* was created where all the cards are made available including the template card with a free link to download all the sets of cards. After that, an *Arabic version* of the tool was created and made available online. In addition, a new set of cards was designed and named *interior design tips*, in response to the need to explain interior design elements to increase teachers' awareness about elements in space and how they could be used to support learning. Finally, *introduction set of cards* which explains the tools aims and show a summary of each set of cards (in order to inform teachers about the whole tool concept) before reading each one separately. Figure 308 - Figure 309 show the introduction set of cards.

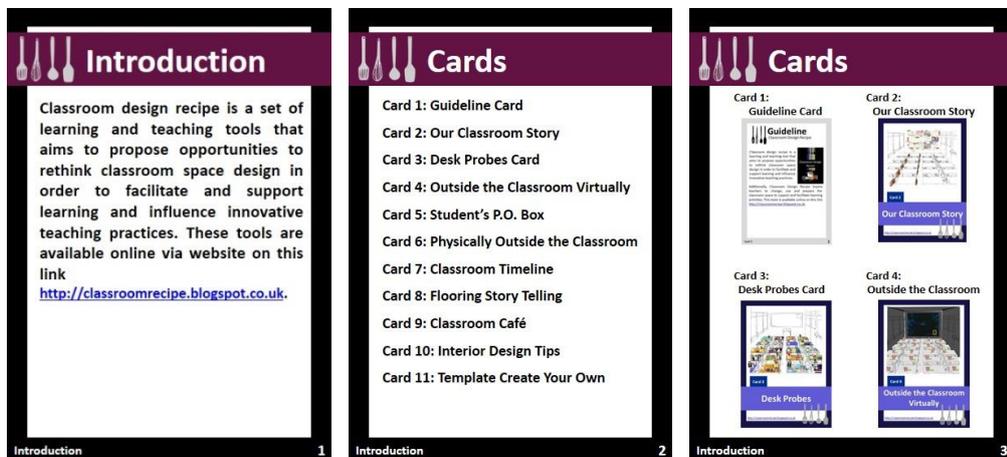


Figure 308: Introduction Set of Cards



Figure 309: Introduction Set of Cards

Table 8: Pilot Study User Feedback and Development Responses

| | User Feedback | Development Response |
|---|--|---|
| 1 | The card numbers are confusing. Teachers were confused between set of cards number and the pages number | Redesign the card numbers, and the set number was added into each page next to the card page number. |
| 2 | An Email address is needed as contact for further questions and comments | Provided an email address |
| 3 | The Guideline card needs extra details and explanations. For example: why each card set is divided into different colours. | Extra explanation and details were added to the guiding card. For example: an image of each section colour is provided with the explanation of what the colour refers to. |
| 4 | Webpage as an online reference for all the cards was suggested | A webpage was created where all the cards were uploaded including the template card |
| 5 | Arabic Translation was needed | An Arabic version of the tool was created |
| 6 | Limited awareness of Interior Design | An extra Interior Design Tips card was developed |
| 7 | A need for users to understand the whole tool concept before reading each one separately | An Introduction set of cards was created. |

5.3.2 Tool Distribution

Eight hard copies of the complete tool box were distributed to teachers in Bahrain Kingdom across different schools. In addition to the hard copy, a downloadable pdf copy of the tool was published through different online social networks and on the website <http://classroomrecipe.blogspot.co.uk>.

5.3.3 Evaluation Methods and Responses

Six teachers requested, and shared feedback in the form of photographs documenting their application of the hardcopy version of the tool. These images were analysed using the affinity diagram method (this method was explained in chapter three). The results informed the evaluation, as evidence of teachers’ understanding of the cards content and students’ responses to the tool’s application, including insights on how it affected them. Figure 310 shows examples of tool application photos.



Figure 310: Tool Application Photos

As a tool, the sets of cards are flexible in application; teachers had the choice to apply all the cards, or just some of them. Moreover, two head teachers reported that they have recommended the tools to their teachers. Four semi-structured interviews were performed as a follow-up to the teachers’ initial feedback, to discuss the tool’s use and perceived value in more detail. Open discussion took place, with 8 teachers who applied the cards, using WhatsApp mobile application, to facilitate easier communication with users and to overcome geographical obstacles, Figure 311 shows the WhatsApp group.



Figure 311: WhatsApp group

The discussion on the smartphone messaging application WhatsApp had a better response rate than the request to engage in semi-structured interviews, and brought more valuable comments through the openness of the discussion and comments, which was not led by researcher questions. As a result, discussions with the 8 participating could involve comments, questions or requests about the tool any time in the virtual online group and informed researcher about aspects that she was not aware of. The teachers' discussion revealed that tool flexibility enables use of each set of cards separately, but also in combinations of two different set of cards together; or taking one idea from one set and applying it in different context. For example, one teacher used the idea of voting from set of cards number 9 and applied it in different context. It is important to mention that during tool applications there was ongoing communication between the researcher and teachers, as the latter raised different questions and requests relating to tool applications. The researcher answered teachers' questions and requests directly through email or the WhatsApp application. Requests from teachers included: (1) More technical details to be added to the cards; (2) Resources (including for download) to be added to the cards; and (3) Set of cards number 10 (Interior Design Tips) is too long. The researcher responded directly to these points. Table 9 explains teachers' requests and the researcher responses.

Table 9: Teachers Requests and Researcher Respond

| Teachers Requests | Researcher Response |
|---|---|
| Teachers need more technical details to be added to the cards | FAQ (Frequently Asked Questions) set of cards is added to answer frequently asked questions such as technical details questions. For example how to hand displays from the ceiling |
| Teachers want more resources to be added to the cards | Resources for direct download and ready to print have been added to some of the sets of cards |
| Set of cards 10 is too long (Interior Design Tips) | To divide the Set of Cards Number 10 into 4 sets of cards |

5.3.3.1 Frequently Asked Questions (FAQ)

In order to answer repeated questions Frequently Asked Questions, FAQ set of cards was added to answer different questions such as: how to hang boards from the ceiling; how to stick and cut cardboard; and how long it would take to prepare different set of cards. Figure 312-Figure 313 show FAQ set of cards.

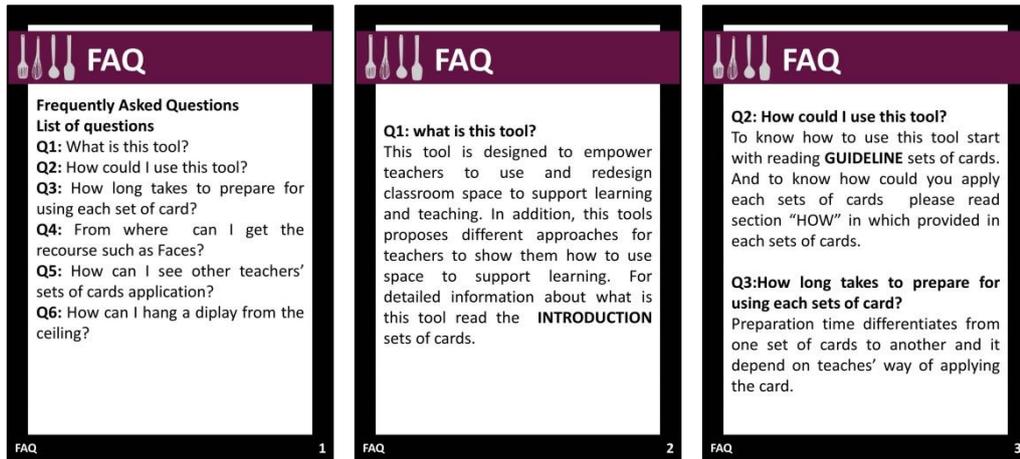


Figure 312: Set of Cards FAQ

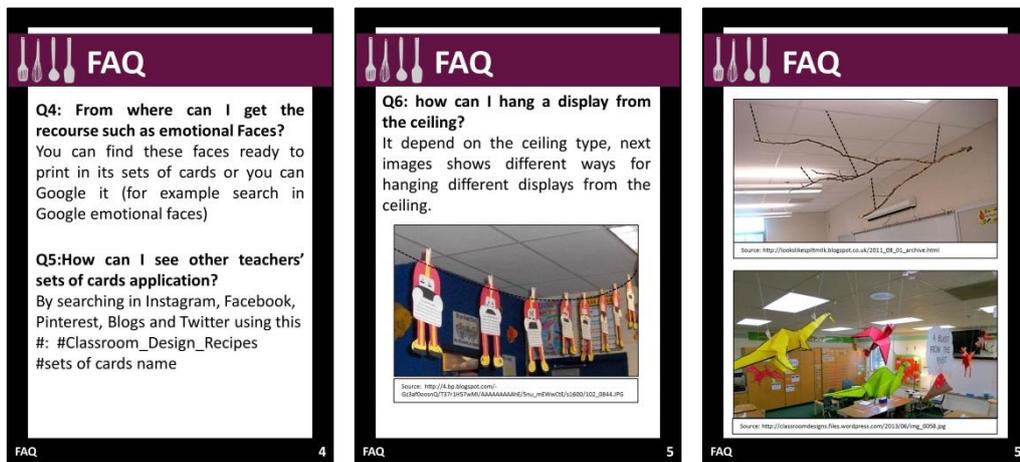


Figure 313: Set of Cards FAQ

5.3.3.2 Resources

Teachers asked for resources that are ready to print in order to make it easier to apply some cards' sets, for example in set of cards 2 "Our Classroom Story" teachers asked for speech bubbles, emotional faces and numbers ready for printing. Responding to the teachers' request, these items were added to Set of Cards 2 (Our Classroom Story Figure 314).



Figure 314: Resources for “Our Classroom Story” Set of Cards

In addition, Cinema tickets were added to set of Cards number 4 “Outside the Classroom Virtually” as an example of how to use them as a playful teaching tool. Figure 315 shows resources for “Outside the Classroom Virtually” set of cards. Figure 316 shows example of cinema ticket as a teaching tool. Also, for set of cards 7 (Classroom Timeline), Awards ribbons and month names were added (Figure 317).



Figure 315: Resources In “Outside the Classroom Virtually” Sets Of Cards

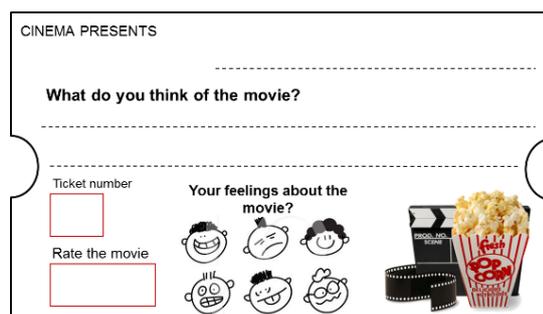


Figure 316: cinema ticket as a teaching tool



Figure 317: Resources in “Classroom Timeline” Set Of Cards

5.3.3.3 Divide Set of Cards Number 10

In the tool evaluation, it had been mentioned that the set of cards number 10 “Interior Design Tips” was too long, therefore the researcher divided this card set into 4 different sets of cards (Figure 318): (10) “Nature inside the Classroom”, (11) “Classroom Party”, (12) “Collage Wallpaper”, and (13) “Stimulating the Senses”. Cards are available in APPENDIX 6.

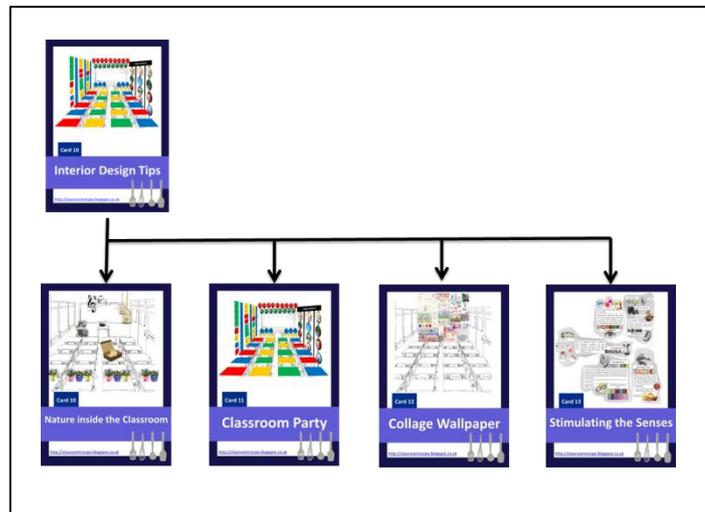


Figure 318: Dividing Interior Design Tips Set of Cards

5.3.4 Further Evaluation

The online copy response went beyond geographical limitation of Bahrain Kingdom where the hard copy was distributed; and attracted interest in applying the tool from other

countries. For example, a user from USA shared the tool through Pinterest and pinned it in as a ‘Project to try’ board (Figure 319).

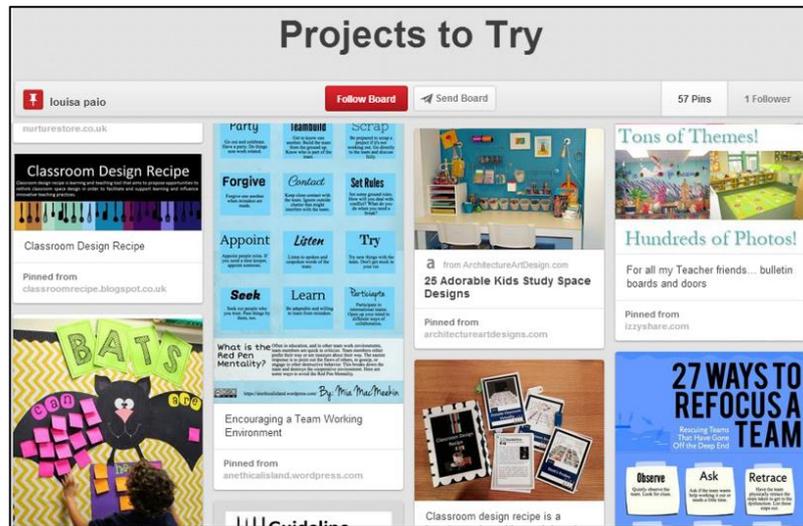


Figure 319: Pinterest User's Respond

During the evaluation of the tool, the researcher got a response from an education expert who heard about the tool through the social network and wanted to discuss the tool with the researcher. This discussion informed the researcher with tool evaluation aspects in relation to educator aspects. This expert had 16 years of teaching experience, one year experience in Quality Assurance Authority in Bahrain’s Ministry of Education and four years’ experience working in improving learning performance projects in nine state schools. Two open interviews were planned with the expert using both phone calls and WhatsApp to discuss the tool (one by phone and one by texting messages using WhatsApp) Figure 320 shows screen captures of the interview from WhatsApp.



Figure 320: Screens Capture of the Interview from WhatsApp

From two open interviews, the expert said that the tool contained interesting ideas and concepts, and she liked its simplicity in application. She said that when she showed the tool to other experts in Quality Assurance Authority in the Bahrain Ministry of Education, they broadly agreed with her that they thought it interesting and easy to apply, although some thought it would be difficult to use in a small size classroom with high number of students, because it demands quite close interaction between individual students and the teacher. Additionally, the expert commented on the attractive colourful visuals as helping to clearly explain the ideas with limited text and commented that this was a valuable contribution to the educational field, which in her opinion is not used to such a rich visual resources. Furthermore, the tool provided practical ideas ready to be applied, rather than more theoretical ideas, which teachers are tasked with applying in ways for which they must seek out support. The educational expert mentioned that *"I have attended lots of workshops that asserts the importance of using learning space and the benefits teachers will get from facilitating space, however it does not explain how to use it."* Furthermore, the expert highlighted the important role of visual communication as a unique and strong element in the tool, because it shows clearly a variety of approaches to change classroom space that teachers might never have thought about. (For examples: displaying students' work or arranging seating layouts). The expert queried how the tool's suggestions for the interactive displays differed to those already used in schools and sent me images of staircase display examples to explain (Figure 321). However, when I asked her if she had observed students interacting with the staircase display, or had any evidence that shows that students had interacted she replied: "no". I reiterated my claim that the idea of interactive displays suggested in the tool was concerned with providing students with playful probes that firstly encourage them to interact with displays, and secondly help teachers to see and communicate with this interaction.



Figure 321: Staircase Display

The expert then invited the researcher to present this tool to teachers in a workshop in Bahrain on using learning space to support and facilitate learning. She said the tool would help her to explain what approaches and opportunities there are in current classroom space that few are not aware of, and in the process increase teachers' competence with space use, which she hoped would reflect on student performance. She asked me to design a PowerPoint presentation so that she could present it herself, reproduced in Figure 322.

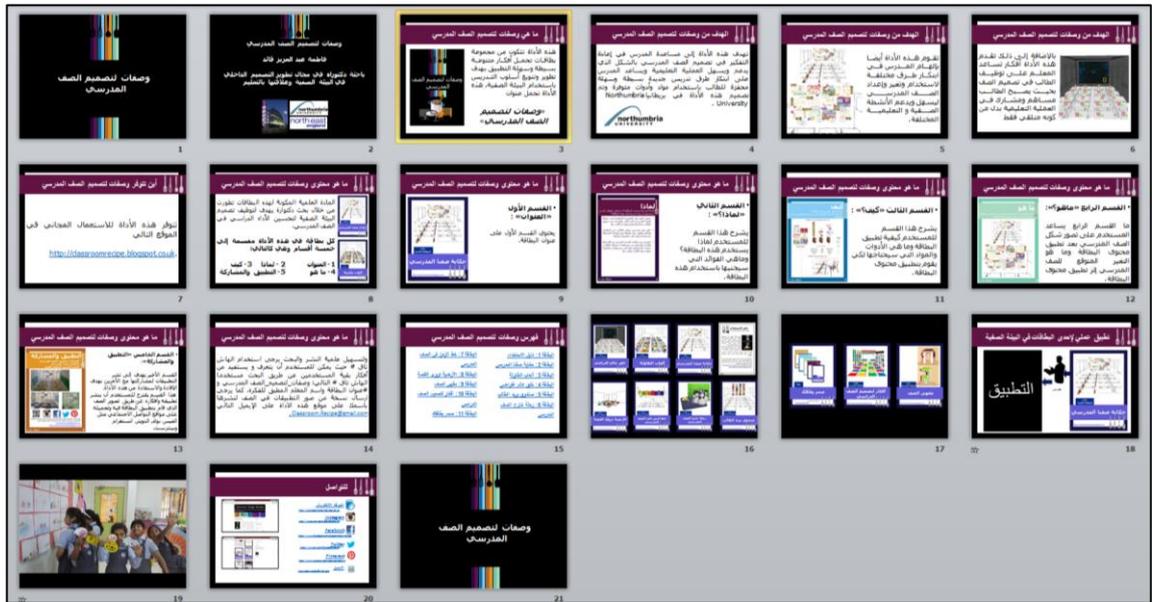


Figure 322: Tool Presentation

Finally, the online tool created an ‘unfocused’ group online that demonstrated a potential to use the tool beyond learning space in unexpected responses from other users who were not teachers. These responses created an interesting discussion about the tool concept and showed its potential beyond formal learning spaces. A mother, for example, asked if the tool could be used with her child at home and taking up this further opportunity, the researcher used an adapted approach with set of cards number 2 “our classroom story” with my child. The researcher suggested using the same props (emotional faces, speech bubbles and ranking numbers), but instead of commenting on students displays she create a story board and asked her child to tell a story using these props. The child asked to add her own props which are princess characters, stickers, and her own drawings. The researcher then displayed the story board on the room wall and asked the child to interact with it to start writing her story in the space of the social

network. Figure 323 shows the preparation for adaptations to “our classroom story”. The Figure 324 shows the interactive storyboard displayed on the wall.



Figure 323: “Our Classroom Story” Home Adaptation



Figure 324: The Child's Interactive Storyboard Displayed on the Wall

Another unanticipated response was from a human resource professional who asked about the idea of interactivity and if this concept could be applied in her office to encourage better use of the display board, where different work news and suggestions was posted. The researcher replied that it would be possible to attach to the display board a shelf with three boxes containing speech bubbles, emotional faces and ranking numbers in order to encourage employees to interact, read and communicate with what is displayed on the wall. Someone else in the online social network made the interesting comment that he was at the doctor's surgery and he was asked to fill in a questionnaire on what he thinks about the information displayed on the board. It occurred to him that it was interesting that he never looked at the board, as it was displayed to be read rather than interacted with. However, this made him think of some of the ideas that the researcher

had provided in the tool which can encourage people to interact and communicate. He commented that usually people are asked to interact with a space without giving them something to interact with.

Table 10: Evaluation Methods and responses

| Evaluation methods | Responses |
|--|---|
| Semi-Structure interviews with teachers | Three semi-structure interviews were performed |
| Open discussion | Through WhatsApp virtual group, an open discussion about tool application between eight teachers and the researcher was facilitated. |
| Photo analysis | Teachers have shared photos of their tool application in classroom spaces. |
| Ongoing communication | Ongoing communication between teachers and researcher through email and internet phone calling enriched the tool evaluation and improved its design |
| Meeting the expert | A discussion between researcher and education expert in Bahrain ministry of education have highlighted the tool education values for teachers |
| Unfocused group | People from different background outside the education profession have revealed potential wider uses for the tool |

In this research, the use of online social networks as a method for collecting data in the first and second phase of research helped to reveal and understand the design problem, and also was central in helping to find solution inspirations, informing the design of the tool content. In this later stage of research, the online social network was used as *an evaluation tool*, which on reflection had advantages and disadvantages that are now explored.

5.3.4.1 Advantages of Social Networks for Research through Design

Social networks mediated online allow users from different backgrounds, with different viewpoints and different perspectives, to participate in evaluation and identify potential further uses of a tool. Additionally, they help to reveal values, for example: adding interactive value to the physical elements of spaces other than learning space. Online social networks allow continuous communication with users during tool application, which had a positive impact on participation of users by enabling direct

replies to, for example, teachers' requests; providing information which helped to enrich the tool content. Teachers in the online social networks had a range of educational backgrounds and years of experience, which was sometimes evident in tool use. Significantly, online social networks had an impact on facilitating design and research both within and outside of Bahrain. Finally, the social networks enabled teachers to share documentation about their individual experiences of preparing for, and using, the tool; this helped in promoting and distributing the tool further as teachers commented on each other's work, sharing knowledge, ideas and inspiration. Figure 325 shows a teacher sharing her tool preparation process on Instagram.

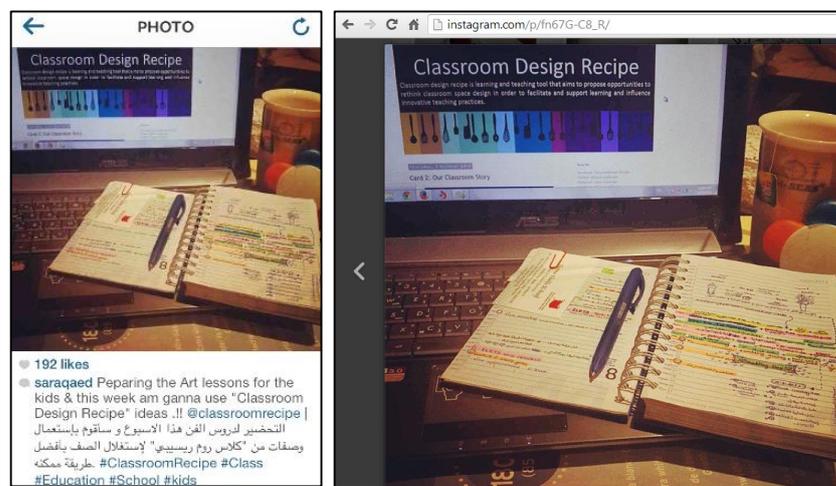


Figure 325: Instagram User's Respond

5.3.4.2 Disadvantages of Social Networks for Research through Design

It is difficult to record users' activities and responses via a social network, because many initial users did not follow-up and share their examples. Therefore, it has been difficult to get a representative and accurate record of the numbers of participants who actually used the card or feedback on their experiences and reported outcomes. Additionally, research time was limited which was a disadvantage for this method. Using online social networks needs a long period of engagement to follow users and stay in contact with them, answer their questions, and socialise with them.

5.3.5 Tool Application Examples

As mentioned, some teachers attached photographic documentation recording their tool applications in learning space. These are now presented,

5.3.5.1 First Example

The first example involved applying “Our Classroom Story” (Figure 326), with its playful interaction wall that uses a learning space wall as a mediator for communication between teachers and students, and students with each other.



Figure 326: Set of Cards 2: Our Classroom Story

The teacher sent detailed images from her application of this set of cards. Figure 327 shows how the teacher introduce the idea to the students. In Figure 328, the students are interacting with the wall display. Figure 329 shows the classroom wall after the cards’ application. Finally Figure 330 shows what this card added to the classroom space. In this example the teacher replaced the bags with envelopes because they are cheaper. As application photos are showing this set was able to integrate learning with walls, walls become an interactive teaching tool. Teacher commented that students’ did not want to move from the wall which previously they did not come near to it.



Figure 327: Teacher's Card explanation



Figure 328: Students Interacting With the Wall Display

In Figure 329 the wall is now telling a story written through students' collaboration.



Figure 329: Classroom Wall after Cards Application



Figure 330: Card Application in Classroom Space

5.3.5.2 Second Example

The second example of applications involved applying set of cards 7 “Classroom Timeline”, shown in Figure 331, to create an interactive wall or ceiling, using space design for recording and visualising students' learning experiences.

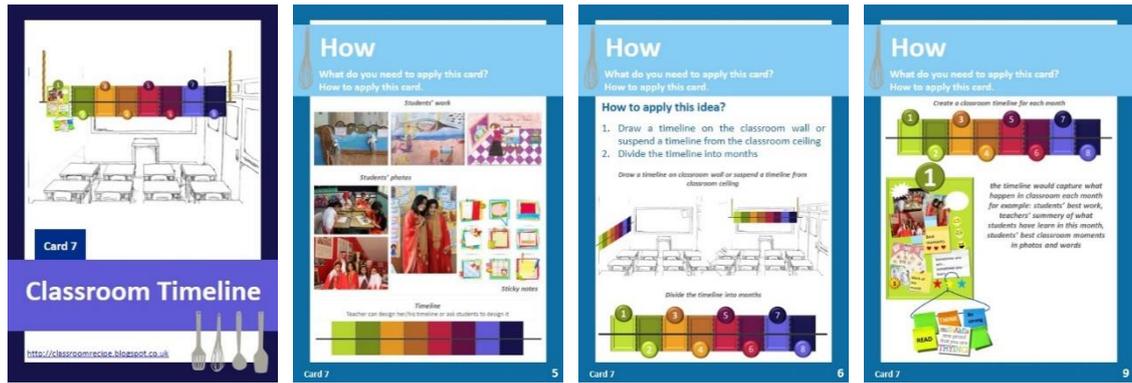


Figure 331: Card 7 Classroom Timeline

Figure 332 shows how the teacher applied the cards idea in her classroom through an interactive wall. The teacher uses the space for recording and visualising students' learning experiences.



Figure 332: Classroom Timeline Application

5.3.5.3 Third Example:

In this example, two teachers applied “Students P.O Box” (Figure 333). This set of cards was about using the concept of sending letters to encourage the communication between teachers and students. Figure 334 shows the first teacher’s application “Students P.O Box”, and Figure 335 shows the second teacher’s application “Students P.O Box”.

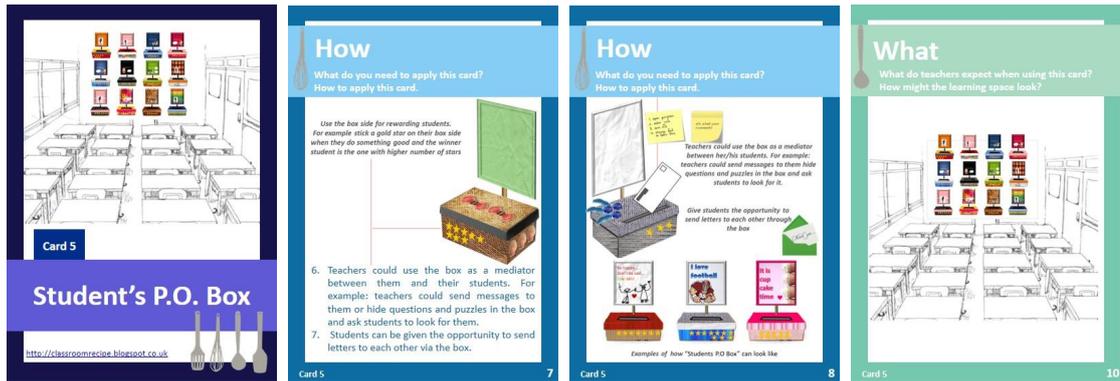


Figure 333: Set of Cards 5 “Students P.O Box”

In this example the teacher has replaced the box for each student with an envelope because it is easier to hang on the wall, and created one P.O. Box for the teacher where students can send her secret letters to tell her about their hidden feelings and problems in classroom space. Teacher said students enjoyed sending letters to her and to each other, they felt it is easier to express their feelings in letters than to say it.



Figure 334: First Application of “Students P.O Box”



Figure 335: Second Application of “Students P.O Box”

5.3.5.4 Fourth Example

The fourth example involved “Desk Probes” (Figure 336). This set of cards is about turning classroom desks into a mediator between teachers and pupils where teachers can communicate indirectly with pupils through their desks. This set of cards makes a classroom desk an interactive piece of furniture, which can represent a student’s identity.

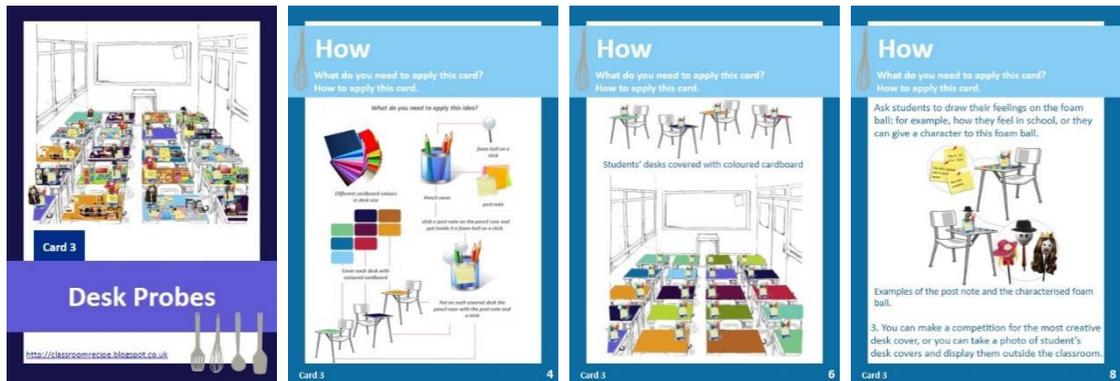


Figure 336: Set of Cards 3 Desk Probs

In this example, the teacher has sent detailed images of her set of cards application. Figure 337 shows teacher preparation for applying this set of cards, while Figure 338 shows tables covered with colourful papers chosen by students.



Figure 337: Teachers' Card Preparation

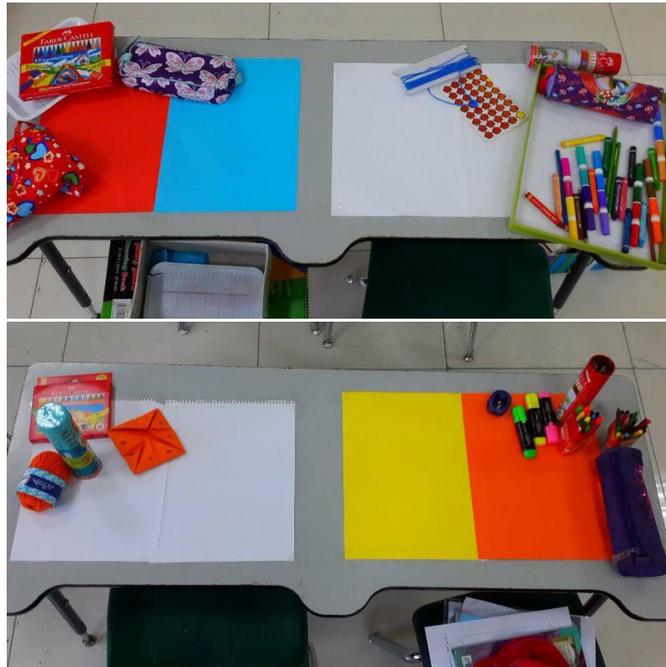


Figure 338: Students' Tables Covered With Their Chosen Colourful Papers

Students chose materials and colours that they needed to personalize their tables (Figure 339). Figure 340 shows what classroom space can look like after applying this set of cards. Finally students start personalizing their tables as shown in Figure 341. Different students personalize their tables differently (Figure 342). In this example teacher used colourful papers instead of cardboard because they are cheaper. Teacher was surprised of students' positive reaction she did not thought that personalizing tables will make students love the space.



Figure 339: Students Preparing Materials to Personalize Their Tables

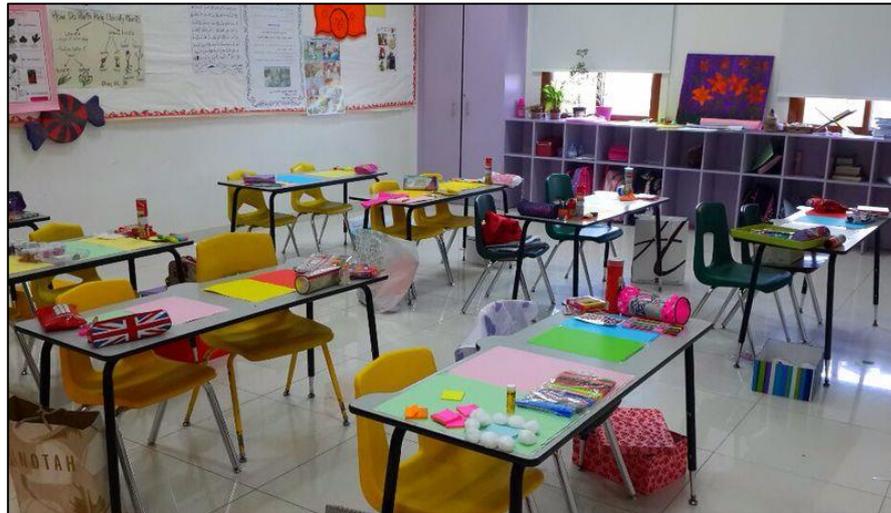


Figure 340: What Classroom Space Can Look Like When Applying Sets of Cards 3



Figure 341: Students Personalizing Their Tables



Figure 342: Students Tables after Personalizing It

5.3.6 Evaluation Results

The evaluation is a crucial stage in the process of evidencing whether a tool or process is achieving, or has achieved, its aims, and this process is important to developing concept tools and processes into designed tools and processes. This tool was evaluated during different stages of the design phase. Firstly, during early tool development the tool concept had been discussed with users and it was developed from booklet to classroom 3 dimensional model, and finally to sets of cards in a box. Secondly, a pilot study was designed to gather users' feedback about different tool design elements, before the main tool distribution and application took place. After the pilot study, the researcher

responded to users' feedback and made the required changes. The final evaluation phase was carried out after meeting the expert, discussing the tool application through the series of interviews and in open discussion with users online, where they demonstrated the tool's value and explained any problems they faced during application, often supporting discussion with evidence shared through photo documentation. The following sections present the results of tool evaluation.

5.3.6.1 The Tool Is Achieving Its Aim

The evaluation involving the teachers showed that the tool is achieving its aim, which is empowering them to change and use the current learning space to support and facilitate different teaching and learning approaches. Teachers commented that the tool showed them how to use space elements such as walls and tables for teaching purposes, while their photographic documentation evidenced and clarified the specific ways in which the tool empowered them, by depicting changes to the classroom space design based on the cards' ideas. Many teachers had a positive reaction to the tool: *"This is exactly what teachers need"* said one. The evaluation showed that using the tool has shown teachers how to use space practically to begin exploit more theoretical benefits and values of space. Furthermore, the tool evaluation exemplified what teachers are able to use the tool for *in the absence of researcher or designer supervision*. It can be applied immediately within learning space readily-available resources, for example in the Fourth application example teachers' used available colourful papers to cover the tables instead of colourful cardboard. Finally, teachers made changes to the tool idea, adapting it through use to suit their needs and further evidencing that the tool can be readily further developed by teachers and students themselves, for example in the Third application example teachers' developed the P.O box idea to ask students to send her secret letters, ask her what they want and how to they feel about their teacher. Additionally, teacher in this example offered an envelope instead of a box for every students and used it as a student P.O Box.

5.3.6.2 Solving Common Problems

Teachers' comments about different set of cards showed that the tool was capable of solving common problems mentioned previously. One teacher mentioned that set 5 "Students P.O Box" helped them to communicate and connect with their students using a playful mediator that encouraged relationship-building between teachers and students. Teachers also said that set 8 "Flooring Storytelling" made their lessons more memorable and better understood. Set 9 "Classroom Café", while more challenging if we apply it in

a competition between school classrooms, could be applied in the school courtyard in the style of an open traditional-style souq (souq is traditional Arabic market), a space which is reliant. Moreover, teachers said that Set 7 “Classroom Timeline” presents very interesting ideas, encouraging students’ creativity through its approach to interactivity. Teachers emphasized that their classroom space became, as one said, a “*beautiful world to live in after applying the card*”. According to teachers, the classroom walls are usually a big challenge as they feel responsible for creating interesting wall displays yet do not know how to do this well, especially science and maths teachers who are not confident with decoration or design ideas. The cards were seen as an excellent source of inspiration for teachers. One teacher reported that it is a great tool with potential positive impact upon students’ performance and concentration.

5.3.6.3 Creating a Space Design Awareness

Teachers have claimed that the tool had increased their awareness of space design elements, because they never thought that a box (the classroom space) could be rearranged or redesigned. There are different easy and simple approaches to make this space attractive to students. Furthermore, other teachers said that space awareness through the cards’ ideas helped teachers to offer different learning experiences. Additionally, this tool created a further awareness of available resources, including digital technology, as one of the teachers commented on Set 4 “Outside the Classroom Virtually” where they had the technology resource used in the card, but had not thought of using it in this way.

5.3.6.4 Flexibility

The tool showed flexibility in applying each set of cards, and also flexibility in merging more than one set together. Also the tool was flexible in using a set idea and applying it in different contexts. For example, in “Our Classroom Story”, the teacher replaced the idea of attaching bags to each student’s table with one envelope for all the students, because this was less expensive for her. Another teacher used the idea of the set of cards “P.O Box” to support her lesson about recycling using the concept of reusing the shoe box that was explained in this set of cards. Another teacher used the same set of cards but replaced boxes with envelopes. And finally, one teacher applied the idea of voting in the “Classroom Café” cards into different teaching context. The flexibility of using this tool encouraged teachers to use the tool and to develop its content.

5.3.6.5 Teaching and Learning Value

Teachers emphasised the central importance of the tool's value to teaching and learning, because they felt encouraged to use and keep using the tool, sometimes through adaptation. When teachers were asked about the value of the tool, they always mentioned the learning and teaching impact immediately, and stressed that it helped them to improve their usual teaching methods, due to the power of space as a teaching instrument. For example:

- Using the idea of sending personalised questions in individually posted notes to facilitate positive classroom communication;
- Using our classroom story to teach students critical thinking;
- Using the P.O. Box idea to teach students about recycling;
- using the desk probes cards to inform teachers with students' behaviour such as self-confidence;
- Using the cinema tickets as a teaching tool as suggested in "going outside virtually" cards.

Additionally, teachers' claimed that learning value was evident in students' responses to the tool applications. Teachers said observing students' impressive reaction to card applications encourages them to apply more card sets, because one of the essential encouragements for teachers to apply the tool are students' responses. Teachers argue that they did not expect to get this encouraging response from simply applying card ideas. One of the teachers explained that students responded to Set 3 "Our classroom story": "Students were very excited to see what is inside the bags and I told them it is a surprise. This card helped me to create a fun, interactive display in classroom space". Additionally it helped to encourage relationship building between students through commenting on each other's work using speech bubbles and sticking funny faces on their displayed work. Also, students who are not social and face communication difficulties in talking with other students have found it easier to communicate through speech bubbles and to start a conversation with students after that. Furthermore, it had made teaching young students how to criticise much easier and more fun, because criticising others work is usually difficult. Moreover, it turned the classroom wall into an active and interactive object. Before, it was very rare that you could see a student standing next to the wall or talking

about what is displayed; now it is difficult to separate students from the wall and they asked for more faces and speech bubbles. Furthermore, the teachers were surprised with some students' comments because of their age, not expecting mature comments, for example, one student wrote to her friend "although your work is not as good as others, I gave you a high number because you have worked hard." Another teacher explained students responded to the Set 3 "Desk Probes", saying: "my students like the idea of choosing their table colour and kept discussing with each other what colour to choose". In addition, students' surprisingly enjoyed drawing on their table and they said they had waited such long time to be able to draw on their tables. Though they were excited about drawing on the table, they were actually drawing on paper stuck on their table. Moreover, students were excited to see what their friends did with the papers on their own tables. Furthermore, students loved personalizing their table; they said "now it's our table." In addition, some teachers claimed that her students were so excited about the application of sets of card 7 "classroom timeline". Furthermore, the teacher argued that before applying this tool, the students used to hate sitting in classroom space, and after applying them the students don't want to get out of the classroom space even during break time. They kept arguing and discussing about displays on the walls, because the tool turned the walls in to a game, a playful element which students could interact with.

This section covers other comments mentioned by teachers and what they think the tool does for them, and how it does it. Teachers have mentioned different features related to card usage and function, listed below:

- The tool ideas are practical, because they only require available resources and low budget materials.
- The tool is easy to apply, because of its simple instructions, clear explanation and illustrations.
- The tool is adaptable to available materials to apply the process. For example: in applying Set 2 "our classroom story" the teacher replaced the bags with envelopes because they are cheaper. Instead of providing each student with three envelopes, the teacher put the faces, numbers and bubble speech together in one envelop. Another example involved Set 3 "Desks Probes", where the teacher replaced the cardboard paper with colourful drawing papers, because they were available, cheaper and

easier to cut. Additionally, teachers asked students to choose the colour of paper and they choose more than one colour.

- Different sets of cards need different preparation time. Whilst some cards need a long time to prepare for and need to ask students to bring material from home, other sets or cards can be applied directly.
- Section WHAT to expect is useful, because it helps teachers to compare between her/his card application and what the designer suggested it would be. However, teachers said their cards application look very similar to the illustration in the WHAT section.
- The tool improve teachers way of teaching in an interesting way, for example a teacher said they teach students outside classroom space, but they did not think of putting it into a picnic theme idea and use the picnic tools as a teaching tool as in Set of Cards 6 “Physically Outside the Classroom”. Another teacher said they display student work, but they never thought of using a students’ displayed work as a teaching tool as in Set 2 “Our Classroom Story”.
- Some set of cards can be applied not only in classroom space, but also in other spaces such as a library. For example: the idea of “our classroom party” can be applied in the library to celebrate reading books.

5.3.7 Evaluation Summary

The aim of the Classroom Design Recipe tool design was to empower teachers to use and change learning space to facilitate and support different teaching and learning approaches. In addition, this tool aimed to increase teachers’ competence with space and their awareness of learning space design elements. The evaluation stage showed that this tool had achieved its aims. Furthermore, during evaluation, teachers highlighted the learning and teaching value of the tool and students’ responses to it, which encouraged teachers to use the tool, as they were always thinking of the cards ideas in a curriculum context. Moreover, as stated above, the educational expert mentioned that this tool is different from other educational resources, because it provides practical ideas ready to be applied rather than theoretical concepts where teachers would continue to ask how to apply these theories, and in a way which is visually clear and interesting. The educational expert emphasised that *"I have attended lots of workshops that argue the importance of*

using learning space and the benefits teachers will get from facilitating space, but they do not explain how to use it". Therefore, this tool shifts the theoretical knowledge into practice, and she said that it can be used to explain to teachers how to change and use space practically.

From the tool discussion in online social networking the researcher realised that the need for how to interact, use, change, the space design element awareness are not just a learning space problem, but a problem that can occur in any space or context. There is no doubt that interacting, and changing space design elements is important in different spaces, whether a learning space or a working space. However, the real problem is how to provide users with readily-applicable and simple solutions using available resources. Furthermore, the evaluation showed that the tool empowered teachers to interact and use current learning space; however, discussing the tool with other types of space users showed that the concept of this tool could be applied in other spaces. Therefore, there is a need for further research to develop the concept of this tool in order to be applied in other spaces to help space users.



Development of a Supportive Tool for Participatory
Learning Space Design

CHAPTER 6: CONCLUSION

This research transformed the understanding of space interior design knowledge, from designing a space that shape its users and control them to designing a space that empowers the users to take control, this transformation achieved by looking at space as a convivial tool.

CHAPTER 6: CONCLUSION

6.1 Discussion

In conclusion, this research aimed to: (1) propose approaches that rethink learning space design, in order to facilitate and support learning; and (2) empower teachers to change, reshape and use the current learning space to aid different teaching and learning methods. To achieve research aims, the research was planned to comprise three phases: (1) Contextual Review, (2) Understanding learning space use and potential, (3) Tool Exemplar and Development. As mentioned, the first two phases were to initially understand the problem and to further reframe it, while phase three planned to design a solution. These phases were not a linear process; rather these phases overlapped, with understandings of the problem and solution continually interacting, connecting, reconnecting, with new connections added.

6.1.1 Phase One: Contextual Review

The first phase provided an understanding of the current learning space literature by reviewing different issues related to learning space design, highlighting gaps in knowledge, and addressing them. For example, once the gap between research and practice appeared, the researcher sourced visual examples to fill this gap. Furthermore, using observation in this phase showed that users' adaptation of space changes the design story of space, knowledge that was missing in the literature, because few researches explain what happens to space after users occupy it. The literature defines learning space as a relationship without explaining the nature of this relationship. The result of this phase showed that current contextual review of learning space explains each part of learning space (users, design elements, and learning) without explaining connections and interactions between them. Therefore, the second phase aimed to understand learning spaces and connections and interactions between their three parts. Clearly, users are the ones who connect space with its purpose after occupying it. They build relationships with space design elements and learning by interacting with space. Therefore, the second phase explored user behaviours, for example: how they interact with space through learning and teaching.

6.1.2 Phase Two: Understanding Learning Space Use and Potential

This phase, aimed to fill gaps discovered in phase one and refine understanding its problems through fieldwork. However, as phase one showed that knowledge of users' understanding of learning space is missing, it was important to understand learning space problems from users' point of view. The literature review emphasised the importance of teacher's use of space, but there was no explanation for teachers of how to use learning space. The finding of this phase filled first phase gaps, as reported in four sections: (1) Comprehend Changes in Classroom Space, (2) Create Understanding of Classroom Space, (3) Classroom Space Design Elements and (4) The Relationship between Design and Teaching Strategy. These four sections explain users' perception of learning space, knowledge that was widely missing in literature.

Fieldwork findings explained users' perception of learning space and built upon (1) understanding how users occupy designed spaces, (2) comparison between users' dream classroom with their adaptation of "finished beginning" classroom and finally (3) understanding the relationship between users, learning and space design elements. The finding showed that usually users' perception of learning space are mediated by their interpretation of the physical space.

Users perceive space different from the way that it is designed. Architects focus on environmental design elements that related to space design, such as air quality and ventilation, while users focus on relating space design elements to teaching and learning experiences. For teachers, the core value of learning space is learning. They respond to and adapt space directly to support their teaching and learning methods. Similarly, architects design tables as a comfortable piece of furniture, but teachers explain soft and rough texture using table materials as examples. In contrast, student perceive space as a fun, playful experience, and draw on and personalise their table as a playful toy. Hence understanding users' different perceptions helps architects to add playful and learning value to space design elements such as tables.

Beside explaining users' perception of learning space and its value theoretically, researcher provided design practice examples for applying theoretical knowledge (Section 5.1: Rethinking Learning Space Design Elements). Moreover, users' perception of learning space supported design of some toolbox card concepts, for example: set of cards number 3 "desk probes", which responds to teachers and students' perception of desks so the card set shows how to use students' desks as playful teaching tools using colourful cardboard cover and pencil case on the desk.

Fieldwork results also revealed that teachers are aware of the importance of using space but do not know how to use it. Many teachers lack space design awareness, as their adaptation of space showed that they miss space design opportunities. However, neither contextual review (phase one) nor the result of fieldwork (phase two) explained how to empower teachers' use of space. Although both phases one and two showed design opportunities for solutions, they were not in a form that could be used by teachers.

6.1.3 Phase Three: Tool Exemplar and Development

The third phase planned to design a tool to empower teachers. As mentioned above, "how to empower teachers' use of space to facilitate teaching and learning" was not answered in phase one or two. Therefore, Phase 3 aimed to design a solution that empowers teachers to use learning space by designing a toolbox. The resulting *Classroom Design Recipe* solution was designed to create spatial awareness to empower teachers to use space to facilitate teaching and learning.

The concept of Convivial Tool was chosen as a strategic guide because it enabled the researcher to empower teachers' use of space to facilitate teaching and learning, because a Convivial Tool:

- lets users invest the world with their own meaning, in comparison to the tool, the tool should allow teachers to invest the learning space with their own meaning
- uses design to make users' productive activities more fulfilling, e.g., *Classroom Design Recipe* uses different interior design concepts to make learning and teaching more fulfilling.
- encourages designers to 'under-design' to let users complete the design process to make space suit their needs without designers' supervision.
- encourages users to move to higher levels of creativity. *Classroom Design Recipe* encourages users to be more creative through its application in space.
- Build scaffolds on which people can make their own experiences.

The content in *Classroom Design Recipe* is based on the knowledge gained from phases one and two. For example, the tool was designed as several sets of cards. Each set empowers teachers' use of space by responding to theoretical knowledge found in the

first research phase and/or solving problems users mentioned in phases two or one. The tool empowered teachers to use and reshape their current space with its available resources without the need for designers' supervision; teachers reported that the tool enabled them to translate their theoretical knowledge of teaching method into design in a space. Furthermore, this tool empowered teachers to use space as a teaching instrument to add teaching and learning value to design elements of space.

Furthermore, through all research phases, three approaches helped to achieve research aims. The research process exploited concepts from three different design thinking approaches:

1. **Overlapping spaces:** Brown (2009) presents a continuum of design innovation as a group of overlapping spaces rather than a sequence of linear steps, As advocated for design thinking, the phases of this research overlap and are not linear steps.
2. **Co-evolution of problem and solution frames and spaces:** Dorst and Cross (2001) explained the nature of design creativity for problem and solution spaces, and the movement between these overlapped spaces. This helped the researcher to understand framing and reframing of problem and solution spaces and their evolution during research phases. However, neither Dorst and Cross nor Brown approaches explain how these spaces are created.
3. **Connecting unconnected ideas:** Koestler's bisociation concept (Sanders and Stappers, 2012) guided understanding of co-evolution of problem-solution spaces across the three research phases. Sanders and Stappers (2012) in their book "Convivial Toolbox" explain that creative thinking usually emerges by making new connections between previously unconnected ideas. This concept is called Bisociation and it was introduced by Koestler in his book "The creation of Art". Problem-solution spaces were created and evolved in each research phase by connecting ideas that could come from anywhere: literature, fieldwork, or other design fields.

In each overlapping research phase, information was gathered (from literature and users) and later connected to create, frame and evolve problem and solution spaces. The connection, reconnection and the exploring of new connections is what formed problem and solution space in each phase. Additionally, in terms of Koestler's bisociation concept, new connections between previous unconnected concepts revised understandings of both solution and the problem, for example:

- Concepts from literature, fieldwork results, social networks, other disciplines' inspirations, and creative practice was connected in the first and second phase to understand and find the problem. Reconnecting these five elements in the third phase produced solutions.
- By reconnecting elements, different solutions emerged, as in each set of cards in the toolbox. A detailed explanation of the connection between these five elements, the ideation process and how solutions emerged every time these five elements were connected is given in the thinking map for each set of cards in APPENDIX 7. Reconnecting these five elements can provide more set of cards ideas in the future.
- Reconnecting these elements helped to rethink some theoretical concepts in the literature review, for example Section 2.7.5.1.1 (Social Spaces). As mentioned in the literature review, learning space is more than its structure; it is the social relationships within the space (Victorian.Institute.of.Teaching, 2011). There is a big focus on socialising and interaction in learning space, as explained in Section 2.5.5.1.1. The current literature does not explain how to design a space that encourages interaction and socialising. Designing social spaces in the literature is limited to different furniture grouping designs. However, the fieldwork showed that there was no evidence for students' interaction with physical elements of space and socialising was not be seen. In addition, users' reported that interaction with space was limited and teachers found it difficult to motivate students to socialise. A comparison was made between successful socialisation on virtual Facebook walls and socialisation on the classroom physical walls (comparison in Set of cards 2). In the fieldwork, teachers claimed that students should interact with the wall displays, comment on, share their work on the classroom walls and criticise each other work, yet evidence of these interactions were not seen on classroom space walls. Comparing teachers' claims about classroom physical

walls with Facebook virtual walls, the way users interact, comment on each other and share shows that there is an interesting interaction happening. Therefore, a question was asked why users of Facebook interact with each other while they don't interact with each other on classroom physical walls. The answer was because Facebook offer users tools that encourage them to interact with each other. Users can share different things and comment on each other using the comment space and like or dislike button. Additionally, users can express their feelings using emotional faces. However, the design of learning space doesn't offer such tools to students. Giving tools to students (as the evaluation of Set of card 2 showed) can encourage students to interact with what teachers display on the wall and communicate with each other to provide a rich social space. This comparison, and the tool evaluation results, revealed that architects need to design tools within social spaces to encourage students to socialise and interact with each other in order to gain the educational value of social spaces. There is a need to rethink social space design not only in the way students sit in group, but also to design tools alongside seating to encourage students to interact, communicate and socialise.

6.2 Research aim

This research aimed to: (1) propose approaches that rethink learning space design, in order to facilitate and support learning; and (2) empower teachers to change, reshape and use the current learning space to aid different teaching and learning methods. The first aim targets the initial stage of designing learning space which is about planning, designing and shaping space, while the second aim targets users who receive the space after building, aiming to empower users to reshape the designed building and continue designing space in order to facilitate their needs. Next sections present the achievements with respect to these two aims.

6.2.1 Propose Approaches to Rethink Learning Space Design

This research proposed approaches to rethink the relationship between theory and practice of learning space design, and how the theoretical knowledge of learning can be translated to design, because design is poorly addressed in current literature on learning spaces. These approaches were presented in the second chapter "contextual review", where theoretical knowledge of learning was translated into design in space, using visuals to show how theory could design in practice by revealing the hidden text in the visuals of

different design projects. This reduce the gap between theory and practice of learning space. A further approach was creating an understanding of users and their responses to designed learning space, and translating this understanding to design practice solutions for architects and teachers. This understanding provided insights for rethinking current and future learning space, and furthermore shows how theoretical understanding can be translated to design practice. For example, this approach explained how to challenge current concept of learning space design and proposed different design solutions to architects for how to add educational value to space design elements to integrate teaching and learning with physical design of space such as furniture, this was explained in chapter four. Similarly, teachers can reshape their space to facilitate different teaching and learning methods using the “Classroom Design Recipe” tool, as explained in chapter five. Furthermore, this research supports a shift in our understanding of learning space interior design currently from a three dimensional space with surfaces (wall, flooring and ceiling) and technical design elements (lighting, temperature and air quality) to in future shaping users’ teaching and learning via toolbox of resources that empowers users to shape learning experiences.

6.2.2 Empower Teachers to Use the Current Learning Space

The “Classroom Design Recipe” tool demonstrably empowered teachers to use and reshape their current space with its available resources as evidenced in the evaluation section of chapter five. Without the need for designers’ supervision, teachers reported that the tool enabled them to translate their theoretical knowledge of teaching method into design in a space. Furthermore, this tool empowered teachers to use space as a teaching instrument to add teaching and learning value to design elements of space.

6.3 Contribution to knowledge

This research has made four main contributions to knowledge, which are now defended:

6.3.1 Different visual forms demonstrate multiple values

Visual resources were vital for the outcomes of this research. Visuals are central to much design practice (Section 2.2: The value of visuals): the IDEO design company use visuals to support lateral thinking (Kelley and Littman, 2001); designers use visuals as an integral part of studio practice (Eckert and Stacey, 2000) including collages and mood

boards (Keller, 2005). However, visual resources have a range of design research roles in this thesis, taking them beyond being a supportive practice element for inspiring and expressing design thinking.

In phase one, a gap was found between the theoretical literature and the practical design of learning space. Researchers have developed theoretical knowledge on the impact of design elements such as colour, texture and lighting, but this knowledge is not communicated with the support of visuals from actual design projects. However, without such visuals, theorised elements lack meaning as design elements in space. Sourcing visuals from different design projects helped to enrich the literature on learning space design, and demonstrated how to design elements to achieve theoretical potentials for environmental and psychological impact. For example in chapter two, Smith (2008) claimed that in theory colours can be used to define a space's form and manipulate its users, but this is better communicated via a visual example of an architect's work. For example, Barragan (Ambasz, 1984) demonstrated this theory in practice by colouring architectural planes such as walls, fins and floor to define forms that look like (and are) entrances or setting benches (chapter two, Figure 37). Similarly, the literature mostly theorises lighting in learning spaces in terms of its purpose, and can provide extensive technical information. However, there is a limited literature about lighting as a decorative element. However, theorising lighting as decorative and not just functional is demonstrated in visuals from the "Tree of Dreams" project: Figure 32, (Chami, 2008). Overall, visuals in phase one reduced the gap between practice and theory, as visuals help to communicate, exemplify and give design meanings to published theoretical knowledge.

Furthermore, visuals can reveal implicit theoretical knowledge that published research has not yet reported, which improves understanding of learning space. For example, there is little or no published theoretical knowledge on how users occupy space and reshape its design, nor is usually expressed theoretically by users. However, this knowledge is explicit in visuals of actual usage of learning spaces. Visuals tell users' stories and expose latent information about their adaptation and usage of learning space. The implicit theories here communicate knowledge about learning spaces after their "finished beginning" from architects. For example, in phase one, visuals from teachers' blogs applying Montessori's educational concepts to classroom space revealed the concept of using space as a *tool* (Section 2.4.2.1: Montessori). Conceptualising space as

a tool extends it beyond the functional capabilities of an architect's "finished beginning" to a set of design elements that can be adapted for new purposes. Thus during phase two fieldwork, visuals of the use and reimagining of space exposed new possible *meanings* for learning space design elements, such as using tables as personalised design elements (chapter four, Figure 245) . One way to use space as a tool is thus to introduce new meanings via design elements. Another way to create new meanings via design elements was seen in phase two students' drawings. Students reconceptualised windows to be not only a functional source of natural light and ventilation, but also a means to provide visual access to wonderful things happening outside classrooms (Figures 221-222: students look from the window at aliens in their spaceship surrounded by a sleeping moon and stars, with other examples in Section 4.2.3: Classroom Space Design Elements). Therefore, in phase one and two, visuals provided theoretical possibilities for non-functional meanings beyond the published literature on design elements.

Visual resources thus informed, structured and guided theoretical research in phase one. In phase two, visuals were sources of critical concepts and lenses through which the researcher could code and interpret fieldwork data. The coding systems for visuals collected from fieldwork and social media are explained in chapter four (Section 4.2.1: Second Phase Analysis, teachers and students). Overall, visuals in phase one and two strengthen the research and practice of learning space design

In the third phase, visuals inspired design solutions and sometimes they *were* the solution in the context of specific sets of cards. Tool content was sourced directly from children's drawings and users' classroom photos in Set of Cards 6 and 7. Overall, the students' drawings inspired rethinking of learning spaces, and inspired the box of cards design (Section 5.1.6). Students' drawings provided specific inspirations, for example, to design *interactive* learning spaces(Figure 159: Interactive Walls, Figure 160: Interactive Ceiling, Figure 161: Interactive Furniture, all Chapter 4) . The design value of students' visuals in phase 3 can be further seen in: drawings of open learning spaces that offer a variety of learning experiences (Figure 343: Users' Open Learning Space, Chapter 4); and in drawings that showed possibilities for changing students' roles in space from passive to active learners.

In summary, visual resources thus had multiple value:

1. They reduced gaps between practice and theory by providing concrete design examples (Phases 1 and 2).
2. They revealed how users reshape their learning spaces, exposing implicit theoretical knowledge absent from the written literature, taking design elements beyond fixed initial functions to providing opportunities for the creation of new meanings and as a tool for teaching and learning (Phases 1 and 2).
3. They guided qualitative data coding of text and images from field work and social media (Phase 2)
4. They inspired solutions, and in some contexts, were used as an element of the solution (Phase 3).

6.3.2 Users' perceptions of learning space

Literature reviewed in phase one separately explained each part of learning space (learning, users and design elements) but not the connections and interactions between them. This limits our understanding of learning space and thus how to design it (Section 2.9: Literature Gaps). For example: the literature emphasises the importance of the relationship between users and space, but does not explain how this relationship is built between them, or how students and teachers occupy their learning space and respond to the objects designed in this space. These gaps in understanding are due to users' perceptions of space being missing from the literature, but it is users in learning spaces who connect learning and design elements through their use of space. Therefore, the second phase of the research aimed to fill this gap.

In phase two, users' perceptions of learning space were researched through primary fieldwork data and social media data (mostly secondary). Users' perceptions were exposed in several ways, for example through their interpretation of physical space, and through comparisons between users' dream classrooms with their current adaptations of "finished beginning" classroom.

Users' perceptions of learning space provided missing answers to phase one "how to design" questions, showing how learning space can be redesigned to work as a third teacher or silent curriculum. For example, Section 4.2.1.1 (Comprehend Changes in

Classroom Space) helped to better understand how to improve learning spaces by comprehending users' changes to space such as: using wall as a teaching tool (Figure 139), displaying on windows (Figure 144), designing a shopping area in corridors to teach students mathematics (Figure 182). This understanding inspired the phase three concept of adding teaching and learning value to learning space design elements (Section 5.1: Rethinking Learning Space Design Elements). Furthermore, it inspired some design solutions in the tool; for example, Set of cards 9: "Classroom Café" suggests designing the corridor as a shopping mall that creates different learning groups and links corridors with classroom space.

Moreover, users' perceptions revealed design elements that were overlooked by architects, as explained in Sections 4.2 and 4.3. Users emphasised design elements such as display, describing it as a powerful design element because of its changing flexibility, and for being a mediator between users and space elements (phase two – chapter four). Another element revealed by teachers is activities, designing activities can create a space that not only offers variety of seating arrangements, but also offers a variety of activities to offer a variety of learning experiences. This understanding was used in phase three to design a tool that used users' understanding of space to support redesign of classroom spaces. The tool did not draw on published knowledge from architecture. For example: users' understanding of display as a design element inspired redesign of classroom walls as an interactive teaching tool (Set of cards two: Our Classroom Story).

Overall, users' perceptions provided new meanings for learning spaces and their design elements that informed the design practice in phase three. For example, during fieldwork, users did not understand space mainly in terms of its architect designed elements, but rather in terms the interactions that accrue from their actions inside classrooms (Figure 158 - interactive flooring, Figure 159 - interactive walls, Figure 160 - interactive ceiling). Therefore, it is important to add learning and teaching value to all interactions between users and space objects. In response to this, the researcher provided design examples in phase three for adding learning and teaching value to learning space interactions (Card sets 2, 3 and 5).

Comparisons between how users design elements (phase one and two) such as nature, texture and colour with architect-provided elements in space exposes new meanings. Users use design elements as teaching and learning resources (e.g., Section 4.3.3.1: Lighting), while architectural designers design them for health and comfort elements. In

addition, users add other meanings to elements through variety and personalising, showing how meanings can be designed into space (Section 4.3.3.12: Variety and Section 4.3.3.13: Personalising).

Similarly, children as important users of learning space communicated their perceptions of space through their drawings. In them, they introduced new meanings that effectively redefined space elements such as tables, chairs and other objects, which became interactive objects that communicated with students to integrate learning within their design (Figure 159: Interactive Walls, Figure 160: Interactive Ceiling, Figure 161: Interactive Furniture, all Chapter 4). Students' redefinitions of classroom furniture strongly influenced designs in phase three, where furniture is used to help students to identify and express themselves (Section 5.1: Rethinking Learning Space Design Elements).

Users' perceptions of learning space as discovered in this research through a range of investigations are an original contribution to knowledge. As with the use of visuals across the research, these discovered perceptions have multiple forms of value:

1. They answer practical "how to design" questions that are not currently answered in published theoretical literature
2. They reveal how some design elements are overlooked in the current literature, and need to be included when designing practical support for learning space users
3. They expose new potential meanings, including using space as a tool to deliver teaching and learning value, for future learning space design by both professionals and learning space users.

6.3.3 Social networks support effective design research practice

Social network sites give users the opportunity to share many of the most desirable qualities of good educational technologies, allow communication through peer feedback and match the social contexts of learning in schools, universities or local communities (Mason, 2006). Social media is opening up new opportunities for virtual interaction and communication with users all over the world, with diverse backgrounds and cultures, and with people that share similar interests (Dingman, 2012). New social media as a communication technology is now an extraordinarily salient information source (Walther et al., 2010), and a data source with a range and richness that was previously was

impossible to access (Walther et al., 2010). As a result, data collected from social networks has made the design research reported here much more effective.

In the first phase, where researcher was reviewing learning space design, social networks were an important visual resource that helped to better understand theoretical knowledge (through the sourcing of actual examples of theory in practice) and revealed new implicit theories through unpublished practices (e.g., chapter two Figure 2: Children Bookstore in Beijing, Figure 4: Colourful Primary School in London, Figure 10: Interactive Wall in Udavi Gentillesse School). Unpublished practices (i.e., outside of the learning space research literature) revealed new potential design meanings in the context of new implicit theoretical knowledge about learning space design elements (Section 2.7: Design Elements of the Learning Space).

In phase two, social networks provided secondary data which complemented primary data from field work to help to understand how users adapted and used learning space, further revealing latent messages in learning space, and adding to those discovered in phase one. The use of social networks in phase two was explained in Section 3.4.5 (Users' Social Medias Analysis and Participation).

In phase three social networks were used twice: at the beginning of the tool design stage to inspire solutions from teachers' shared teaching aids (Section 5.2.33: Figure 266: McDonald's Word Wall, Figure 267: Angry Verbs); and at the end of tool design for evaluation (Section 5.3.3 Evaluation Methods and Responses).

Social media thus proved to be a valuable support for research practice with different roles during research: understanding theoretical knowledge in the first phase, understanding users' adaptation of space in the second phase and lastly inspiring and evaluating the toolbox in the third phase. The use of social media in this research as a source of examples, inspirations and evaluation data is an original contribution to methodological knowledge for participative design research. As with the use of visuals and the discovery of users' perceptions across the research, social media resources provided multiple forms of research value:

1. They provided practical "how to design" questions that are not currently answered in published theoretical literature by providing examples of users' adaptation of space

2. They revealed how some design elements are overlooked in the current literature, and need to be included when designing practical support for learning space users
3. They inspired elements of the tool solution
4. They supported evaluation of the tool solution.

The first three forms of research value are shared with visuals and users' perceptions. However, from phase two onwards, use of social media became more interactive with direct involvement of the researcher, moving beyond sourcing visual and textual examples to interactions with learning space users. Both primary and secondary data was thus gathered. The fourth form of research value was unique to the use of social media, and is evidence of its reach and richness. Social media allowed discussions and interactions across countries and professional communities, and drew in a key influencer in one professional areas. The interactive capabilities here added research value that simple data collection, whether visual or textual, could not.

6.3.4 Empowering teachers through Classroom Design Recipes

The current literature on learning space (as reviewed in phase one) emphasised the importance of teachers' use of space, while phase two findings showed that teachers are aware of the importance of using space, but do not know how to fully exploit it. However, both phases one and two did not provide a basis for empowering teachers' use of space. Although both phases one and two showed design opportunities for solutions, they were not in the form that could be used by teachers. Both phases one and two raised the concept of using classroom as a tool through new possibilities for meanings and associated interactions. However, these phases do not explain how to design space as a tool. Therefore, the main influence for the tool developed in phase three was the *Convivial Tool* concept (Section 5.2.3.1 Convivial Tool), which had not been in scope in phases one and two. A convivial tool does not give teachers instructions or guidelines to follow, but instead gives them inspiring resources to work with and adapt. A tool becomes convivial when it removes the boundaries between professional experts and clients, and instead empowers users to find their own solutions without expert support.

The convivial toolbox concept helped the researcher, using her background as interior architect, to empower teachers by packing an interior design space into a toolbox, which was a box containing sets of cards. This toolbox (Classroom Design Recipes) empowers

teachers by suggesting a variety of practical solutions through different sets of cards. Each set of cards presents different ways to increase teachers' awareness of space and its design elements to finish an "architects' beginning" design, which helps teachers to facilitate their teaching and learning methods. For example, Set of cards 2 (Chapter 5), increases teachers' awareness of wall displays and involves students in designing displays by using walls as a teaching tool. Furthermore, applying the tool adds educational value to physical space objects, which empowers teachers to use space as a teaching instrument. For example, Set of cards 3 adds teaching value to students' desks.

The conviviality concept helped the researcher to build on discovered users' perception of learning space to share integrations of learning with space elements via sets of cards. This shows teachers how to add learning and teaching values via redesign of interior space elements, such as using flooring as a teaching tool to tell students different stories (Set of cards 8) and using ceiling to record classroom activities timeline (Set of cards 7).

This approach opened up a broad range of ways to empower teachers to reshape the interior of learning spaces through the cards' application. The potential here was confirmed by the evaluation activities. This toolbox packs interior design solutions in a portable box (with a web version) that can benefit a large number of learning space users, by helping them to customize their own design solutions. The tool was designed to be a scaffold on which users can build their own learning experiences. Its flexibility lets its users adapt the cards' ideas with their available resources. Each set of cards can be used by all teachers within their limited resources. New sets of cards can be (and were) easily added. Existing sets of cards can be (and were) easily revised.

In summary, the Classroom Design Recipe tool:

1. Exploits the Convivial Tool concept to empower learning space users to redesign learning spaces as tools for new meanings and interactions that create new teaching and learning value
2. Has been positively evaluated, primarily through social media, which extended the reach of these activities beyond teachers in Bahrain to professionals and key influencers in more than one country, profession or role.

3. Is an open solution that can be extended and revised by its designer and (learning) space users, both collaboratively and independently
4. Makes use of learning space users existing resources to scaffold independent redesigns of learning spaces

6.4 Research Limitations

Although this research has reached its aims, the researcher still aware of its limitations and shortcomings. First of all, the research took a long time to understand the problem, find and design a solution which limited the tool evaluation time. A better evaluation would be achieved by a larger group over a longer time. Secondly, using social networks in evaluation caused difficulties in recording users' responses to the tool, because many users do not share their tool applications. Therefore, it is difficult to have an accurate record participants' use. Using social networks need longer time to follow the users and keep in contact with them, answer their questions, and socialise with them. Thirdly, during this research journey, two methods were developed to collect data from classroom users, however, researcher did not apply these methods and change them because of users' time limitation, and the difficult political situation in Bahrain during data collecting period.

6.5 Further Work

1. A further work is needed to continue the tool evaluation and gain more insights to develop the tool, as users are still using this set of cards. The users' respond will help also to create new sets of cards and enrich the theoretical knowledge of learning space design.
2. The work which that brought together the theoretical knowledge of learning and learning space design projects which started in literature review chapter will be continued, more learning space projects will be analysed and connected to theoretical knowledge of learning and space design to build a bridge between research and design.
3. As the evaluation showed that some teachers needed the cards with resources, researcher is planning to develop the idea of each set of card separately in different toolbox that offers the written illustrated cards with resources needed to apply the

set of cards such as: faces, papers, toys and other three dimensional objects. In addition, different ways of applying the ideas card will be added.

4. This research gave design examples for adding teaching and learning value to elements such as students' desk, walls and windows, (Section 4.2.3). However, due to limited knowledge in this area of research, future work will primarily focus on integrating learning and teaching with design elements of learning space and revealing design solutions for adding learning and teaching value to physical elements of space.
5. The framework of learning space design elements developed during this research will be developed and restructured. The framework constructed in Section 4.3 brought together design elements from the literature and users' together. This research explained the design practice of these elements and went beyond the health and comfort impact. However, this framework is at its beginning stage, and still need a further research to examine the new design elements to help architects meet users' need in space.
6. The researcher also intends to continue collaborating with space users by activating the YouTube channel for "classroom design recipe". I will be working with teachers in classroom space in order to give video examples of tool preparation, application and its effect on students' learning and teachers' teaching method. Activating YouTube channel will activate users' role and other social network that is linked to it to continue collaborating and communicating with users and study their respond.
7. Part of the concept of making "Classroom Design Recipe" came from transferring the concept of convivial toolbox Tools to interior design (explained in Section 5.1.3.1). This reflection offered a different perspective for understanding the interior design of a space, as it showed that a space given to users can be compared with a toolbox. A space can be a toolbox that has three dimensional triggers such as: flooring, wall and ceiling. This understanding showed a potential in designing an interior space that gave more power to its users to reshape the designed space, and inspire designers to design a space that encourage users connectivity and communication. As I started applying this concept in learning space in this research, I would like to take this concept further and apply it in other spaces such

as workspaces, children's rooms and libraries as the evaluation of the tool have showed a potential for applying it in different space context (Section 5.2.3, 'unfocused' group).

8. The researcher is planning to continue exploring new materials and techniques to design tools that help design researchers to work with children. As "Classroom Design Recipe" suggested using different materials with different techniques through tool application such as feathers, wools and newspapers. I have started exploring different materials and techniques with my eight years daughter. Next examples of materials and techniques I have been exploring. First example (Figure 344 and Figure 345) I used different materials in gardens to produce different visuals with my daughter, using garden materials, such as tree leaves benefiting from their colour, texture and shape diversity. Figure 344 is a face made of tree leaves and Figure 345 shows two birds with blue sky created by clips.



Figure 344: Face Made out of Leaves



Figure 345: Two Birds with Blue Sky

Second example (Figure 346) is using children Finger Prints to create and describe different characters. Third example (Figure 347) is Story Cubes. Story Cubes is a box with nine dices and images on them. This tool is designed to help children tell stories by asking them to roll dices randomly then have a look at the images they got, connect images and write a story. I used them with my daughter to write a story and she suggest a further use which is using the dices to create imaginative thoughts starting by imagine that. Every time you roll the dice new connections can be made and new creative thoughts could be discover. The Story Cubes concept could be applied in different contexts using different visual connections.

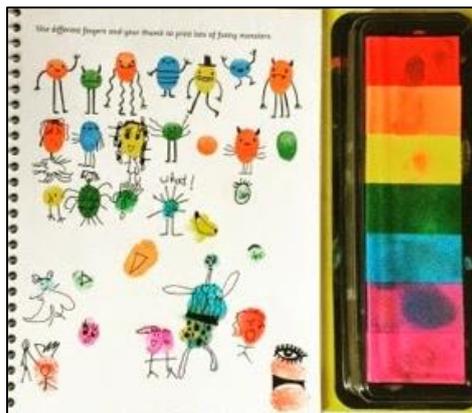


Figure 346: Finger Prints Characters



Figure 347: Story Cubes

6.6 Summary

This research has addressed the gap between learning space research and user practices. Current research does not offer practical guidance or take note of best practices by architects and space users. Teachers and students need to be enabled to make the best use educationally of the “finished beginning” provided by architects.

The research began with filling the gap between research and practice by building a bridge between the theoretical knowledge and practices of learning space design. This bridge was built by looking into three areas (1) Research: asking where is design guidance in the theoretical knowledge of learning? (2) Design: asking what is the theoretical knowledge behind design? (3) Usage: what do users contribute to learning space practices? Findings across these three research areas produced a foundation for understanding learning space use and potential, but their findings were not in a form that classroom users could apply. They would not empower teachers.

Empowering teachers achieved by designing the “Classroom Design Recipe” tool. This tool empowers teachers to use and reshape their current space with available resources and use space as a teaching instrument to add teaching and learning value to design elements of space. The tool achieved its aims using the convivial toolbox concept, which allows teachers to customize their own design solutions. This tool is designed to be a scaffold on which users can build their own learning experiences. Additionally, the toolbox supports future data collection from classroom users that will extend our understanding of learning space use and potential.

This research made rich use of visuals to fill the gap between research and practice. Visuals provided concrete examples of theoretical knowledge of learning and learning space. However, also visuals informed and supported design practice with undocumented implicit theoretical knowledge of learning. Further, visuals exposed users’ tacit knowledge underlying their adaptation and usage of learning space. Finally, visuals inspired or provided the solution and provided examples of toolbox usage for the evaluation. However, all these uses of visuals depended on a deep understanding of qualitative analysis, and ethnography especially the concept of thoughtless acts.

This research transformed the understanding of space interior design knowledge, from designing a space that shape its users and control them to designing a space that empowers the users to take control. This transformation happens by understanding space as a convivial tool with resources controlled by its users instead of a space with environmental design elements. This transformation in understanding interior design of space opens a new door in designing interior space and understanding the role of users in space.

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APPENDICES

APPENDIX 1: John Dewey

John Dewey was one of the most dominant figures in American education (Novak, 1960). Dewey created and experienced school where he explored new methods of teaching (Dudek, 2007). He espoused democratic principles and championed occupational, hands-on instruction, and this concept revolutionised learning practice in the USA, Europe and Asia for thirty years (Dudek, 2007, Simpson, 2006). Dewey's main focus was in creating schools that were cooperative communities to help individual learners achieve their potential (Dudek, 2007). He believed that one of the most challenging goals for schools was the cultivation of reflective people, people who had the ability to reflect on and grow from their own life and school experiences (Simpson, 2006). In addition, one of the most famous learning concepts that was first recognised by Dewey, and that has been used since by learning space designers, is that to stimulate children's senses is an important part of education (Dudek, 2007): *"The boy flying a kite has to keep his eye on the kite, and has to note the various pressures of the string on his hand. His senses are avenues of knowledge not because external facts are conveyed to the brain, but because they are used in doing something with a purpose"* (Dewey, 1916).

John Dewey's specific approach to teaching influenced schools designed by Frank Lloyd Wright between 1900 and 1908. This approach captured the imagination of educators during the immediate post-war years and such school architecture became paradigms in the history of school architecture (Dudek, 2007). Additionally, these schools encompassed many of Dewey's educational ideas in new architectural forms and designs of real complexity (Dudek, 2007). His thoughts on architecture demonstrated the important relationship between education and building architecture. Dewey connected educational methods in the nineteenth century to a comparable spirit in the architecture of that period, with its stylistic as opposed to social concerns (Dudek, 2007). Furthermore, Dewey's philosophy had a great impact on the spirit of the new pluralistic architecture represented by the work of Frank Lloyd Wright and C.R. Mackintosh during the twentieth century. Dewey's philosophy supported good planning, sound construction, visual delight and variety, which was exemplified by Arts and Crafts embellishments in the space design (Dudek, 2007). Dewey wanted to create a parallel transformation in children's education by making it more various and natural and he felt that new learning spaces should have complementary qualities for this new way of education. Frank Lloyd

Wright echoed Dewey's philosophy and designed the first building for Hillside Home School at Spring Green, Wisconsin (Dudek, 2007).

The reason for choosing Dewey is the effect of his theory on the way new learning spaces were built, therefore his concept of learning was translated into school design by architects. However, comparing his theory with Montessori, Dewey's theory is limited to the schools which were built using his theory, while Montessori tools because of the flexibility of the tool making have moved to different learning spaces, applied in different countries and changed the learning spaces that have been built.

APPENDIX 2: Examples of Participatory Approach Projects

1. New Dalry Primary School, North Ayrshire

New Dalry Primary School is one of the schools in the 'Changing Classrooms' project, which was produced by The Lighthouse (the Scottish Centre for Architecture, Design and the City) and supported by the Scottish Government and COSLA (Hyslop and Hutton, 2009). The aim of this project was to illustrate the importance of the relationship between space and learning. The 'Changing Classrooms' projects provide interesting examples of different ways of using spaces which can help teachers to improve learning in the context of the Curriculum for Excellence (Hyslop and Hutton, 2009). The projects show how spaces can implement and support a variety of learning activities by, for example, changing and re-arranging the layout of a classroom, or by using it differently to create new places within current spaces, as well as by using outside spaces more effectively (Hyslop and Hutton, 2009).

The design of New Dalry Primary School in North Ayrshire supports the concept that the architecture of a space can be a learning resource; it can demonstrate theories, ideas and inspire people's curiosity as well as stimulate users' senses (Jamieson et al., 2006). Additionally, New Dalry Primary School's project reflects the process of learning by demonstrating the value of a whole school cooperating with a school community by involving them in a school design project (Jamieson et al., 2006). Furthermore, in this project, artists and architects have cooperated with pupils and teachers in the design process creating a new concept in primary school architecture (Hyslop and Hutton, 2009). This school is designed as a learning prototype to offer users many opportunities to employ different teaching methods and to use or modify the facilities and spaces (Hyslop and Hutton, 2009).

The aim of the New Dalry Primary School project was to offer a new language of learning spaces, thoughts, concepts and data within the fabric of the design of the new school by using an 'imbedded intelligence' approach. This approach to the design of learning spaces starts from the concept that the space itself can be a learning tool. Thus, this concept aims to create designs where the space structure delivers the curriculum (Colquhoun, 2009), where hallways and corridors tell stories, where the layout proposes systems of measurement, and where particular 3-D space relationships speak about the local and global environment (Jamieson et al., 2006). The building construction methods

and the materials in this concept provide and are used as a variety of learning tools and teaching approaches. For example, in the “environment house” at New Dalry Primary School, a floor was cut out and replaced with a glass sheet to show the under-floor central heating pipes; the same idea was used in part of the ceiling in order to show the rainwater system (Colquhoun, 2009). *“Facts, figures, phrases and stories have been incorporated into the structure with historical, site specific text and information and these help to prompt pupils to engage with their environment, to ask questions and encourage them to take responsibility for their learning”* (Jamieson et al., 2006). Figure 348 shows the Abacus wall and .

Figure 349 shows the classroom interior in New Dalry Primary School.



Figure 348: (Left): Abacus wall in New Dalry Primary School.

Source: (Colquhoun, 2009).

Figure 349: (Right): Classroom interior in New Dalry Primary School.

Source: (Colquhoun, 2009).

Figure 350 shows the Brain from outside this is a space for the ICT Suite, .

Figure 351 shows the Brain space from inside, Figure 352 illustrates the Library space in the school, while Figure 353 and Figure 354 show New Dalry Primary School from the outside.



Figure 350: (Left): The Brain from outside (a space for the ICT Suite). Photo: Dirk Buwalda. Source: (Colquhoun, 2009).



Figure 351: (Right): The Brain from inside. Source: (The-Scottish-Government, 2008).



Figure 352: Library space in New Dalry Primary School.

Source: (The-Scottish-Government, 2008).



Figure 353: (Left): New Dalry Primary School from outside. Source: (Architecture-and-Design-Scotland, 2010a).



Figure 354: (Right): New Dalry Primary School from outside.

Source: (mike331278, 2010).

2. Colmonell Primary: an Award Winning School

Colmonell Primary is a small rural school in South Ayrshire which was completed in 2011 for South Ayrshire Council by ARPL Architects in Colmonell. The school won the

i.e. ; Silver Award for Education and Sustainability Categories i.e. ;Roses Design Awards 2011 i.e. ;Best Education Design and Glasgow Institute of Architects 2011 (Architecture-and-Design-Scotland, 2011). Figure 355 shows Colmonell Primary School from the outside.



Figure 355: Colmonell Primary School from outside.

Source: (Elite-Ayrshire-Business-Circle, 2011).

The main challenge of this project was to create a variety of spaces within one space, and different scales within the space (Architecture-and-Design-Scotland, 2011). Figure 356 shows the plan of Colmonell Primary School.

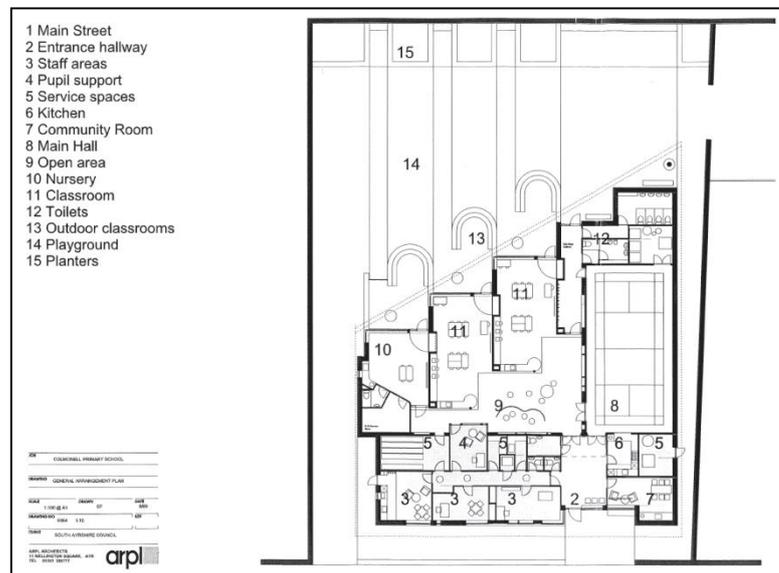


Figure 356: Plan of Colmonell Primary School. Source: (Architecture-and-Design-Scotland, 2011).

According to the project designer, the project’s success depends on three key ideas: “Engagement, involvement and ownership are the keys to the whole success – out of that you’ll get the information that you need”(Architecture-and-Design-Scotland, 2011). Communication and participation among the project architects, the client (South Ayrshire

Council), school users and the community was thus the key to the project's success. There was a strong relationship between the school architects and school users; this relationship was built through informal conversation (Architecture-and-Design-Scotland, 2011) in which pupils and teachers were asked what they wanted from their new school. After that, the architects presented a rough 3D model made of foam board to give pupils something visual to interact with; in addition, teachers and pupils showed architects sketches of what their ideal school looked like (Architecture-and-Design-Scotland, 2011). The result of the participation revealed that pupils were interested in two main issues: firstly, pupils addressed environmental issues and asked for a school that was good for them and good for the environment; secondly, the pupils strongly requested a space to play and an outside area that would keep them active. Thus, the outdoor learning space is an important teaching element in the Colmonell School programme; particularly, it enables plants and vegetables to be grown in the garden (Architecture-and-Design-Scotland, 2011). Some of the key design features of this school are:

1. Semi-open plan classrooms were designed with a wall separation to create different spaces within one space. Additionally, these classrooms were joined with a “break-out” area that allows a variety of activities to be carried out at the same time in one space. Designers created different activity spaces and different zones within one space using soft furnishings, different floor surfaces and lighting for areas such as the library. This helped teachers to deal with groups of pupils carrying out a variety of activities in the same space. Figure 357 shows pupils executing a variety of activities in the same space while Figure 358 shows the semi-open plan classrooms in Colmonell Primary School.



Figure 357: Pupils carrying out a variety of activities in the same space.

Source: (Elite-Ayrshire-Business-Circle, 2011).



Figure 358: Semi-open plan classrooms in Colmonell Primary School.

Source: (Architecture-and-Design-Scotland, 2011).

2. The furniture and settings at this school are designed in such a way that allows pupils of different ages and sizes to be involved in different activities. For example, there are spaces where the worktops drop down, enabling a child to sit or kneel; bay windows in the classrooms where pupils can sit and read; and a comfortable seating zone next to the bookshelves which creates a library and a seating area (Architecture-and-Design-Scotland, 2011). Figure 359 shows examples of the furniture in Colmonell Primary School and Figure 360 shows some of the settings in the school.



Figure 359: (Left): Examples of furniture in Colmonell Primary School.

Source: (Thornton-EME-Group, 2011).

Figure 360: (Right): Examples of settings in Colmonell Primary School.

Source: (Architecture-and-Design-Scotland, 2011).

3. The classrooms and playground have visual contact with the fields and countryside surrounding the school; this creates a strong connection with outdoors. Additionally, designers created outdoor learning and play areas are directly connected to each classroom; these are covered with an overhang so they can be easily used, even in bad weather conditions (Architecture-and-Design-Scotland, 2011). Figure 361 shows the visual contact from classroom to the fields and countryside surrounding the school.



Figure 361: Visual contact between the classroom and surrounding fields and countryside.

Source : (Thornton-EME-Group, 2011).

APPENDIX 3: Aesthetics

An Example of high-quality, café style furnishings materials, designed with an inclusion of an outdoor ‘learning terrace’ can be seen in Karolinska Institute in Sweden. Karolinska Institute where designed as a learning space café with different high quality seating arrangements using a variety of colours, textures, materials and seating shapes as shown in Figure 362.



Figure 362: Karolinska Institute

Source: <http://www.contemporist.com/2013/09/06/future-learning-environments-by-tengbom/>

Additionally this Institute was designed with an inclusion of an outdoor ‘learning terrace’ which shown in Figure 363, however, this design have brought the aesthetic experience of outdoor natural features to indoor space and connected outdoor nature to indoor interior design.



Figure 363: ‘Learning Terrace’ in Karolinska Institute

Source: <http://www.contemporist.com/2013/09/06/future-learning-environments-by-tengbom/>

APPENDIX 4: Crowding

Crowding is about the number of students in a certain place; it is the degree of perceived social density within a school or classroom space (Evans, 2006, Lang, 2002, King and Marans., 1979). Elements such as density, crowding and privacy support social regulation. It is important to mention here that density is a physical concept while crowding is a psychological one (Martin, 2002a). Density can be defined as the number of users per unit of space (Martin, 2002a) while crowding is a personal reaction which is based on the sense of being in too small a space (Steele, 1973, Heimstra and McFarling, 1978, Moore, 1979). Additionally, Graetz and Goliber's (2002) research linked density with low student achievement. In a crowded classroom, pupils can easily be overlooked because of the small space size and the high number of students which causes a high density situation. Furthermore, according to Moore's (1979) observations, high-density increases aggression, decreases social interaction, and encourages non-involvement. However, teachers may not be aware of the way space may support or hinder group dynamics, individual privacy and feelings of crowding (Lackney, 1994).

APPENDIX 5: Data Analysis

This appendix presents details of the methods' analysis. Methods which are used in this research explained in table 1. Table 11: Explains Methods Used to Collect Data in This Research

Table 11: Explains Methods Used to Collect Data in This Research

| RESEARCH METHODS | | | | |
|-------------------|--------------------------------------|--|---|---|
| METHODS | METHODS' TOOL | WHO? | | WHY? |
| Observation | Note recoding | Classroom space with and without users | Participants | Understanding literature review gap |
| | Drawing sketches | | Five Schools: 1. Al-Eman School 2. Al-Naseem School 3. Muharraq Al-Falah School 4. Riffa Al-Falah School 5. Umar Ben Al-Katab School | How users utilize classroom space |
| | Taking photos | | | |
| | | | | Understand what is happening in classroom space |
| | | | | Learning space design elements |
| Interview | Semi structure interview questions | Teachers | Participants | Explore classroom space through users eyes |
| | | | 15 teachers | Understand classroom space through users eyes |
| | | | | Learning space design elements |
| Photo analysis | Photos of teachers' classroom spaces | | Participants | Visualising teachers interview answers |
| | | | More than 400 photographs | Explains teachers' terminologies which are different from designers |
| | | | | Limits interview bias |
| | | | | Different aspects of classroom space |
| | | | | Teachers' awareness of classroom design elements |
| Document analysis | Pages of teachers planning book | | Participants | Limits interview and photos bias |
| | | | 38 pages of teachers' planning book | Comparison between interview, photos and documents |

| | | | | |
|------------------|---|----------|--|--|
| | | | | Teachers' competence of classroom space |
| Drawing Analysis | Students' drawing "classroom of their dreams" Notes explains their drawing | Students | Participants | Understand students' perception of classroom space Explore classroom space through students' eyes |
| | | | 170 Drawings were collected supported by students' notes | |

Observation Analysis

At this stage, the researcher has visited five schools and took notes and photographs of the learning spaces. During observation notes, sketches and photographs were taken for each classroom. These five schools are: (1) Al-Eman School, (2) Al-Naseem International School, (3) Muharraq Al-Falah School, (4) Riffa Al-Falah School, and (5) Umar Ben Al-Katab School.

Table 12: Observation School

| School Number | School Name |
|-----------------|--------------------------------|
| School 1 | Al-Eman School |
| School 2 | Al-Naseem International School |
| School 3 | Muharraq Al-Falah School |
| School 4 | Riffa Al-Falah School |
| School 5 | Umar Ben Al-Katab School. |

School 1 Al-Eman School is one of the religious schools in Bahrain, it is an expensive private school and it has two separate buildings for girls and boys. For this particular research, only the girl's buildings were visited. Figure 364 shows examples of Al-Eman School classrooms. *School 2* Al-Naseem International School is an American international school in Bahrain which teaches American curriculum. Figure 365 shows examples of Al-Naseem International School classrooms. *School 3* Muharraq Al-Falah School is a three story building which transformed into a primary girls and boys private school. Figure 366 shows examples of Muharraq Al-Falah School classrooms.



Figure 364: Examples of Al-Eman School Classrooms



Figure 365: examples of Al-Naseem International School classrooms



Figure 366: Examples of Muharraq Al-Falah School Classrooms

School 4 Riffa Al-Falah School was a compound of three houses which transformed into a primary school for boys and girls. Figure 367 shows example of Riffa Al-Falah School classrooms. *School 5* Umar Ben Al-Katab School is a state primary school, which is for girls only. Figure 368 shows example of Umar Ben Al-Katab School classrooms.



Figure 367: Example of Riffa Al-Falah School Classrooms



Figure 368: Example of Umar Ben Al-Katab School Classrooms

The researcher used observation methods as a comparative approach to reviewing the literature on learning space. This approach took into account the teachers' ways of utilising their space and their support for various teaching techniques and strategies. Five schools were observed, and the observations were recorded through written notes, drawing sketches and capturing photographs of different school learning spaces. In order to analyse observation data, the researcher connected the sketches with the notes and the photographs using different analysis approaches. The following sections explain these approaches: (1) First Approach, (2) Second Approach, and (3) Third Approach.

First Approach

In the first approach, *Affinity Diagram*, was used to analyse the different types of observation data. In this approach sketches were connected with photographs and notes of each school. The schools included: School 1- Al-Eman School, School 2- Al-Naseem School, School 3- Muharraq Al-Falah School, School 4- Riffa Al-Falah School and School 5- Umar Ben Al-Katab School. The following section shows first approach applied to each school.

Al-Eman School

Putting together different types of observation data explains in Figure 369 and Figure 370 interior details of classroom space in Al-Eman School, in these figures different interior details are shown such as store, curtains, whiteboard, displays, flooring materials and ceiling lighting.

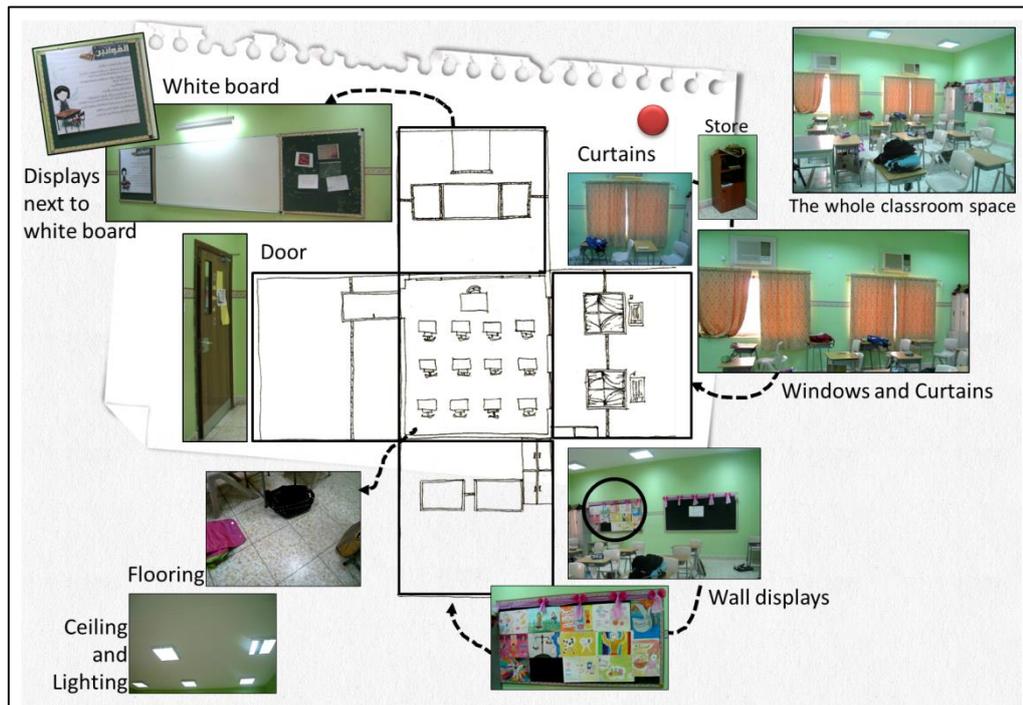


Figure 369: Interior Details of Classroom Space in Al-Eman School

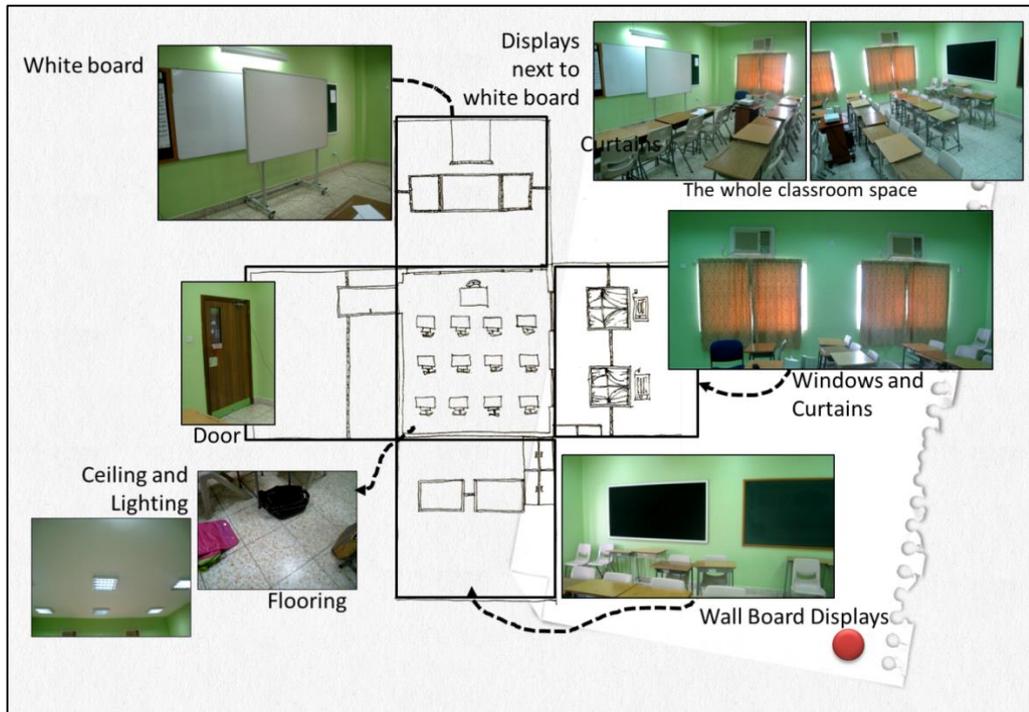


Figure 370: Interior Details of Classroom Space in Al-Eman School

Classroom space is connected with other spaces in school such as corridors, Figure 371-Figure 373 show corridors in Al-Eman School. These have shown the different purposes and interior details in the corridors. They also show interior details such as: flooring materials, wall colours and displaying board.



Figure 371: Corridors in Al-Eman School



Figure 372: Corridors in Al-Eman School



Figure 373: Corridors in Al-Eman School

In addition, the researcher observed other learning spaces in Al-Eman School. Figure 374 shows IT room, library and Laboratory spaces in AL-Eman School. Additionally, Figure 375 shows stair case and lockers space, multi-purpose hall, theatre, teacher space and praying space in Al-Eman School.



Figure 374: IT Room, Library and Laboratory Spaces



Figure 375: Stair Case, Lockers, Multi-Purpose Hall, Theatre, Teacher and Praying Spaces in Al-Eman School

Additionally, the researcher has observed outdoor spaces in Al-Eman School. Figure 376 shows outdoor sitting areas, fountain, and playful spaces in Al-Eman School.



Figure 376: Outdoor Siting Areas, Fountain, and Playful Spaces In Al-Eman School

Al-Naseem School

Putting together different types of observation data explains interior details of different classroom spaces in Al-Naseem School which is shown in Figure 377-23. Comparing the sketch of different classroom spaces in Al-Naseem School showed that classrooms have almost the same plan, and what differentiates between classrooms spaces are the interior details of space especially the displays. Observing these interior design details in Figure 377 the diverse display ideas can be seen and different space surfaces are used for display such as: walls next to the white board which are usually the classroom space focal point, displaying boards on the window walls and finally displays on the classroom door which is the entrance of the classroom space.

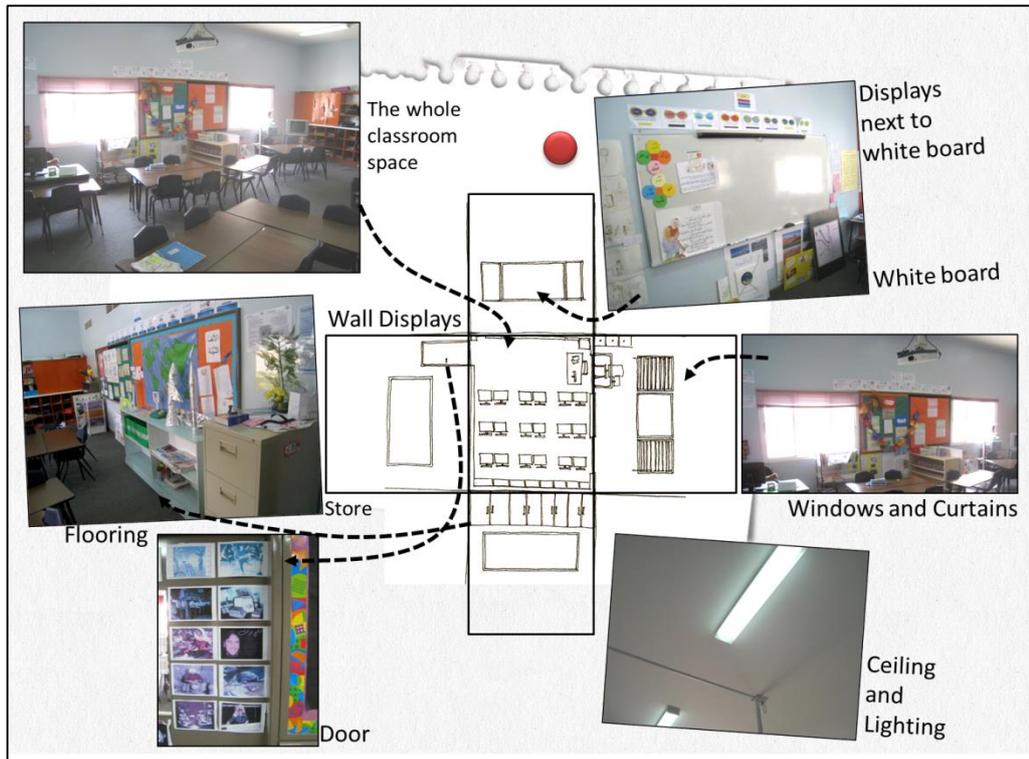


Figure 377: Interior details of classroom space in Al-Naseem School

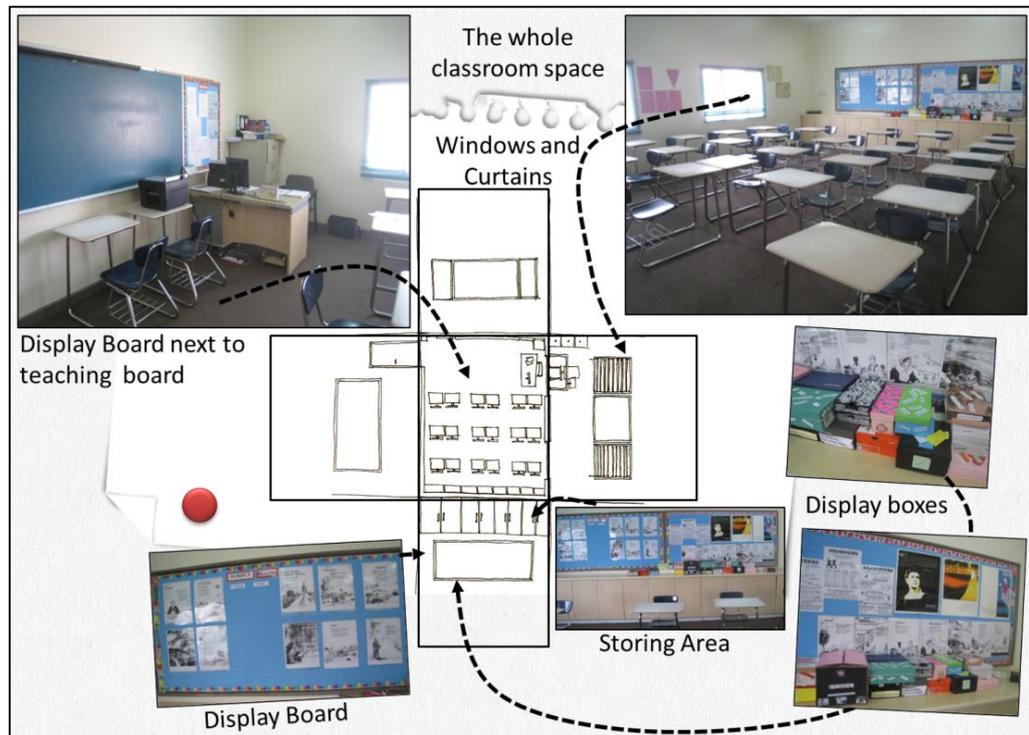


Figure 378: Interior details of classroom space in Al-Naseem School

However, there are other interior designs details that can be seen in Figure 379 which are tables and chairs. These create a colourful classroom space with rich diverse shapes and colours; however their design limits teachers teaching strategy because tables and

chairs arrangements are not flexible to be change. In addition the door display in Figure 379 had added interesting visual pattern to the space entrance.

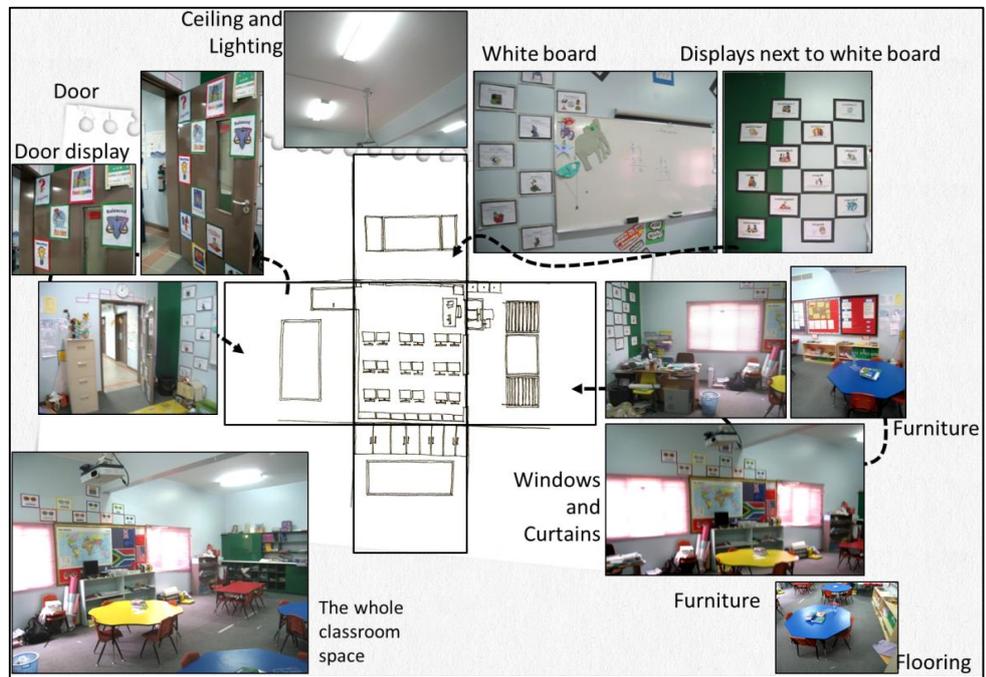


Figure 379: Interior details of classroom space in Al-Naseem School

There are some common objects that could be seen in almost all the classroom space interiors, for example: students’ tables and chairs, window, store, board, display boards, teacher’s table and chair and projector. Figure 380 and Figure 381 show some of the classroom space common objects.

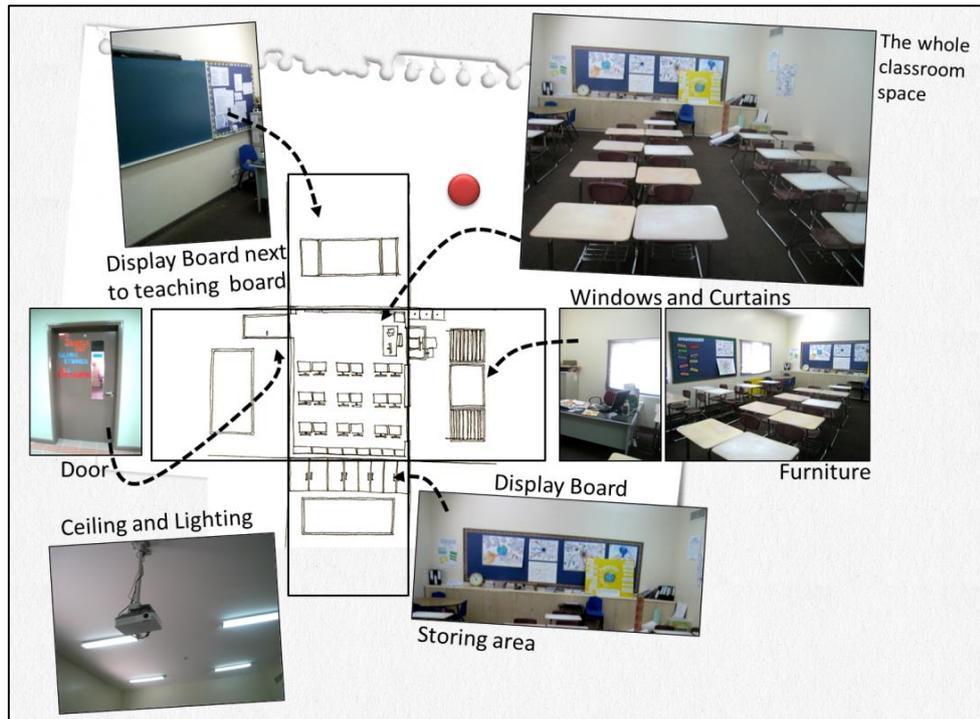


Figure 380: Classroom Space Common Objects

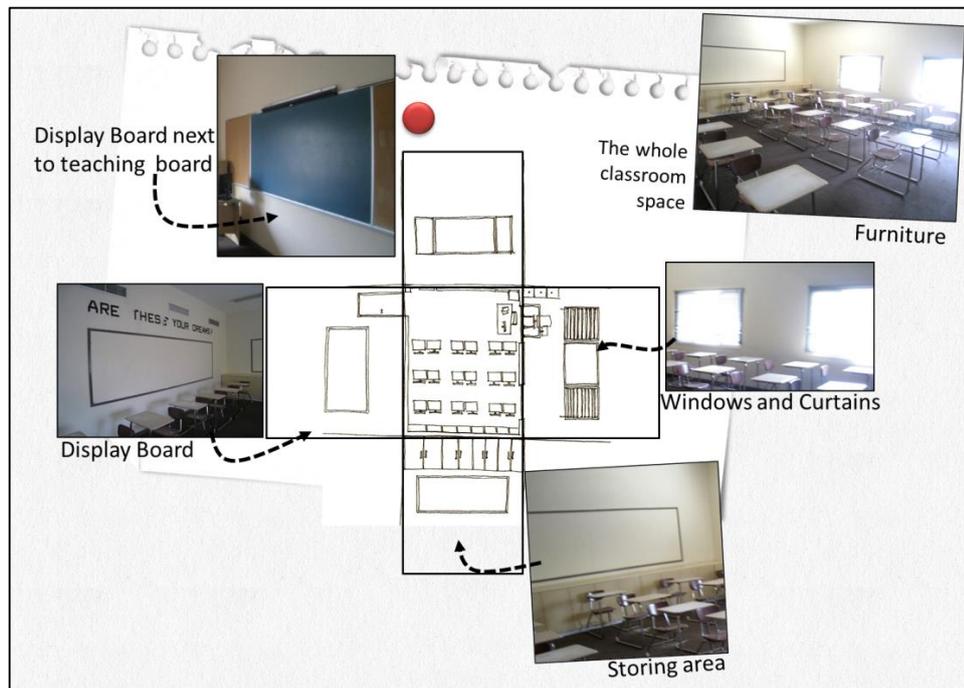


Figure 381: Classroom Space Common Objects

Some of the teachers add to classroom space their own interior design details, as an example Math teacher classroom in Al-Naseem School, Figure 382 shows Math teacher classroom in Al-Naseem School. The Math teacher believed that it is important to stimulate students' five senses through space design therefore; he had added colourful decorative lighting next to the board and an aquarium with colourful fish to stimulate

students' sight sense. In addition he used different perfume smells in different lessons for students to link different lessons with different perfumes smells, because according to him different smells stimulate students' smell sight.

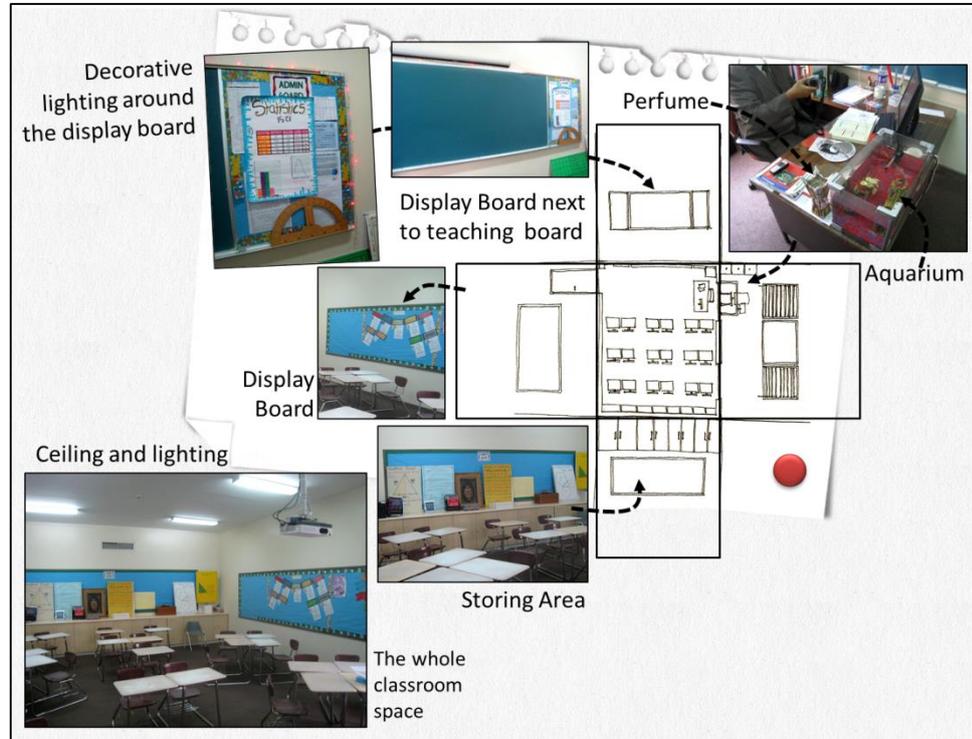


Figure 382: Math teacher classroom in Al-Naseem School

It is important to mention classroom space display tells observers part of what is happening in the classroom space and explains some of the space story. For example the world map displayed on the wall in Figure 383 tells the space observer that classroom students have been learning about something related to world maps.

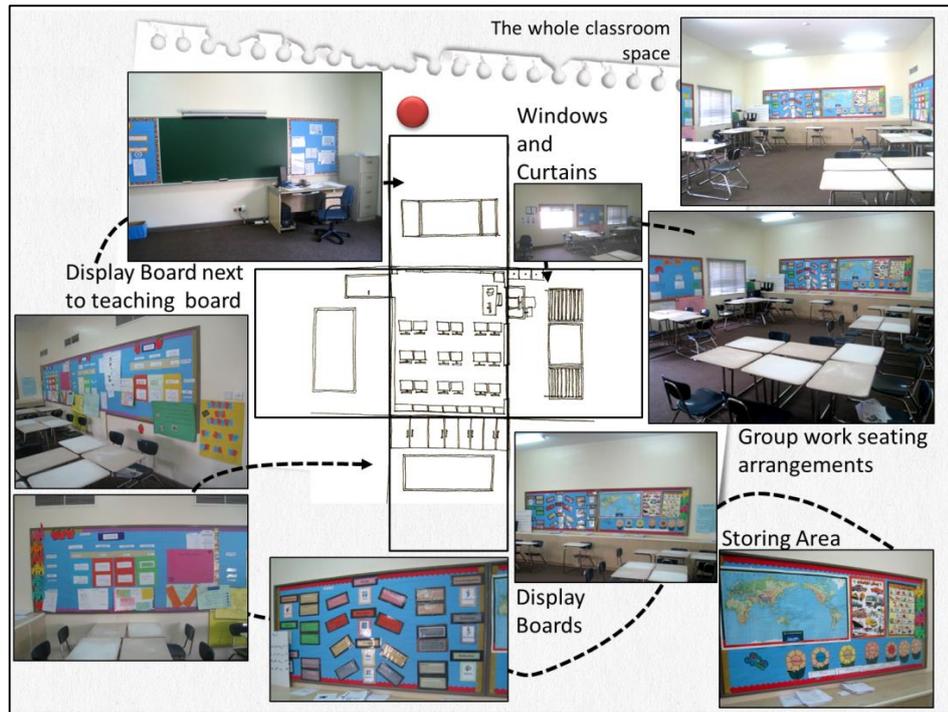


Figure 383: World Map Displayed in the Classroom Space and Other Interior Design Details

In Figure 384 diverse ways of displays add diverse aesthetics to learning space in term of diverse patterns, shapes and colours.

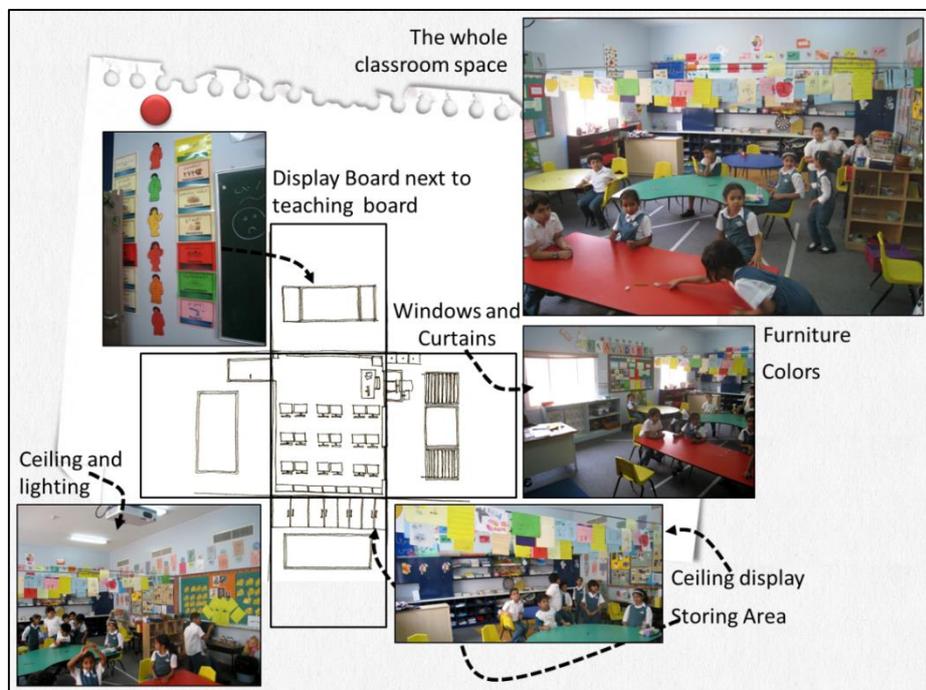


Figure 384: Diverse Ways of Displays

Some teachers had created more than one space within one classroom space using storing shelves as a partition and different colourful rugs as a separation between different

spaces function. Figure 385 shows more than one space within one classroom space. Although classroom space in Figure 385 has the same plan as other classroom spaces its interior design details have given it a different character. For example: the colourful furniture and displays with their diverse shapes and pattern.

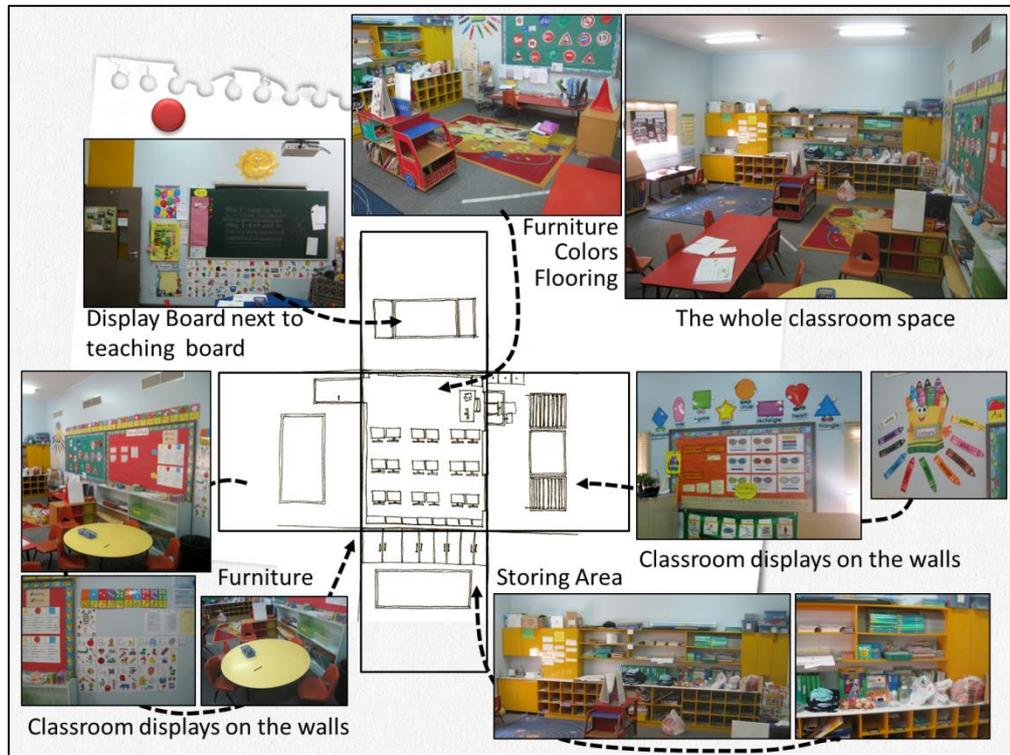


Figure 385: More Than One Space within One Classroom Space

Classroom space is connected with other spaces in school such as corridors. Figure 386- Figure 389 show corridors in Al-Naseem School. Corridors in schools are used for different functions, for example: in Figure 386 corridors are used for displaying students' work and for students to hang their bags.



Figure 386: Al-Naseem School Corridors Used For Displaying Students' Work and Hanging Their Bags

Corridors displays in Figure 387 shows rich colours, shapes, visuals, patterns and topics



Figure 387: Displays in Al-Naseem School Corridors shows rich Colours, Shapes, Patterns and Topics

Usually in corridors displays are on the walls, but in Figure 388 ceilings are used for displays as well. Figure 388 shows displays hanged from the ceiling in Al-Naseem School corridors. Moreover corridors are used for students' cabinets and as a seating area as shown in Figure 389.



Figure 388: Displays Hanged from the Ceiling in Al-Naseem School Corridors



Figure 389: Students' cabinets and seating areas in Al-Naseem School Corridors

Figure 390 and Figure 391 show other learning spaces in Al-Naseem School. Figure 390 shows library, and staircase space in Al-Naseem School and Figure 391 shows Teachers room and laboratory space in Al-Naseem School. Figure 392 shows outdoor spaces in Al-Naseem school such as: different seating areas, soft playground and greeneries.

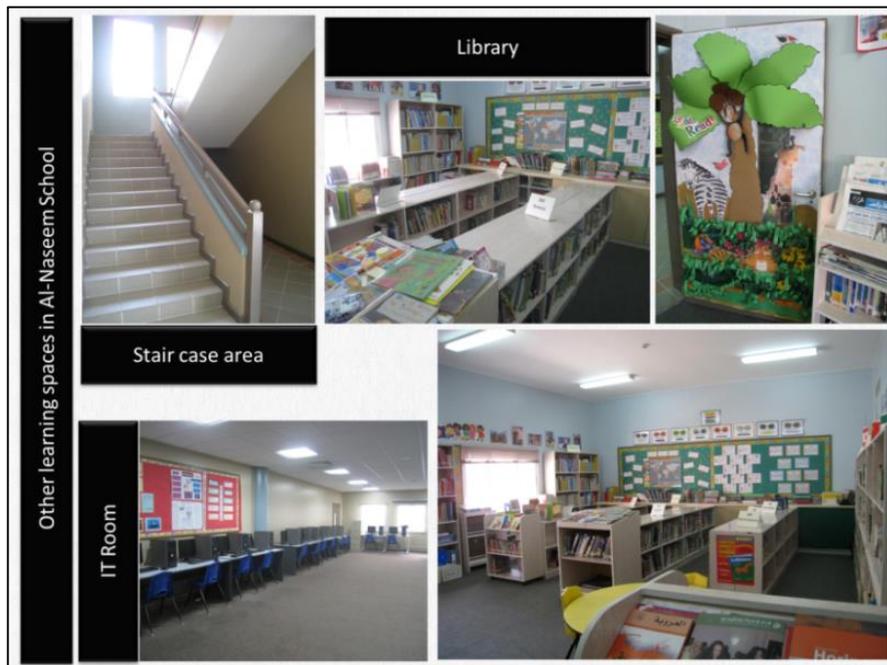


Figure 390: Library, And Staircase Space in Al-Naseem School



Figure 391: Teachers' Room and Laboratory Space in Al-Naseem School

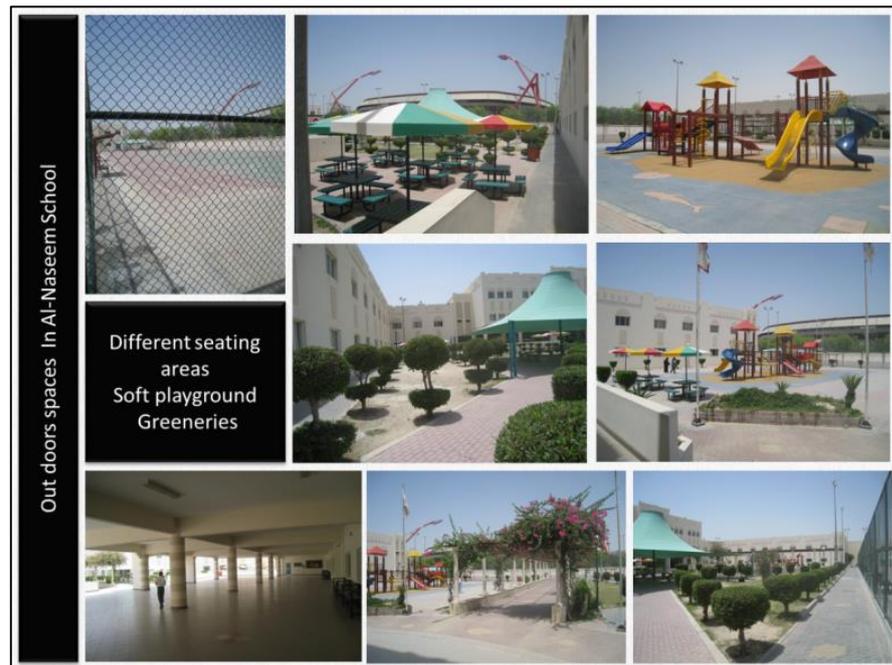


Figure 392: Outdoor spaces in Al-Naseem school

Muharraq Al-Falah School

Figure 393-40 show different examples of Classroom space in Muharraq Al-Falah School, and classroom space interior details such as: whiteboard displays boards, windows, furniture, curtains, ceiling, lighting and flooring.

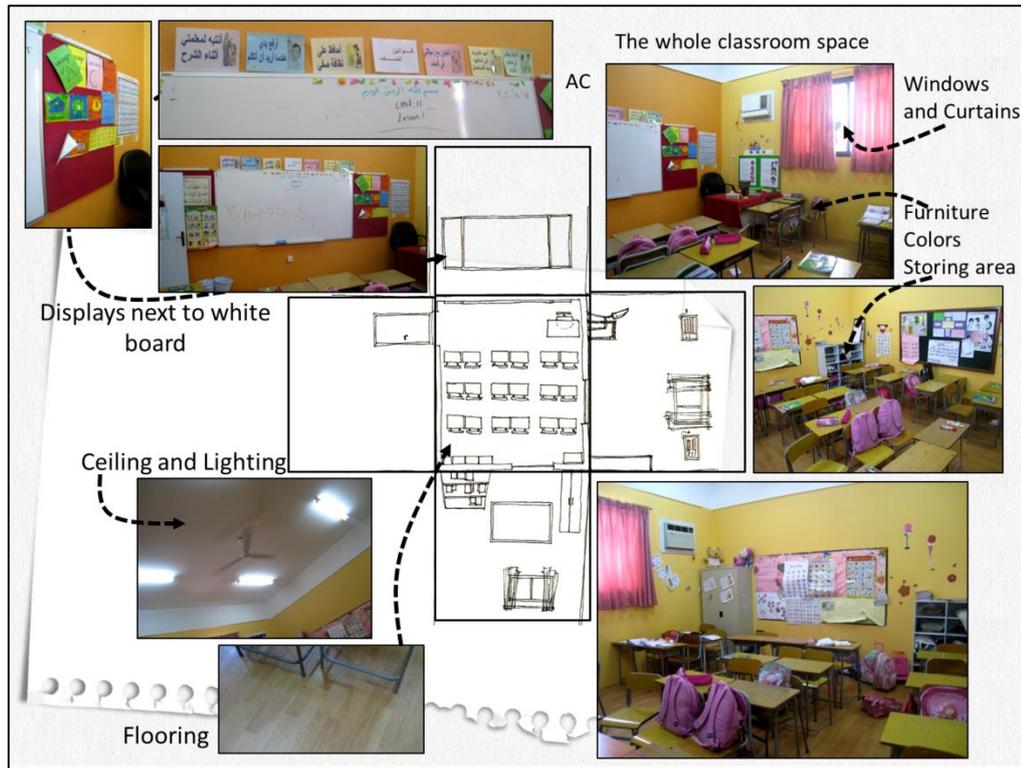


Figure 393: Interior Details of Classroom space in Muharraaq Al-Falah School

All classrooms in Muharraaq Al-Falah School have almost the same layouts; however users' give different classroom spaces different characters using different wall colours. For example in Figure 393 walls are yellow, in Figure 394 walls blue, in Figure 395 walls are aqua green and in Figure 396 walls are lemon green. Often the walls are used to for displaying things in the classroom space, nevertheless in Figure 394 and Figure 395 displays are suspended from the ceiling.

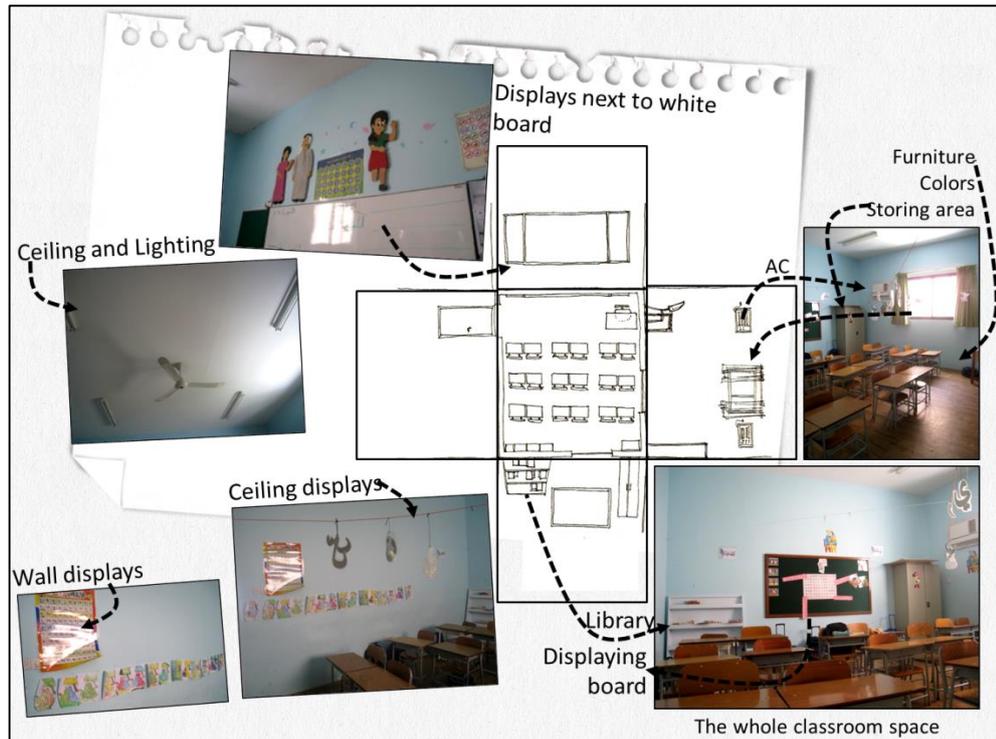


Figure 394: Classroom space in Muharraq Al-Falah School



Figure 395: Classroom space in Muharraq Al-Falah School

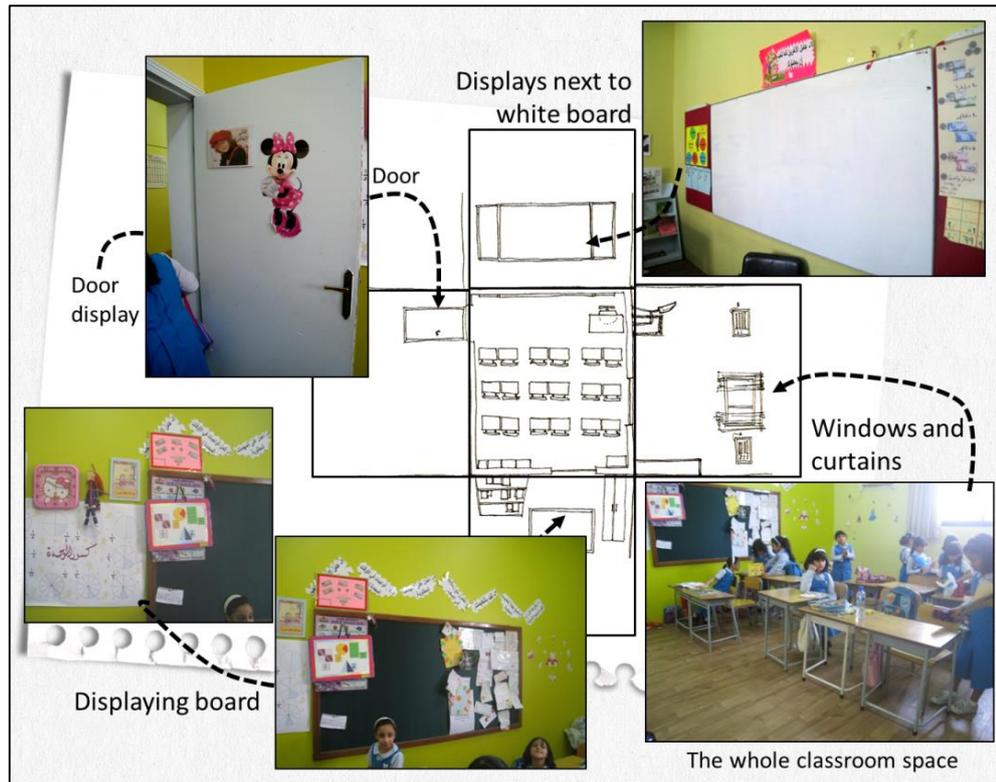


Figure 396 :Classroom space in Muharraq Al-Falah School

Corridors are connected with classroom space; Figure 397 shows corridors in Muharraq Al-Falah School. In Muharraq Al-Falah School corridors ceiling are covered with different fabric colours and walls are painted with yellow colour. As shown in Figure 397 corridors are used for different functions, for example: displaying motivational quotes, honouring excellent students by displaying their names on corridors walls and having competitions between students and displaying their scores on corridor walls. In addition, Figure 397 shows corridors' interior design details such as colours, furniture, doors and displays.



Figure 397: corridors in Muharrq Al-Falah School

Figure 398 show other learning spaces in Muharrq Al-Falah School, it shows photos of administration, IT room, multipurpose hall and library space.



Figure 398: other learning spaces in Muharrq Al-Falah School

Riffa Al-Falah School

Figure 399-Figure 401 show different examples of classroom space in Riffa Al-Falah School. Classrooms in Riffa Al-Falah School almost have the same plan; however, what distinguish between different classroom spaces are their interior design details such as windows, furniture, displays, lightings and wall colours. For example: classroom walls in Figure 399 and Figure 400 are light blue and classroom walls in Figure 401 are light pink.

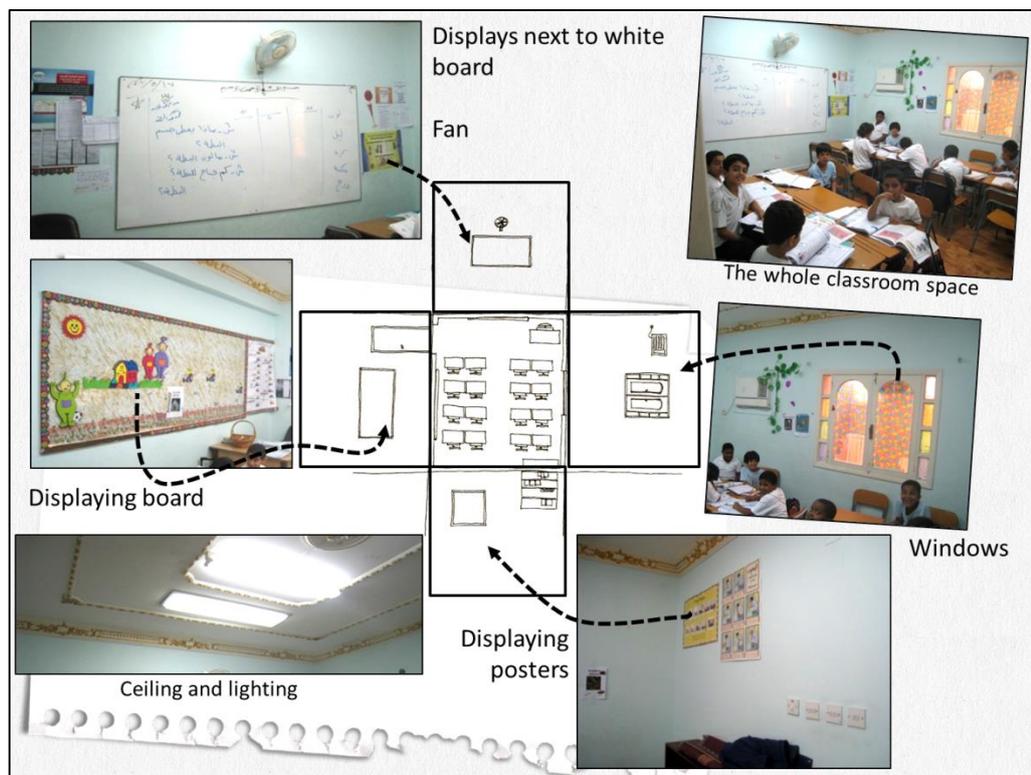


Figure 399: Classroom space in Riffa Al-Falah School

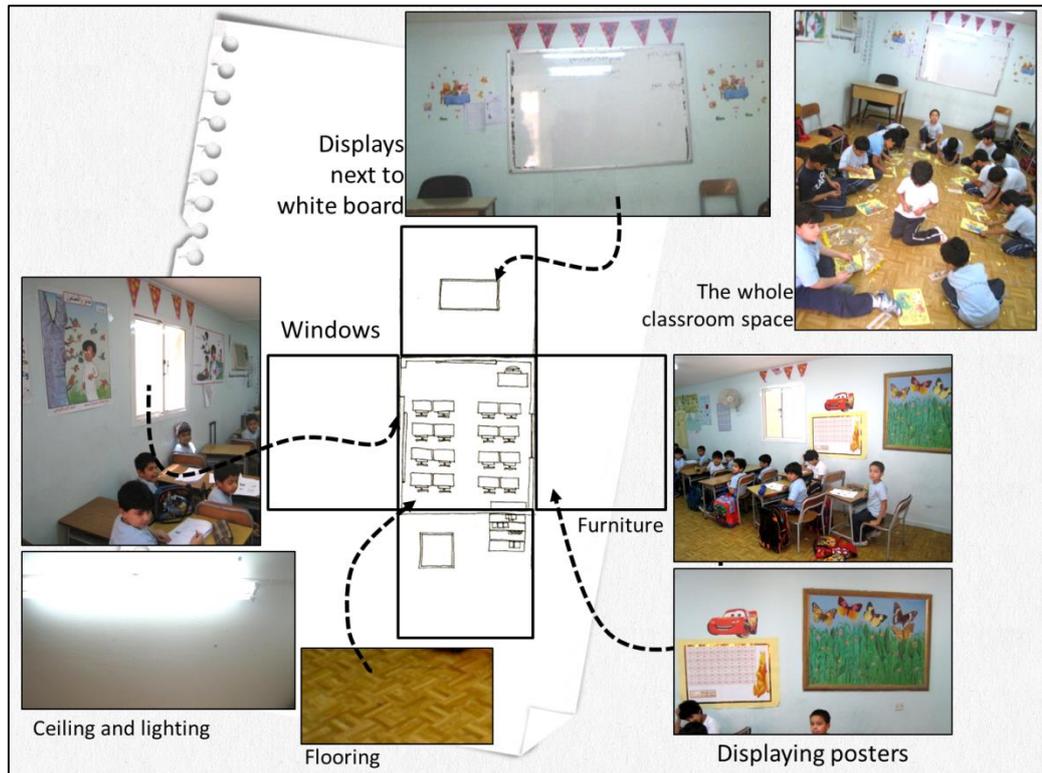


Figure 400: Classroom space in Riffa Al-Falah School

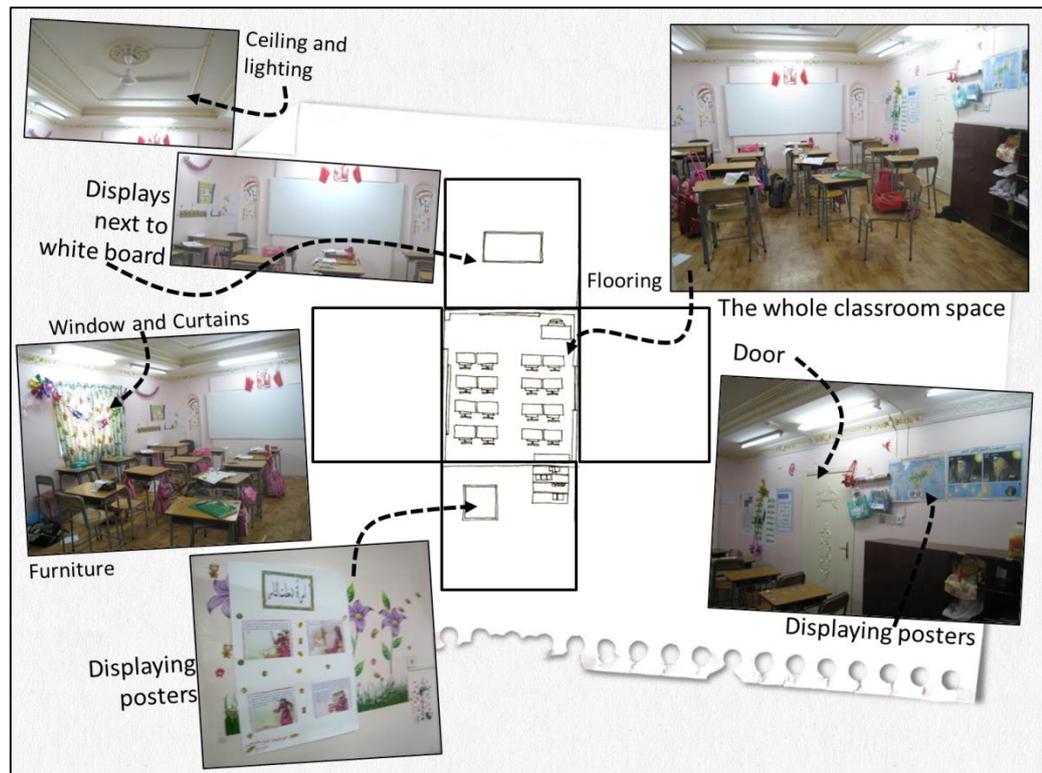


Figure 401: Classroom space in Riffa Al-Falah School

Corridors connect the courtyard with classrooms; Figure 402 shows Riffa Al-Falah School Corridors and courtyard. Researcher had observed in Riffa Al-Falah School

Corridors and courtyard as shown in Figure 402 different displays, different doors designs, seating areas, library corners, lockers and recycle bins.



Figure 402: Riffa Al-Falah School Corridors and courtyard

Finally Figure 403 shows other learning spaces in Riffa Al-Falah School, which are library, laboratory, and art classroom spaces; never the less Figure 403 shows interior design details in these spaces such as the furniture and displays.

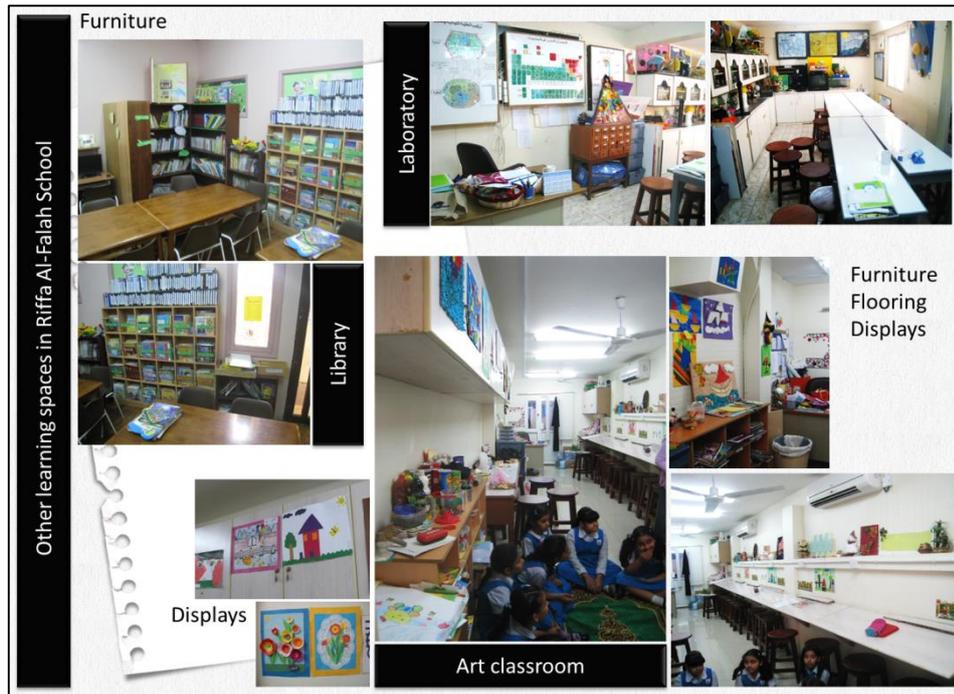


Figure 403: other learning spaces in Riffa Al-Falah School

Umar Ben Al-Katab School

Figure 404 and Figure 405 show classroom space in Umar Ben Al-Katab School, which are designed as open learning spaces where different areas with different functions are created in each classroom space. The details of these different spaces with different functions are explained in Figure 404 and Figure 405, and they show the interior design details such as: store, white board, ceiling, lighting, windows and curtains.

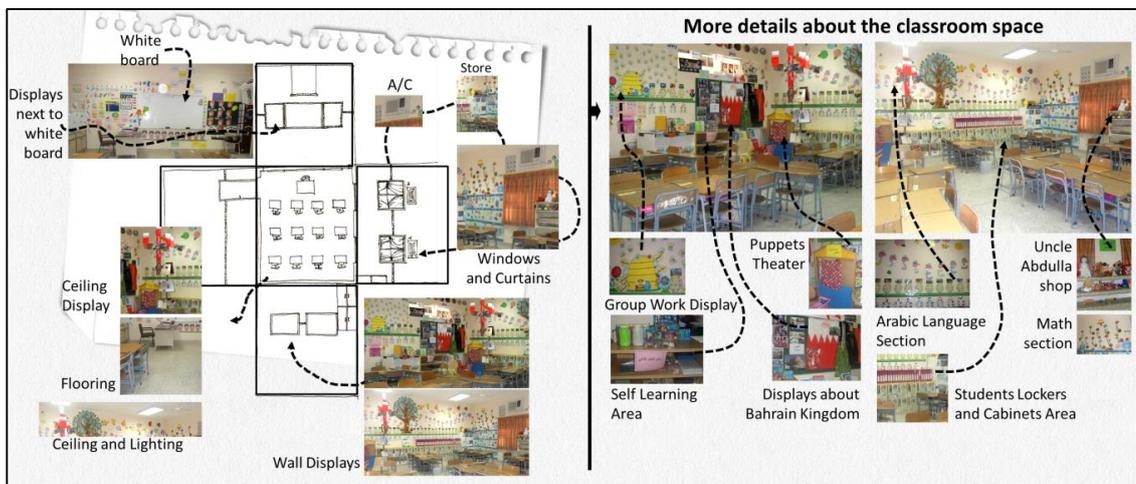


Figure 404: classroom space in Umar Ben Al-Katab School

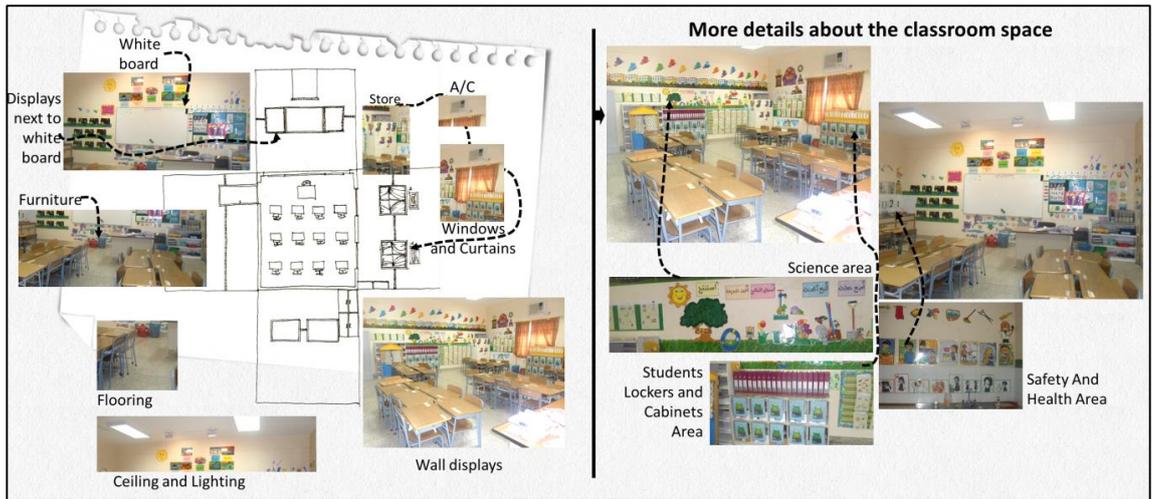


Figure 405: Classroom space in Umar Ben Al-Katab School

In Figure 406-Figure 401 the researcher describes different examples of areas within one classroom space. Figure 406 shows self-learning section, students' cabinets and lockers area, Math section and Arabic language section in one classroom space.



Figure 406: Different Areas within One Classroom Space

Another example in Figure 407 shows group work section, library area, Uncle Abdulla shop, Bahrain displays and puppet theatre in one classroom space.



Figure 407: Different Areas within One Classroom Space

Figure 408 shows library area, science area and classroom rules area in one classroom space.



Figure 408: Different Areas within One Classroom Space

Figure 409 shows students homework area, group work section, classroom rules area, classroom behaviour area, puppet theatre area and Science area in one classroom space.



Figure 409: Different areas within one classroom space

Figure 410 shows library area, Bahrain displays, safety and health section, Arabic language section, self-learning area and students' lockers area in one classroom space.



Figure 410: Different areas within one classroom space

After putting observation data together, an affinity diagram was used to analyse them. It is important to mention that this step helped the researcher to understand the details of learning space design elements and the difference between what architects' design and

what users design in the space. Figure 92 and Figure 93 show examples of notes that emerged from the affinity diagram.

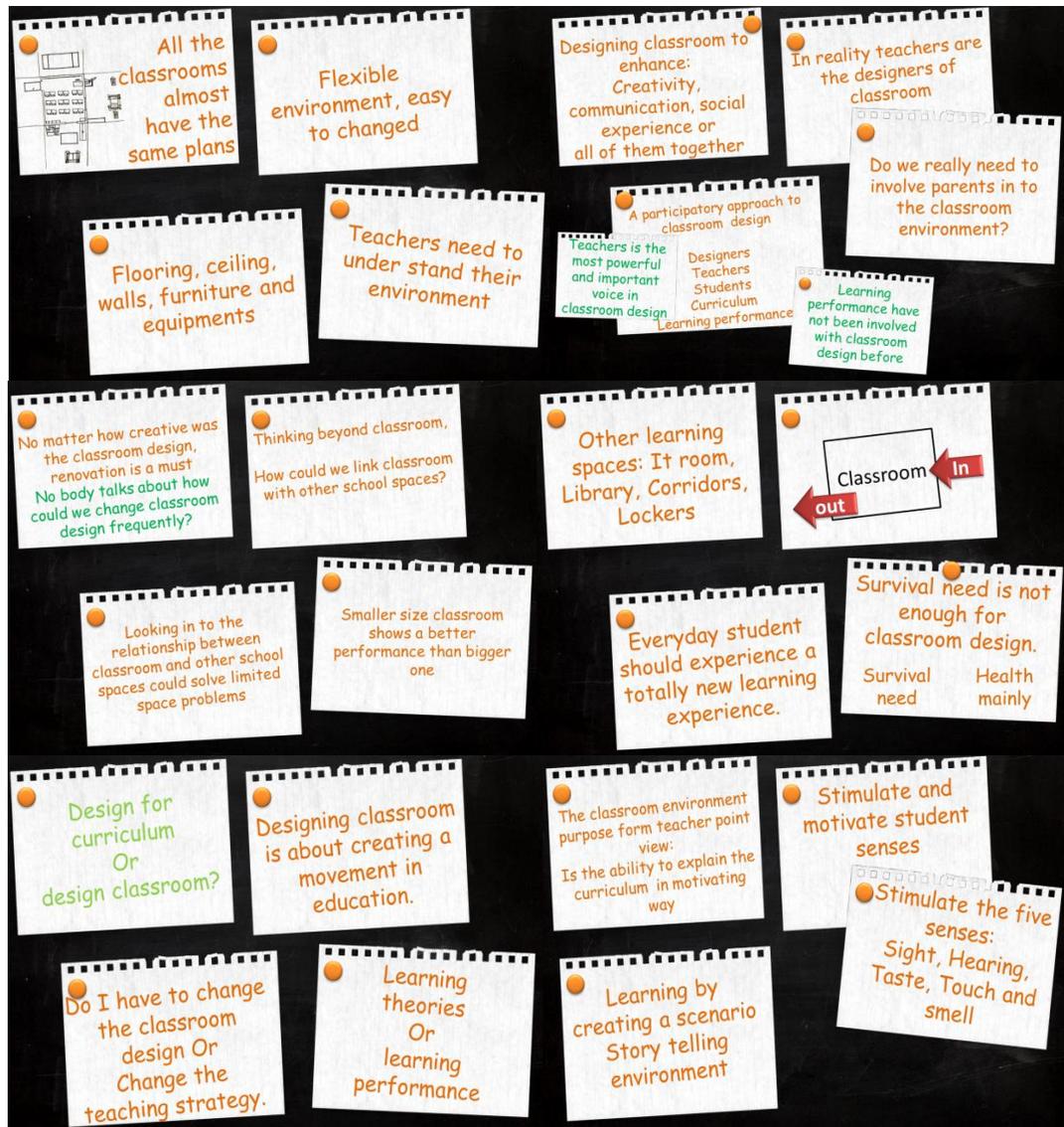


Figure 411: Examples of Notes That Emerged from the Affinity Diagram- PART A



Figure 412: Examples of Notes That Emerged from the Affinity Diagram- PART B

Second Approach

To understand the affinity diagram findings of the first approach analysis the researcher adopted the second approach which involved table themes. For the table themes approach the post-it notes, which were obtained from the affinity diagram analysis, were categorized and supported by photographs. In order to classify those post-it notes each table had presented one classroom. Figure 413-Figure 415 show examples of classrooms' table themes.

| Classroom 1 | Walls | | | Ceiling | | Flooring | | Furniture | |
|---|--|--|--|---------------------|-------------------------|--------------------------------------|---|---|---|
| | Display | Visual access | others | lighting | others | granite floor tiles | Type of furniture | Arrangements and layout | others |
|  | Rectangle is widely used | Windows are the only visual access in the room | Walls are painted with light green color and divided with decorative line of wallpaper | Florescent Lighting | White Gypsum board | Durable material and stands for ages | Poly plastic chairs with steel legs For students | Rows: the room is organized on rows tables and chairs are facing the teacher and the board. | Furniture color is light gray seats and white steel legs. |
|  | No interactive displays | Windows are always covered with curtains | Walls are the surrounded element of the classroom | Natural sun light | Standard height ceiling | Easy to clean and wash | Wooden and steel tables For students | Teacher desk is always in the front next to the white board | Durable furniture and easy to clean |
|  | The displays usually are done by students them self | Teacher thinks that visual access distract student attention | Walls are used only as display unit. | | | White with black and brown chips | White board Which is usually the focal point of the classroom | Green boards for displaying | Flexible and easy to move and change the arrangement |
|  | White board wall is the focal point wall which the classroom rules are displayed on it as well Displays related directly to curriculum | High temperature in Bahrain prevent big size windows | | | | | | | Students are not allow to personalize the tables |
|  | | Very small glass opening in the door | | | | | Wooden and steel cabinets For storage. Teacher desk and chair | Clear path ways between furniture | |
|  | | | | | | | | | |
| Classroom 2 | | | | | | | | | |
| Display | Visual access | others | lighting | others | granite floor tiles | Type of furniture | Arrangements and layout | others | |
|  | Rectangle is widely used | Windows are the only visual access in the room | Walls are painted with light green color and divided with decorative line of wallpaper | Florescent Lighting | White Gypsum board | Durable material and stands for ages | Poly plastic chairs with steel legs For students | Rows: the room is organized on rows tables and chairs are facing the teacher and the board. | Furniture color is light gray seats and white steel legs. |
|  | No displays | Windows are always covered with curtains | Walls are the surrounded element of the classroom | Natural sun light | Standard height ceiling | Easy to clean and wash | Wooden and steel tables For students | Teacher desk is always in the front next to the white board | Durable furniture and easy to clean |
|  | White board wall is the focal point wall which the classroom rules are displayed on it as well Displays related directly to curriculum | Teacher thinks that visual access distract student attention | Walls are used only as display unit | | | White with black and brown chips | White board Which is usually the focal point of the classroom | Green boards for displaying | Flexible and easy to move and change the arrangement |
|  | | High temperature in Bahrain prevent big size windows | | | | | | | Students are not allow to personalize the tables |
|  | | Very small glass opening in the door | | | | | Wooden and steel cabinets For storage | Projector | Furniture color is light gray seats and white steel legs. |
|  | | | | | | | | | |
| School corridors | | | | | | | | | |
| Display | Visual access | others | lighting | others | Others | lighting | Flooring | | |
|  | Interactive displays | One throw staircase window | | | Standard height ceiling | Florescent Lighting | granite floor tiles | | |
|  | Some of the corridors displays done by students them selves | visual access into students classrooms throu their doors | | | White Gypsum board | Natural sun light | Durable material and stands for ages | | |
|  | Connection between classrooms and corridors throu walls interactive displays | | | | A/C | | White with black and brown chips | | |
|  | Distinctive students names displayed on the walls Students work displayed on the wall as well. Students are interacting with what displayed on the walls Students see other learners' names on the corridors which energize them to learn. Changing the corridors displays by creating different themes. | | | | | | | | |
|  | Some Walls are painted with light green and divided with decorative wallpaper same as classrooms and other walls are divided in to two degrees of orange color. | | | | | | | | |
|  | Board shows process of praying or how to pray. | | | | | | | | |

Figure 413: Table Theme

| | Walls | Ceiling | Flooring | Furniture |
|--------------------|---|--|--|--|
| Classroom 1 | <p>Display</p> <p>Visual access</p> <p>others</p> <p>Fan and A/C</p> <p>Hidden fluorescent light</p> <p>Decorative white and golden gypsum board</p> | <p>lighting</p> <p>others</p> <p>Natural sun light</p> <p>Standard height ceiling</p> <p>Natural color</p> | <p>Wooden vinyl flooring</p> <p>Durable and easy to wash</p> <p>Decorative white and golden gypsum board</p> | <p>Type of furniture</p> <p>Arrangements and layout</p> <p>others</p> <p>Wooden and steel chairs for students</p> <p>Group: the room is organized in groups</p> <p>Furniture color is natural color of wood and steel grey color</p> <p>Teacher desk is always in the front next to the white board</p> <p>Durable furniture and easy to clean</p> <p>Flexible and easy to move and change the arrangement</p> <p>Clear path ways between furniture</p> |
| Classroom 2 | <p>Display</p> <p>Visual access</p> <p>others</p> <p>Fan and A/C</p> <p>White fluorescent light</p> <p>Natural sun light</p> <p>Walls are painted with light blue</p> <p>High temperature in Bahrain prevent big size windows</p> <p>Western cartoon characters are used as a display</p> | <p>lighting</p> <p>White gypsum board</p> <p>Standard height ceiling</p> <p>Natural sun light</p> <p>Walls are painted with light blue</p> | <p>Wooden vinyl flooring</p> <p>Durable and easy to wash</p> <p>White board</p> <p>Comfortable to walk and set on</p> <p>Cheap and easy to be changed and renovate</p> | <p>Type of furniture</p> <p>Arrangements and layout</p> <p>others</p> <p>Wooden and steel chairs for students</p> <p>Rows: the room is organized on rows tables and chairs are facing the teacher and the board.</p> <p>Furniture color is natural color of wood and steel grey color</p> <p>Teacher desk is always in the front next to the white board</p> <p>Durable furniture and easy to clean</p> <p>Flexible and easy to move and change the arrangement</p> <p>Clear path ways between furniture</p> |
| Classroom 3 | <p>Display</p> <p>Visual access</p> <p>Others</p> <p>A/C</p> <p>white fluorescent light</p> <p>Decorative white and golden gypsum board</p> <p>Walls are painted with light pink</p> <p>High temperature in Bahrain prevent big size windows</p> <p>Western cartoon characters are used as a display</p> <p>White board wall decorative with Bahrain flag</p> | <p>lighting</p> <p>others</p> <p>Natural sun light</p> <p>Standard height ceiling</p> <p>Natural color</p> <p>Fan</p> <p>Comfortable to walk and set on</p> <p>Cheap and easy to be changed and renovate</p> | <p>Wooden vinyl flooring</p> <p>Durable and easy to wash</p> <p>White board</p> <p>Comfortable to walk and set on</p> <p>Cheap and easy to be changed and renovate</p> | <p>Type of furniture</p> <p>Arrangements and layout</p> <p>others</p> <p>Wooden and steel chairs for students</p> <p>Rows: the room is organized on rows tables and chairs are facing the teacher and the board.</p> <p>Furniture color is natural color of wood and steel grey color</p> <p>Teacher desk is always in the front next to the white board</p> <p>Durable furniture and easy to clean</p> <p>Flexible and easy to move and change the arrangement</p> <p>Clear path ways between furniture</p> |
| Corridors | <p>Visual access</p> <p>white color paint</p> <p>Interactive displays</p> <p>Standard height ceiling</p> <p>Decorative white and golden gypsum board</p> <p>Rules of the school displayed on the wall</p> <p>Motivational quotes and poems displayed on the corridors walls</p> | <p>lighting</p> <p>Others</p> <p>Standard height ceiling</p> <p>Natural sun light</p> | <p>Wooden lockers</p> <p>Recycle bin</p> | <p>Type of furniture</p> <p>Arrangements and layout</p> <p>others</p> <p>Wooden lockers</p> <p>Wooden vinyl flooring</p> <p>Except the staircases a finishing material is ceramic tiles</p> |

Figure 415: Table Theme (Because of point size, I think these will need to be fold-outs)

Each table theme was classified into different sections which are: walls, ceiling, flooring and furniture. Also, under each section more details were added. The following section explains table themes classifications.

Table Theme Classifications:

Walls:

- Display: what was displayed on the classroom walls, how it was displayed and who displayed it?
- Visual access: classroom visual access such as windows and doors.
- Other points such as the colour of the walls and type of hanged furniture on the wall, such as cabinets, shelves and boards.

Ceiling:

- Lighting: type of lighting, artificial and natural.
- Other issues related to the ceiling such as ceiling material, height of the ceiling and ceiling as a display area.

Flooring:

- Type of material

Furniture:

- Type of furniture.
- Ways of arranging classroom furniture in different layouts to accommodate different types of activities. Rearranging furniture has eventually created different space types within one classroom.
- Other issues related to colours, and materials.

Figure 416-Figure 418 show table theme classifications.

| Aleeman School | | | | | | | | | |
|--|--|--|--|---------------------|-------------------------|--------------------------------------|---|---|---|
|  | | | | | | | | | |
| Classroom 1 | Walls | | | Ceiling | | Flooring | Furniture | | |
| | Display | Visual access | others | lighting | others | granite floor tiles | Type of furniture | Arrangements and layout | others |
|  | Rectangle is widely used | Windows are the only visual access in the room | Walls are painted with light green color and divided with decorative line of wallpaper | Florescent Lighting | White Gypsum board | Durable material and stands for ages | Poly plastic chairs with steel legs For students | Rows: the room is organized on rows tables and chairs are facing the teacher and the board. | Furniture color is light gray seats and white steel legs. |
|  | No interactive displays | Windows are always covered with curtains | A/C | Natural sun light | Standard height ceiling | Easy to clean and wash | Wooden and steel tables For students | | Durable furniture and easy to clean |
|  | The displays usually are done by students them self | Teacher thinks that visual access distract student attention | Walls are the surrounded element of the classroom | | | White with black and brown chips | White board Which is usually the focal point of the classroom | Teacher desk is always in the front next to the white board | Flexible and easy to move and change the arrangement |
|  | White board wall is the focal point wall which the classroom | High temperature in Bahrain prevent big size windows | Walls are used only as display unit. | | | | Green boards for displaying | | Students are not allow to personalize the tables |

Figure 416: Table Theme Classifications

| Alflah School in Muharrq | | | | | | | | | |
|--|--|--|---|---------------------|-----------------------------|---|---|---|---|
| This building was three stories building with apartments then transformed in to primary privet school building for boys and girls. | | | | | | | | | |
| Classroom 1 | Walls | | | Ceiling | | Flooring | Furniture | | |
| | Display | Visual access | others | lighting | others | Wooden vinyls flooring | Type of furniture | Arrangements and layout | others |
|  | Rectangle is widely used | Windows are the only visual access in the room | Walls are painted with two degrees of yellow | Florescent Lighting | White Gypsum board | Durable and easy to wash | Wooden and steel chairs For students | Rows: the room is organized on rows tables and chairs are facing the teacher and the board. | Furniture color is natural color of wood and steel gray color |
|  | No interactive displays | Windows are always covered with curtains | A/C | Natural sun light | Standard height ceiling | Natural color | Wooden and steel tables For students | | Durable furniture and easy to clean |
|  | The displays usually are not done by students them self | Teacher thinks that visual access distract student attention | Walls are the surrounded element of the classroom | | Fan hanged from the ceiling | Comfortable to walk and set on | White board Which is usually the focal point of the classroom | Teacher desk is always in the front next to the white board | Flexible and easy to move and change the arrangement |
|  | Divers sizes of displays | High temperature in Bahrain prevent big size windows | Walls are used only as display unit. | | | Cheap and easy to be changed and renovate | boards for displaying | | Students are not allow to personalize the tables |
|  | White board wall is the focal point wall which the classroom rules are displayed on it as well | | | | | | | | |
| | Displays related directly to curriculum | | | | | | Wooden and steel cabinets For storage. | | |

Figure 417: Table Theme Classifications

| Alnaseem International school | | | | | | | | | |
|---|--|--|--|---|-----------------------------------|------------------------------------|---|--|---|
| | | | | | | | | | |
| <p>This building is built to be an international school for boys and girls from nursery This school teaches students American curriculums. Students haven't any classroom, however each subject teacher has her own classroom and students move to each classroom subject. The student gather in two areas the cafeteria and multipurpose hall when they don't have lessons.</p> | | | | | | | | | |
| Early primary classroom 1 | Walls | | | Ceiling | | Flooring | Furniture | | |
| | Displays | Visual access | others | lighting | others | Carpet tile | Type of furniture | Arrangements and layout | others |
| | Rectangle is widely used | Windows visual access to outside | Walls are painted with light blue | Florescent Lighting | White Gypsum board | Durable | Poly navy blue Chairs with steel legs For students | Groups: The room is organized in groups. Tables and chairs arrangement could be easily changed. | Tables are dark brown wood with black steel legs. Chairs are dark navy blue with black steel legs. |
| | No interactive displays | Windows are always covered with wooden blinds | Some corners are painted with orange which the same as cabinet color | Natural sun light | Standard height ceiling | Dark gray color | Wooden tables with steel legs For students | | |
| | | | | | | | For students | | |
| | interactive displays | Wooden blinds allow users to control the amount of natural light they need | Furniture distribution had created a less height walls in the middle of the classroom space. | | projector hanged from the ceiling | Comfortable to walk and set on. | One table for group of students | Good path and circulation between furniture | Durable furniture and easy to clean |
| | The displays usually are done by students them self | Door have one small glass window which creates visual access to corridors | Walls are used as a display unit. | All the ceilings have the same design | | easy to be changed and renovate | Rectangular and square boards for displaying | The way of distributing chairs and tables group within the cabinets had brake out the rectangular outline of the room. | Flexible, easy to move, light weight and change the arrangement. |
| | Divers sizes and colors of displays | High temperature in Bahrain prevent big size windows | A/C | | | Reasonable price | Wooden, plastic and steel cabinets For storage. | | Students are not allowed to personalize the tables. |
| | Displays usually related directly to curriculum | All the classrooms have the same design and size window | A/C openings | Walls are the surrounded element of the classroom | | | Projector connected with teacher computer on teacher office | | |
| | Some of the walls displays are used to explain curriculum. | | | | | Rugs on the top of the carpet tile | Diverse shapes, sizes and colors of tables | | |

Figure 418: Table Theme Classifications

Third approach

After analysing the observation data the researcher went back to the literature and connected the observation findings with the literature review in another affinity diagram, and through this approach more learning design elements were added and more questions were raised and remain unanswered. Figure 419-Figure 425 show examples of affinity diagram notes after connecting observation findings with literature review.

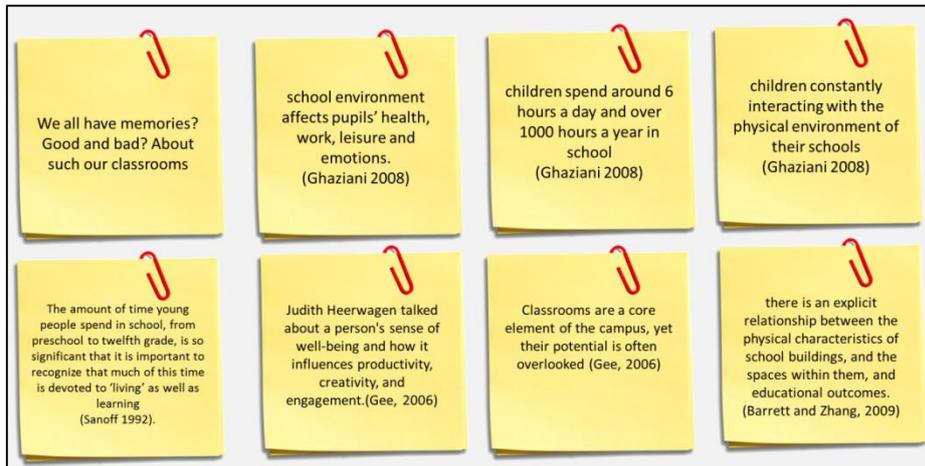


Figure 419: Affinity Diagram Notes after Connecting Observation Findings with Literature Review



Figure 420: Affinity Diagram Notes after Connecting Observation Findings with Literature Review



Figure 421: Affinity Diagram Notes after Connecting Observation Findings with Literature Review



Figure 422: Affinity Diagram Notes after Connecting Observation Findings with Literature Review

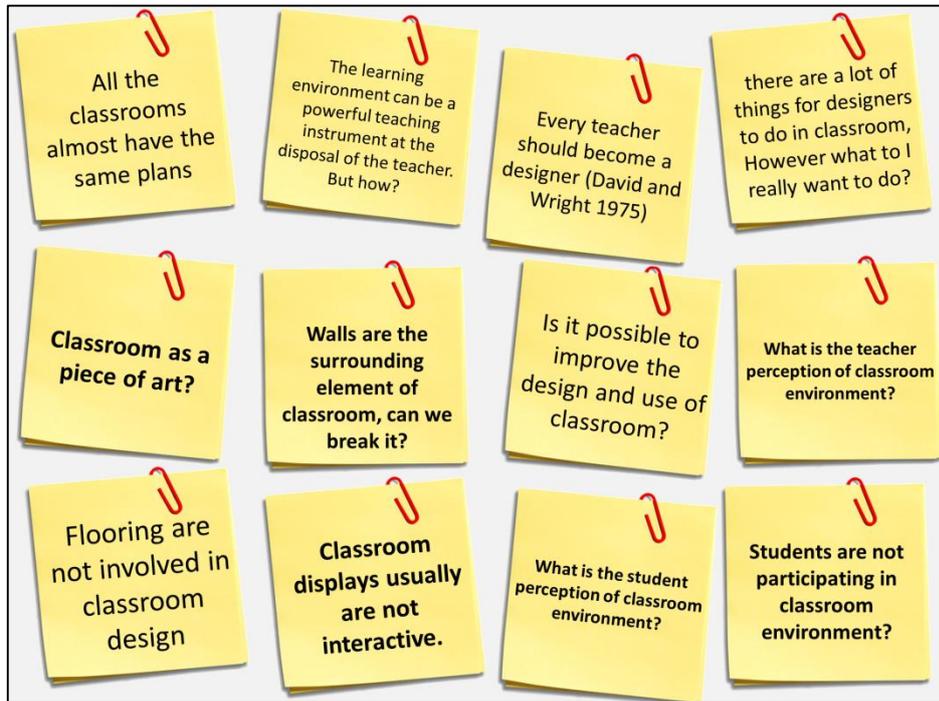


Figure 423: Affinity Diagram Notes after Connecting Observation Findings with Literature Review



Figure 424: Affinity Diagram Notes after Connecting Observation Findings with Literature Review

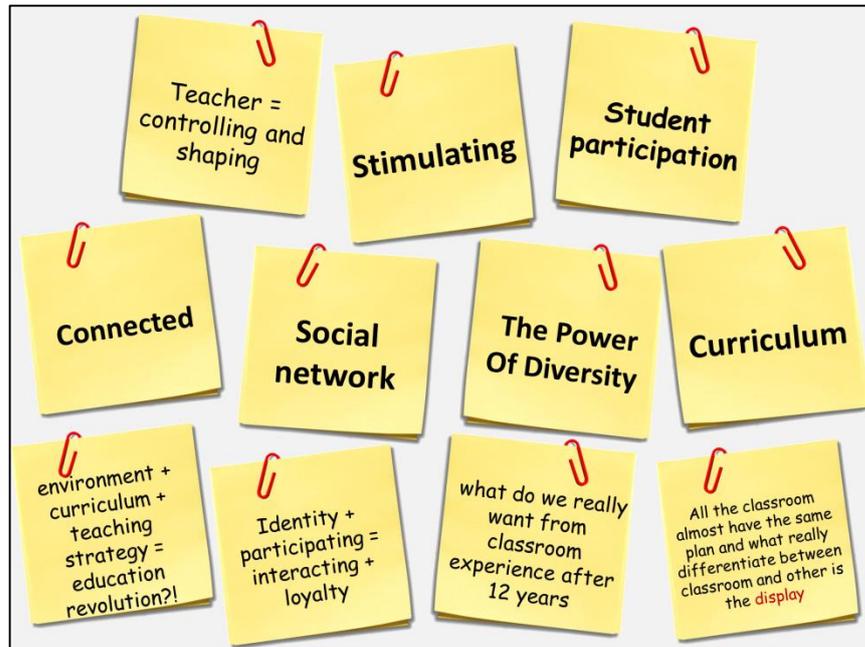


Figure 425: Affinity Diagram Notes after Connecting Observation Findings with Literature Review

Teachers' Phase

Teachers are key classroom users, who shape, adapt and re-design classroom space after the architects initially designed it. Therefore, the main aim of this phase was to explore classroom space and understand it from the teachers' point of view, and the researcher needed the teacher to explain to her some of what she observed in the first fieldwork. In phase three the qualitative methods were triangulated involving: Semi structured interview, Photographs and Teachers' planning book (teachers' planning book is teachers' diary of classroom environment, where teachers' document her/his everyday learning approach, teaching plan in term of teaching strategy, teaching aid and how they apply it in the classroom), (Figure 78).

Participants' teachers were interviewed and asked to visualise their responses with their classroom photographs supported by pages from their planning book, Figure 79 explains methods used in Teachers' phase. 15 teachers from 6 different primary schools in Bahrain teaching 10-13 year-old pupil year-group were engaged in this phase. Of these, 11 groups had female and 4 had male teachers, and length of their teaching experience ranged from 7 to 33 years. More than 400 photographs and 38 pages of teachers' planning books were collected. The aim of this phase was not to create the basis for statistical comparisons across different classroom design elements, which would not be appropriate

with such a sample size; rather, the goal of this phase was to build an understanding of classroom space through the teachers' eyes.

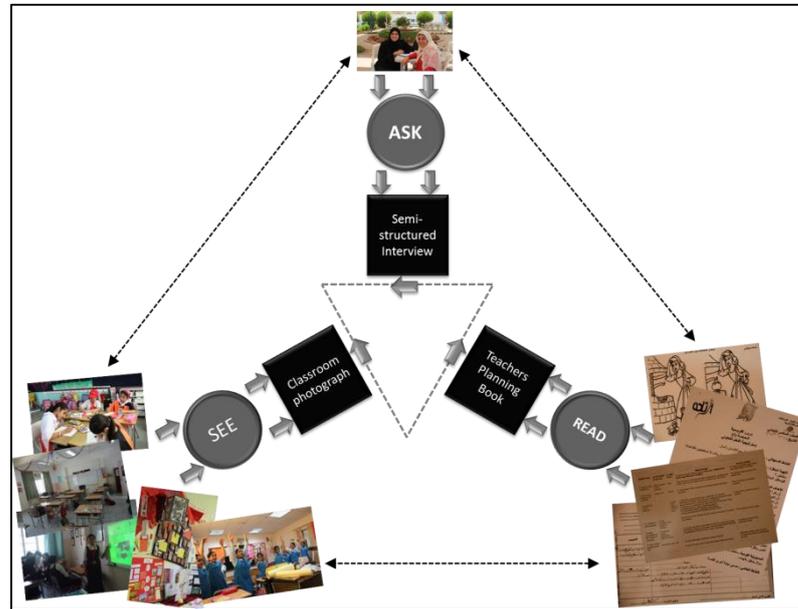


Figure 426: Triangulating Three Qualitative Methods in Teachers phase

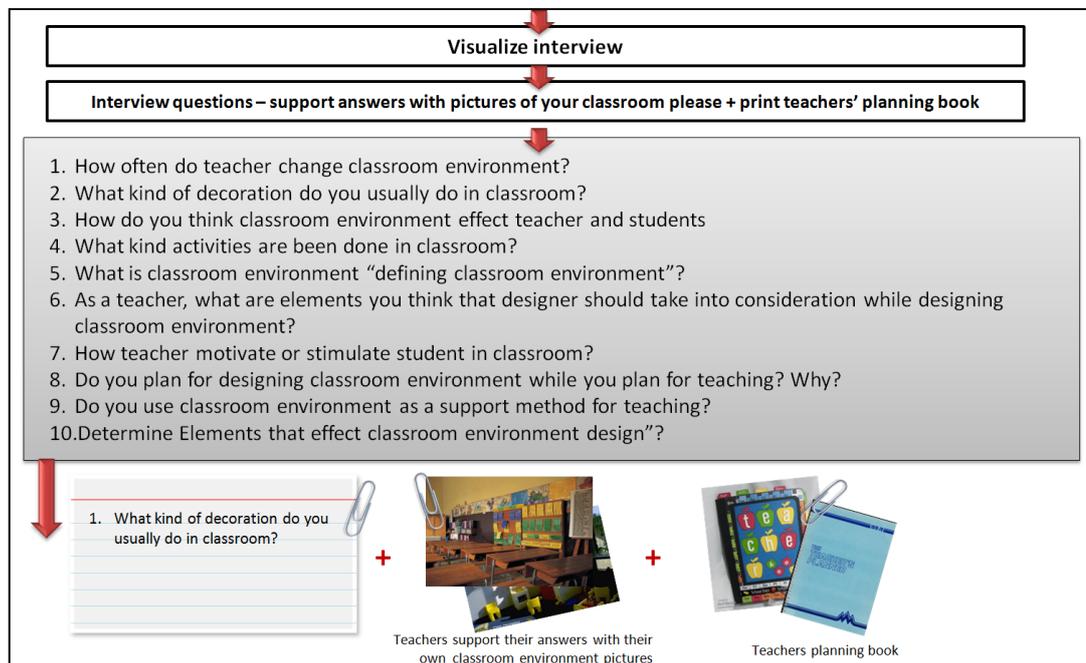


Figure 427: Teachers' Interview

Table 13 shows semi structured interview questions.

Table 13: Semi Structured Interview Questions

| Interview Questions: | |
|-----------------------------|---|
| Q1 | Your gender please? |
| Q2 | Name of the subject you are teaching? |
| Q3 | Years of teaching experience? |
| Q4 | The gender you are teaching? |
| Q5 | How often do teachers change the classroom environment? |
| Q6 | What kind of decorating do you usually do in classroom? |
| Q7 | How do you think classroom environment effects teacher and students? |
| Q8 | What kind of activities are been done in the classroom? |
| Q9 | What is the classroom environment? "Define the classroom environment"? |
| Q10 | As a teacher, what are elements you think that designers should take into consideration when designing classroom environments? |
| Q11 | As a teacher, how do you motivate or stimulate students in classroom? |
| Q12 | Do you plan for designing classroom environments or changing its design while you plan for teaching? Why? |
| Q13 | Do you use the classroom environment as a support method for teaching? How? |
| Q14 | Determine Elements that effect classroom environment design"? Please put them in order first the important then the less important? |

Students' Drawing Analysis

Figure 428 explains students' phase methods and Figure 429 explains students' phase preparation. 170 students were engaged in this phase from 6 different primary schools in Bahrain, and Figure 430 shows participants in students' phase, their ages were 10-13 years old. 170 Drawings were collected supported by students' notes, Figure 431 shows example of student drawing supported with written notes.

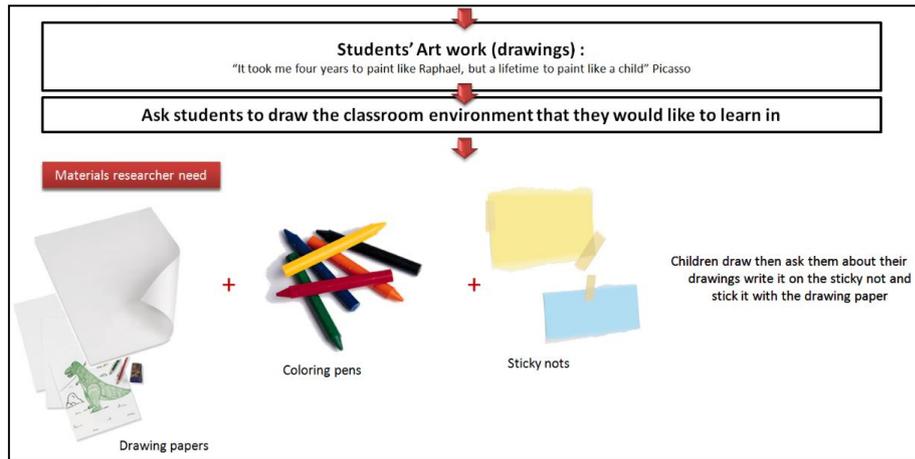


Figure 428: Students' Methods



Figure 429: Students' Analysis Preparation



Figure 430: Participants in Students' Analysis

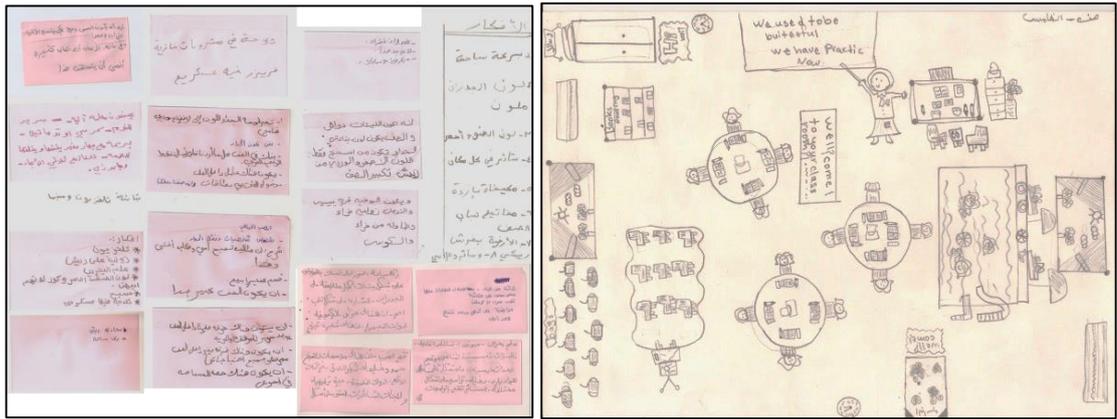


Figure 431: Example of Student Drawing Supported With Written Notes

Teacher Phase Analysis

The main aim of this phase was to explore classroom space and understand it from the teachers' point of view. In this phase, three qualitative methods were triangulated: Semi structured interview, visualised by Photographs and supported by the Teachers' planning books. Participant teachers were interviewed and asked to visualise their answers with their classroom photographs supported by pages from their planning books, Figure 94 explains the methods for the teacher phase.

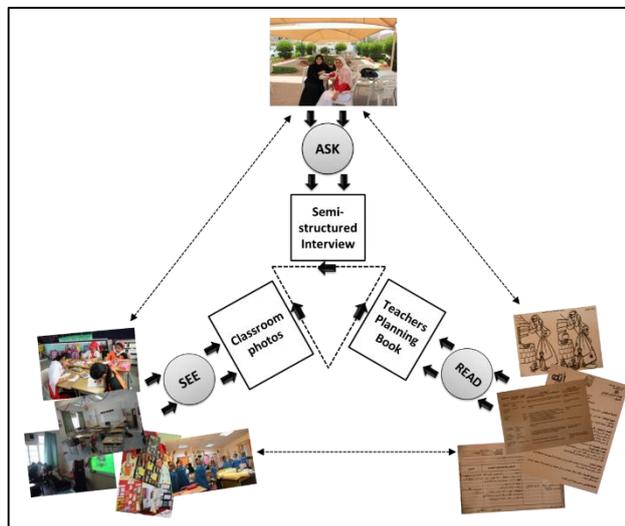


Figure 432: Teacher Phase Methods

Students' Drawing Analysis

The second user of classroom environment is the student. Therefore, a way of exploring the classroom is to ask those who learn in classroom space, the students themselves. In this phase researcher aim was to understand classroom space perception

and explore it through students' eyes. Therefore, the researcher asked students to draw "The Classroom of Their Dreams" and support their drawings with written notes that explained their drawings. 170 Drawings were collected, supported by students' notes; **Figure 108** shows examples of students' drawings supported with their notes. Students' drawings and notes have been analysed in two level of analysis which are Affinity Diagram and Comic Strips and the findings of students' drawings analysis was merged with the teachers' findings.



Figure 433: Examples of Students' Drawings Supported with Their Notes

In the first level of analysis researcher had used an affinity diagram to analyse the 170 drawings collected, supported by students' notes. After analysing the students' drawings and notes using an affinity diagram, the researcher realized that there were several classroom design stories that students expressed through their drawings and notes while imagining the classroom of their dreams. Students' stories cannot be understood well without their drawings, therefore the researcher organized the affinity diagram notes into comic strips; in order to be able to read the students classroom design story with its drawings.

According to students' drawings, there were two ways of looking at the classroom space before thinking of its design elements; these two ways are outside the classroom box and inside the classroom box. Thus, students' second level of analysis is divided into two sections which are: living outside the box and it's represented with orange colour, and living inside the box and it's represented with purple colour. Figure 111-120 show students' comic strips "living outside the box". **Figure 114**-**Figure 120** explain students' comic strips "living inside the box".



Figure 434: "Living Outside the Box"



Figure 435: "Living Outside the Box"



Figure 436: "Living Outside the Box"

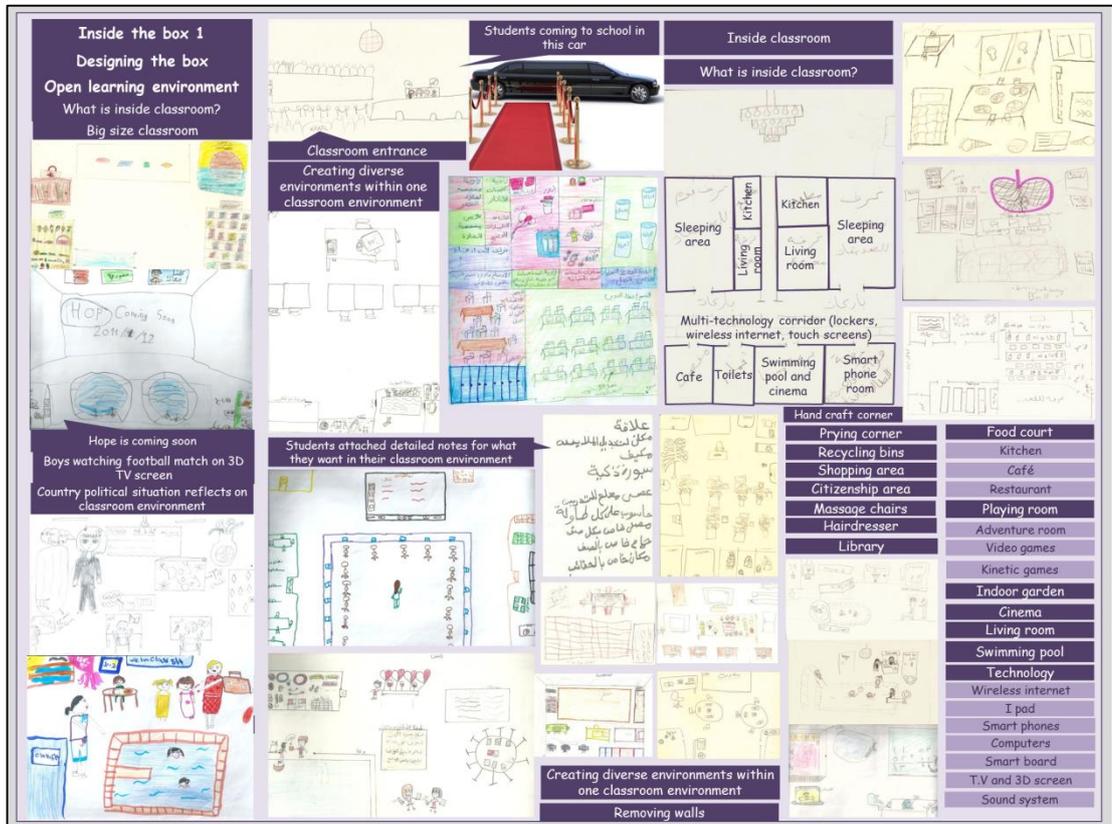


Figure 437: "Living Inside the Box"

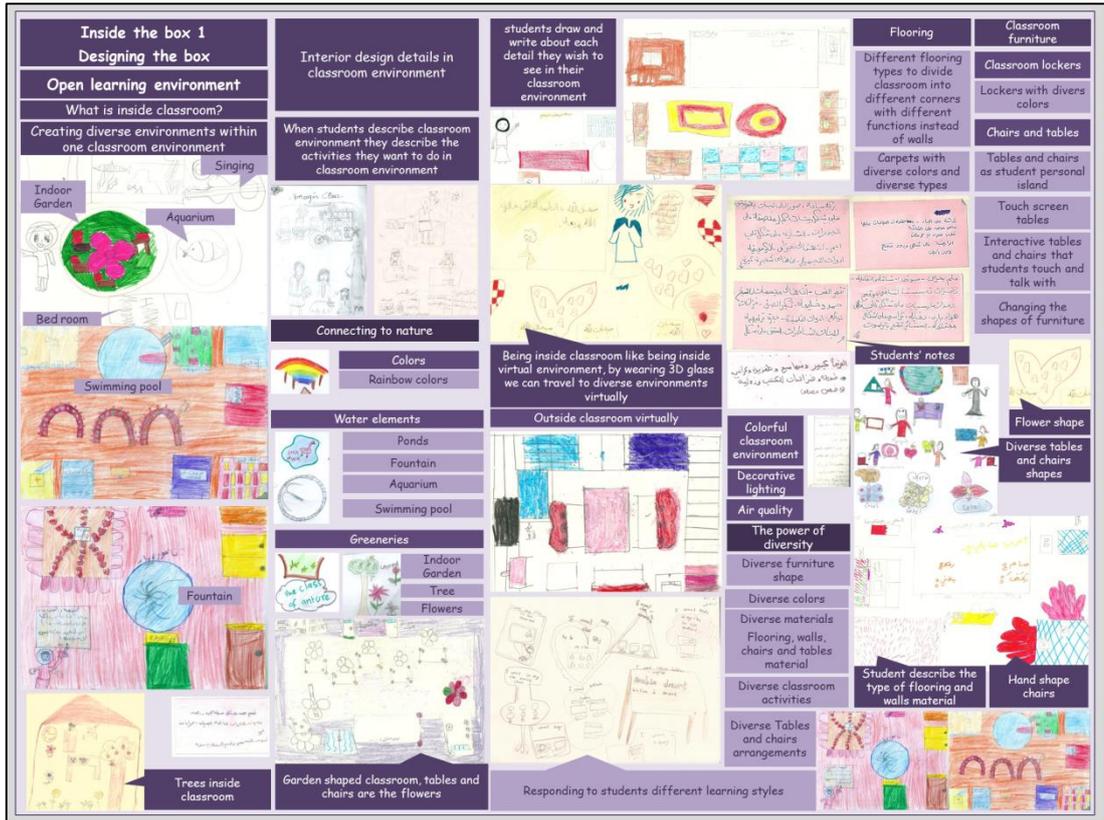


Figure 438: "Living Inside the Box"

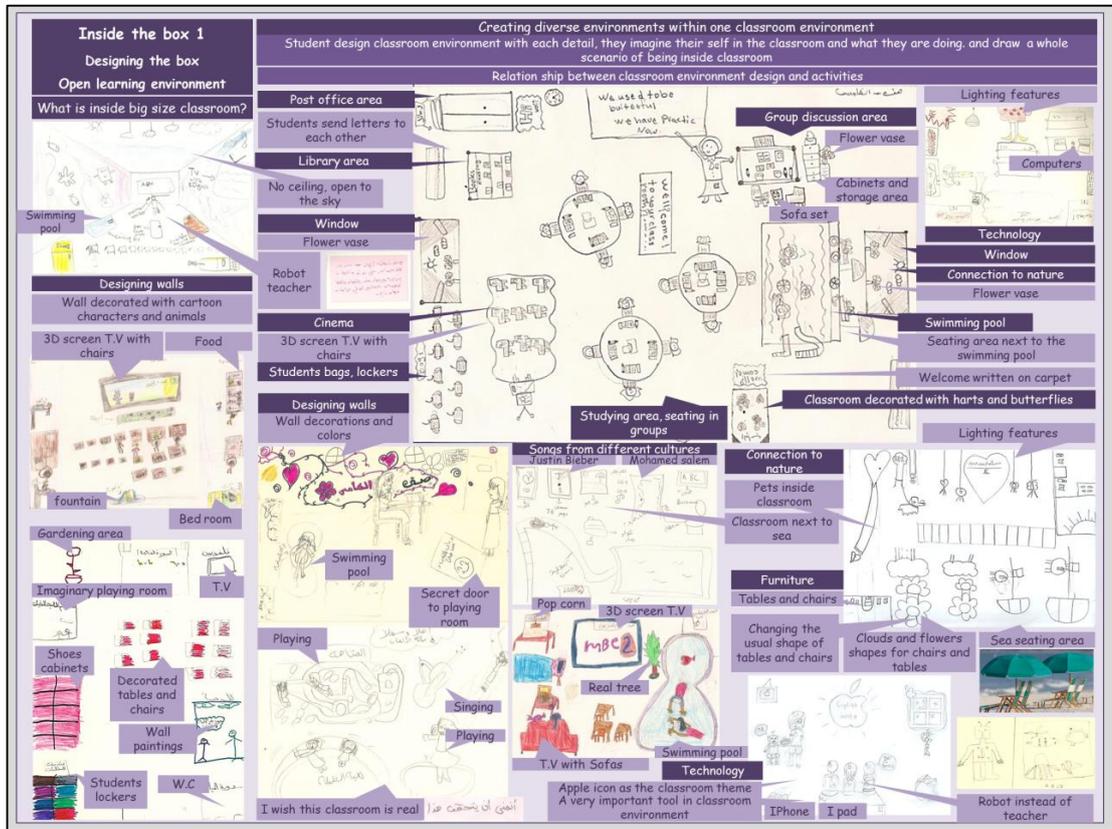


Figure 439: "Living Inside the Box"

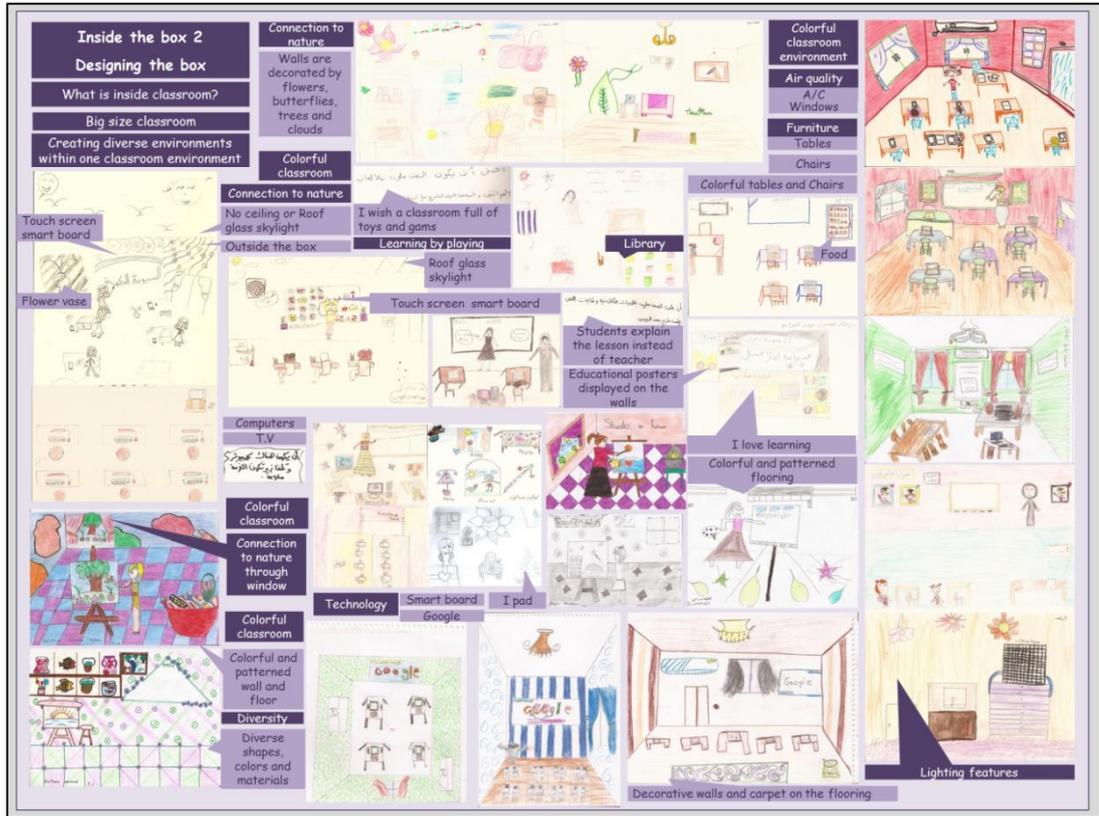


Figure 440: "Living Inside the Box"



Figure 441: "Living Inside the Box"



Figure 442: "Living Inside the Box"

After that Students' Second Level of Analysis "Living outside the Box" and "Living inside the Box" were compared together in one sheet, Figure 120 shows Students' second level of analysis compared together in one sheet.



Figure 443: Students' Second Level of Analysis Compared Together in One Sheet

Holistic Analysis (Teachers and Students)

Finally students' comic strips were merged with the teachers' Teachers' Final analysis under the four sections which are: (1) Comprehend changes in classroom space which are represented by yellow colour, (2) Classroom space design elements which are represented by green colour, (3) Understanding relationship between classroom space design, teaching strategy and curriculum which are represented by blue colour and (4) Create an understanding of classroom space which are represented by pink colour. Figure 121 shows the final analysis sheet which represents classroom users' perception and vision of classroom space results. The reason for merging teachers' and students' analysis together is to be able to compare teachers' vision and perception of classroom space with students in order to understand the similarities and differences.

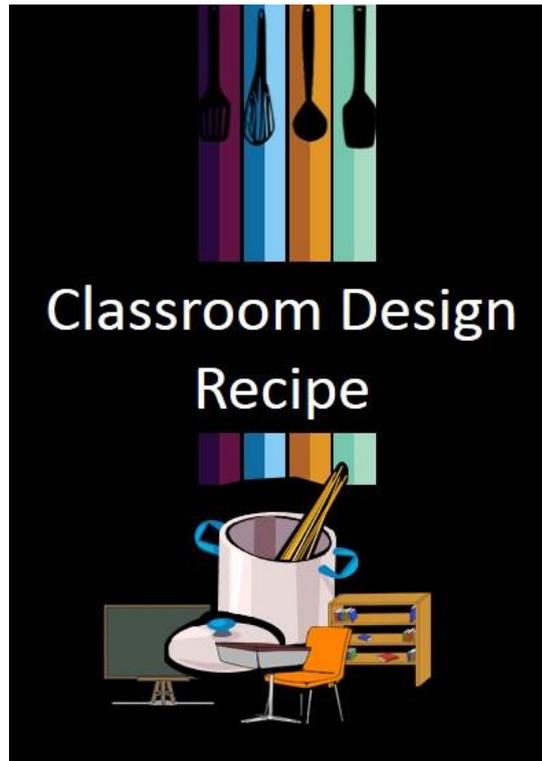


Figure 444: The Final Analysis Sheet

APPENDIX 6: Tool Set of Cards

This tool is consist of cards, these cards are:

- Introduction
- Set of Cards 1: Guideline Card
- Set of Cards 2: Our Classroom Story
- Set of Cards 3: Desk Probes Card
- Set of Cards 4: Outside the Classroom Virtually
- Set of Cards 5: Student's P.O. Box
- Set of Cards 6: Physically Outside the Classroom
- Set of Cards 7: Classroom Timeline
- Set of Cards 8: Flooring Story Telling
- Set of Cards 9: Classroom Café
- Set of Cards 10: Interior Design Tips
- Set of Cards 10 Nature inside the Classroom
- Set of Cards 11 Classroom Party
- Set of Cards 12 Collage Wallpaper
- Set of Cards 13 Stimulating the Senses
- Set of Cards 14: Template Create Your Own



Introduction

Introduction

Classroom design recipe is a learning and teaching tool that aims to propose opportunities to rethink classroom space design in order to facilitate and support learning and influence innovative teaching practices. This tool is available online via website on this link <http://classroomrecipe.blogspot.co.uk>.

Introduction

Cards

- [Card 1: Guideline Card](#)
- [Card 2: Our Classroom Story](#)
- [Card 3: Desk Probes Card](#)
- [Card 4: Outside the Classroom Virtually](#)
- [Card 5: Student's P.O. Box](#)
- [Card 6: Physically Outside the Classroom](#)
- [Card 7: Classroom Timeline](#)
- [Card 8: Flooring Story Telling](#)
- [Card 9: Classroom Café](#)
- [Card 10: Interior Design Tips](#)
- [Card 11: Template Create Your Own](#)

Introduction

Cards

Card 1: Guideline Card


Card 2: Our Classroom Story

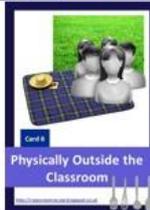

Card 3: Desk Probes Card

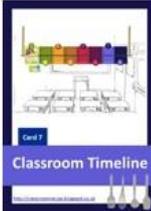

Card 4: Outside the Classroom


Introduction

Cards

Card 5: Student's P.O. Box


Card 6: Outside the Classroom


Card 7: Classroom Timeline


Card 8: Flooring Story Telling


Introduction

Cards

Card 9: Classroom Café


Card 10: Interior Design Tips


Card 11: Template Create Your Own


Introduction

Contact us

Website
<http://classroomrecipe.blogspot.co.uk/>

Instagram
<http://instagram.com/classroomrecipe>

Facebook
<https://www.facebook.com/classroomdesign.recipe>

Twitter
<https://twitter.com/ClassroomRecipe>

Pinterest
<http://www.pinterest.com/classroomdesign/>

Email
classroom.recipe@gmail.com

Introduction

Set of Cards 1: Guideline Card



Card 1 Guideline

Classroom Design Recipe

Classroom design recipe is a learning and teaching tool that aims to propose opportunities to rethink classroom space design in order to facilitate and support learning and influence innovative teaching practices.



Additionally, Classroom Design Recipe inspire teachers to change, use and prepare the classroom space to support and facilitate learning activities. This tools is available online on this link <http://classroomrecipe.blogspot.co.uk>.

Card 1
1



Guideline

Classroom Design Recipe

The design of this tool responds to insights from the fieldwork. Inspired by teaching tools, it responds to users' diverse ways of teaching and learning, and aids understanding of how learning spaces are used. In addition, the tool is designed to offer teachers an opportunity to participate by adding their own ideas to the tool and to inspire each other.



This tool consists of different cards. Each card offers an idea that could be applied in the classroom in order to facilitate and utilise classroom space to support learning. The information in these cards has been developed from PhD research. Each card in this tool is divided to five sections:

Card 1
2



Guideline

Classroom Design Recipe

- Section 1. **Title:** This presents the title of the card.
- Section 2. **Why:** This section tells users what benefits they will get from using the card and why they need to use this card.
- Section 3. **How:** This section gives users guidelines on how to apply this card and what they need to do in order to apply it.
- Section 4. **What:** The section shows users what to expect when they apply this card.
- Section 5. **Apply and Share:** The Apply and Share section is about users' applications and sharing their implementation with others. When users employ this card they can take a photo of their application and share it on social networks such as Facebook, Twitter, Instagram and Pinterest. Also, by using #Classroom_Design_Recipes and #the name of the card users can look at other users' cards and applications.

Card 1
3



Guideline

Classroom Design Recipe

Card Title

Picture: explains the idea of the card



Card number

Card Title

Why

This explains the benefits users will get when they use the card and why they need to use this card.



Card 1
4

Guideline
Classroom Design Recipe

How

The How section gives users guidelines on how to apply this card



In addition, the How section show users what do they need in order to apply the card idea.



Card 1 5

Guideline
Classroom Design Recipe

What

The What section shows users what to expect when they apply this card.



Apply & Share

The Apply and Share section is about the users' application tool and sharing their implementation with others using social networks.



Card 1 6

Guideline
Classroom Design Recipe

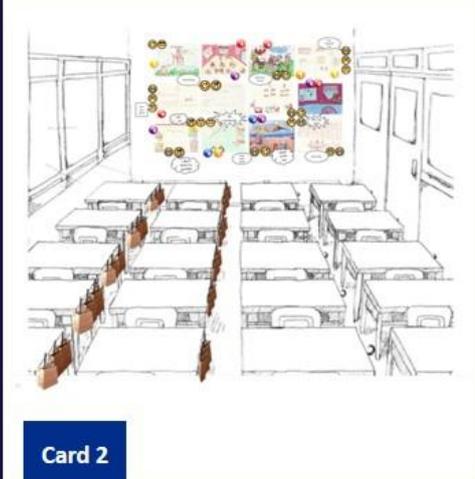
Additional card templates will be added to the Classroom_Design_Recipes tool that will allow users to add their own ideas and participate in the tool's design.

Also, the template could be downloaded from this internet site:
<http://goo.gl/147Zof>



Card 1 7

Card 2: Our Classroom Story



Card 2

Our Classroom Story

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users will get when they use this card:

- Turning classroom display into a game; pupils create it and play with it.
- Creating a playful interaction in the classroom space using probes.
- Storytelling is one of the teachers' teaching methods; this card will help students to create and tell their own story through their displayed work; they can also comment on each other's work.
- Strengthening the feeling of belonging to the classroom space by involving pupils in displaying and sharing their own work.
- Teachers can communicate with students by commenting on their work.
- Usually classroom displays respond only to students with a visual learning style and not to other types of learning styles. Using this card will help teachers to respond to students with a kinetic learning style, as well as creating movement in the classroom space.

Card 2 2

How

What do you need to apply this card?
How to apply this card.



Card 2 3

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this card?

- Students' work.
- Three small bags: a bag of numbers, a bag of emotional faces and a bag of speech bubbles.
- Hangers.

How to apply this card

1. Give each student three small bags (a bag of numbers, a bag of emotional faces, and a bag of speech bubbles).
2. Stick the three bags on each student's desk.
3. Display students' everyday work on the wall.
4. Ask students to comment on each other's work using the bubbles and emotional faces.
5. Finally, ask students to rank each other's work using the numbers.
6. Teachers can participate as well. They can comment on students' work using the same speech bubbles and emotional faces.

Card 2 4

What

What do teachers expect when using this card?
What will the learning space look like?

5

Card 2

Apply and Share

#Classroom_Design_Recipes
#Our_Classroom_Story #your_name

To share your work, please send it to this email
Classroom.Recipe@gmail.com
<http://classroomrecipe.blogspot.co.uk>

6

Card 2

Set of Cards 3: Desk Probes Card

2

Card 3

Desk Probes

<http://classroomrecipe.blogspot.co.uk>

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Involving students in designing and decorating classroom space.
- Turning desks into a mediator between teachers and pupils where teachers can communicate indirectly with pupils through their desks. For example, teachers can display motivational quotes and wisdom, or send an indirect message to students through their desks using this card.
- Making the classroom desk an interactive piece of furniture which can represent a student's identity.
- Offering students an opportunity to personalise their tables and express themselves through their tables. For example, they can stick their favourite photos on the desk, or write motivational word, quotes and pieces of wisdom.

2

Card 3

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Students can learn from each other's desks, turning the classroom space into a colourful and inspirational space.
- It helps teachers to apply different teaching strategies: for example, writing the questions on paper and sticking it on the pencil case, hiding questions under the pencil case and asking students to look for it, or creating a competition among students for the most creative desk cover.
- Turning the classroom desk into a surface where students and teachers can create displays.
- Using this card will turn students' desks into part of their identity, which will allow teachers to know more about their students.

Card 3 3

How

What do you need to apply this card?
How to apply this card.

What do you need to apply this idea?

Different cardboard colours in desk size

Pencil cases

foam ball on a stick

post note

stick a post note on the pencil case and put inside it a foam ball on a stick.

Cover each desk with coloured cardboard

Put on each covered desk the pencil case with the post note and a stick

Card 3 4

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this idea?

- Different cardboard colours of desk size to cover each desk.
- Pencil cases for each student's desk with a post note on it and a foam ball on a stick.

How to apply this idea

1. Cover each student's desk with different cardboard colours and ask them to personalise their desk cover to identify themselves through their desks. Your desk is your identity, how you would like others to see you. Teachers can give students some examples: stick on your favourite photos, your motivational wisdom, words and quotes, or write on interesting information.

Card 3 5

How

What do you need to apply this card?
How to apply this card.

Students' desks covered with coloured cardboard

Card 3 6

How

What do you need to apply this card?
How to apply this card.

Examples of how students can personalise their desks

2. On the desk, give each student a pencil case, stick a post note on it and put inside the pencil case a foam ball on a stick. Use the post note to send messages to your students or use it as part of your teaching strategy: for example, write a question.

Card 3 7

How

What do you need to apply this card?
How to apply this card.

Ask students to draw their feelings on the foam ball: for example, how they feel in school, or they can give a character to this foam ball.

Examples of the post note and the characterised foam ball.

3. You can make a competition for the most creative desk cover, or you can take a photo of student's desk covers and display them outside the classroom.

Card 3 8

What

What do teachers expect when using this card?
What would the learning space look like?

Card 3 9

Apply and Share

#Classroom_Design_Recipes
#Desks'_probes #your_name

To share your work, please send it to this email
Classroom.Recipie@gmail.com
<http://classroomrecipe.blogspot.co.uk>

Card 3 10

Set of Cards 4: Outside the Classroom Virtually



Card 4

Outside the Classroom Virtually

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users' will get when they use this card:

- Motivating students and offering them different learning experiences by taking students outside the classroom space virtually.
- Stimulating students through different ways of using available technology.
- Responding to students' diverse learning styles by using different teaching tools and strategies, for example: responding to visual learning styles using images with projectors; responding to auditory learning styles by playing music, bird sounds and other sounds using sound systems; and responding to kinetic learning styles by creating movement in the space by playing with the teaching tools.
- Turning elements from nature into a teaching tool.
- Bringing real natural elements, such as birds, leaves and an indoor fountain, inside the classroom space.

Card 4 **2**

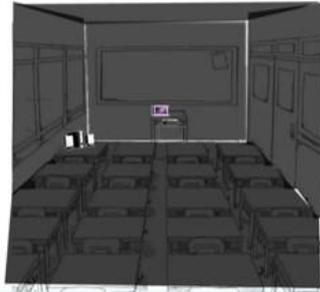
How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this card?



Projector + Computer + Sound system



Card 4 **3**

How

What do you need to apply this card?
How to apply this card.

How to apply this idea.

There are many ways to apply this card which is about taking students outside the classroom virtually. Here are three examples:

1. **Create a cinema mood**
2. **Go to an imaginary world**
3. **Travel to diverse environments**

1. Create a cinema mood: using a projector, computer and sound system, the teacher can play educational movies. Diverse interesting educational movies and videos are available, such as: National Geographic education (<http://education.nationalgeographic.co.uk/st/?ar a=4>), YouTube education (<http://www.youtube.com/education>) and You Tube teachers (<http://www.youtube.com/teachers>).

Card 4 **4**

How

What do you need to apply this card?
How to apply this card.

Examples of how to create a cinema mood

Projector + Computer + Sound system

Diverse interesting educational movies and videos are available, such as:

National Geographic education

Card 4 5

How

What do you need to apply this card?
How to apply this card?

YouTube Education

YouTube Teachers

Card 4 6

How

What do you need to apply this card?
How to apply this card.

In addition, teachers can enhance the cinema mood learning experience with popcorn and cinema tickets. Cinema tickets can be used as a teaching tool where teachers can write questions for students to think about while watching the movie. After answering them, teachers can display the cinema tickets on classroom walls.

Popcorn + Cinema tickets

TRANSFORMERS
what do you think of this movie?

Card 4 7

How

What do you need to apply this card?
How to apply this card.

Applying the cinema mood idea in the classroom space

Card 4 8

How

What do you need to apply this card?
How to apply this card.

2. Go to an imaginary world: using a projector, computer and sound system, teachers can play videos (e.g. cartoons and movies that stimulate students). These can take students into an imaginary world and be taught there. Also, teachers can create teaching tools using elements from a movie, using characters and objects from the film to support the curriculum.

Go to imaginary world

Projector + Computer + Sound system

play videos from cartoons and movies such as :

Card 4 9

How

What do you need to apply this card?
How to apply this card.

For example: Using a Harry Potter movie, teachers can use the idea of working in groups in the Harry Potter movie to support cooperative teaching strategies.

Card 4 10

How

What do you need to apply this card?
How to apply this card.

Furthermore, teachers can replace paper teaching tools with the probes used in this movie, such as using Harry Potter's hat, broom, glasses, map, secret letter and other probes as teaching tools.

Each one of these probes can support teachers' teaching strategies differently . For example:

- **The hat:** The teacher can put a specific request related to her/his curriculum in the hat, hide it and ask students to look for the hat under the staircase or any space outside classroom. When they find it, they must do what the hat asks them to do.
- **The broom:** The teacher can hang the broom from the ceiling with questions for students to answer after they find the broom with their name on.

Card 4 11

How

What do you need to apply this card?
How to apply this card?

- **Harry Potter's glasses:** The teacher can use Harry Potter's glasses to add more drama to his/her teaching strategy. She/he can tell students, "By wearing these glasses you will be ready for this mission".
- **The map:** The teacher can display the map on the wall and an use the map to turn the teaching instructions into a game.
- **Secret letters:** The teacher can hide letters under the table and tell them, "Under your tables there is a secret letter with a secret mission for you to do". This will help the teacher to turn paper questions into a game.

Card 4 12

How

What do you need to apply this card?
How to apply this card.

Harry potter Hat: Teacher can put a specific request which related to her/his curriculum in the hat and hide and ask students to look for the hat under the staircase or any space outside classroom when you find it, do what the hat asks you to do



The broom: Teacher can hang the broom from the ceiling with questions for students to answer after the find the broom with their name on.



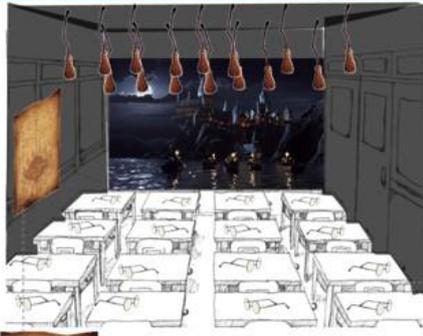
Harry Potter glass: Teacher can use Harry potter glass to add more drama to her teaching strategy, she/he can tell students by wearing this glasses you will be ready for this mission.



Card 4 13

How

What do you need to apply this card?
How to apply this card.



The map: Teacher can display the map on the wall, you can use the map to turn the teaching instructions in to a game



Secret letters: Teacher can hide letters under the table and tell them under your tables there is a secret letter with a secret mission for you do, that would help teacher to turn her paper questions into a game.



Card 4 14

How

What do you need to apply this card?
How to apply this card.

3. Travel to diverse environments: using a projector, computer and sound system, teachers can take students virtually to other environments and teach them there by displaying images from diverse environments such as under the sea, in the garden, sky and beach.



Projector + Computer + Sound system

Take students virtually to other environments, and teach them there by displaying images from diverse environments such as:



Under the sea



Garden

Card 4 15

How

What do you need to apply this card?
How to apply this card?



sky



sky

Applying travel to the diverse environment idea



Card 4 16

How

What do you need to apply this card?
How to apply this card.

Additionally, teachers can utilise different elements of the chosen environment to support their teaching strategies. Also, they can create teaching probes using elements from the chosen environment.



Applying travel to the idea of diverse environments in the classroom space

Card 4 17

How

What do you need to apply this card?
How to apply this card.

For example, teachers can use images from a garden and use elements such as birds and an indoor fountain to bring real garden sounds inside the classroom space. Leaves and twigs can be used as teaching tools from which teachers can hang cards, letters and boxes.



birds and indoor fountain to bring real garden sounds inside classroom space

leaves and tree twig as a teaching tool where teachers can hang cards, letters and boxes.

Card 4 18

What

What do teachers expect when using this card?
How might the learning space look?

Create a cinema mood

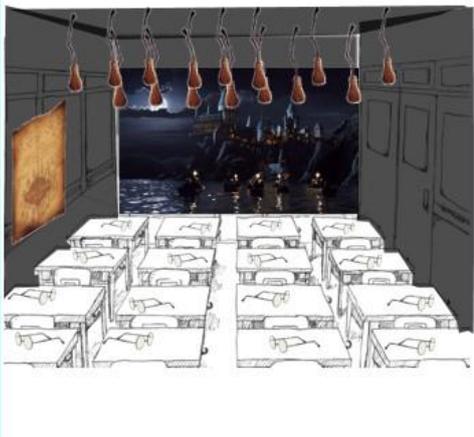


Card 4 19

What

What do teachers expect when using this card?
How might the learning space look?

Go to an imaginary world



Card 4 20

What

What do teachers expect when using this card?
How might the learning space look?

Travel to diverse environments



Card 4 21

Apply and Share

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#Outside_Classroom_Virtually #your_name



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<http://classroomrecipe.blogspot.co.uk>

Card 4 22

Set of Cards 5: Student's P.O. Box



Card 5

Student's P.O. Box

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users' will get when they use this card:

- Motivating students to interact with each other through their P.O boxes.
- Enhancing classroom users' interaction with the space. Besides, classroom walls will not be a solid rigid boundary around students any more because this card will make the classroom wall communicate with its users.
- Supporting teachers' communication with students. Teachers will be able to communicate with their students' through their P.O boxes.
- Helping students to define and express themselves to other students. (How do they want others to see them?)
- Creating a 3-dimensional classroom display.
- Providing a space for students to personalise.
- Providing teachers with an area to reward students and appreciate their work.
- Teachers could use the box as a mediator between them and their students.

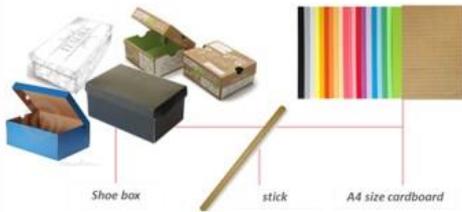
Card 5 2

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this idea?

- Shoe box
- Stick
- A4 size cardboard



Shoe box stick A4 size cardboard

Card 5 3

How

What do you need to apply this card?
How to apply this card.

How to apply this idea.

1. Ask each student to bring an old shoe box.



Ask each student to bring an old shoe box
Ask each student to personalize her/his box

2. Ask each student to personalise her/his box. For example: colour it, cover it with wrapping paper, cover it with colourful patterned paper or use any other ideas using different materials with different textures such as: sack cloth, wool, silk, cotton, fabrics, feathers, glass, aluminium, tiles, shells, leather, paper plates. Ask students to be creative in designing their box.

Card 5 4

How

What do you need to apply this card?
How to apply this card.

For example:



colour it or cover it with wrapping paper or cover it with colourful patterned paper



or any other ideas using different materials with different textures such as: sack clothes, wool, silk, cotton, fabrics, feathers, glass, Aluminium, tiles, shells, leather, paper plates.

Card 5 5

How

What do you need to apply this card?
How to apply this card.

3. Glue a stick to A4 size cardboard.
4. Ask students to define themselves on this A4 size paper. Ask them: "How would you like to define yourself to others?"



Glue a stick with an A4 size cardboard

Ask students to define their self in this A4 size paper. Ask them: "How would you like to define you self to others?"

5. Use the side of the box to reward students. For example, stick a gold star on their box when they do something good; the winning student is the one with the highest number of stars.

Card 5 6

How

What do you need to apply this card?
How to apply this card.

Use the box side for rewarding students.
For example stick a gold star on their box side when they do something good and the winner student is the one with higher number of stars



- Teachers could use the box as a mediator between them and their students. For example: teachers could send messages to them or hide questions and puzzles in the box and ask students to look for them.
- Students can be given the opportunity to send letters to each other via the box.

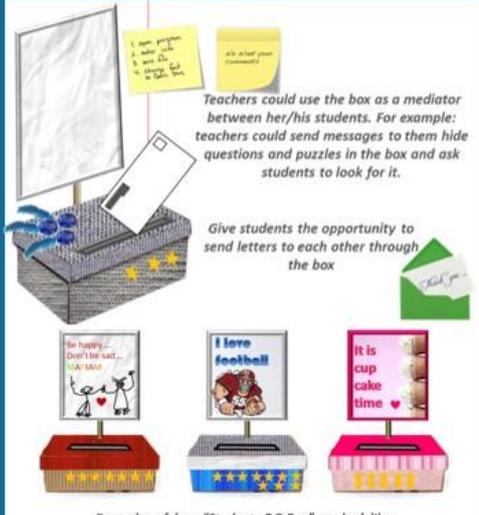
Card 5 7

How

What do you need to apply this card?
How to apply this card.

Teachers could use the box as a mediator between her/his students. For example: teachers could send messages to them hide questions and puzzles in the box and ask students to look for it.

Give students the opportunity to send letters to each other through the box



Examples of how "Students P.O Box" can look like

Card 5 8

What

What do teachers expect when using this card?
How might the learning space look?



How the classroom space can look like when teachers apply "Students P.O Box" card

Card 5 9

What

What do teachers expect when using this card?
How might the learning space look?



Card 5 10

Apply and Share

#Classroom_Design_Recipes
#Student's_P.O_Box #your_name



To share your work, please send it to this email
Classroom.Recipe@gmail.com

<http://classroomrecipe.blogspot.co.uk>

Card 5 11

Set of Cards 6: Physically Outside the Classroom



Card 6

Physically Outside the Classroom

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users' will get when they use this card:

- Creating outside classroom activities.
- Making going outside the classroom easier.
- Breaking everyday routine and offering new learning experiences.
- Extending classroom space and connecting students with outside the classroom.
- Stimulating and motivating students by creating a kinetic activity.

Card 6 2

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this idea?

- Picnic equipment.
- Divide students into groups with each group bringing a picnic blanket to sit on.
- Teacher can pack her/his teaching tools in the picnic basket.
- Picnic with healthy food.

Card 6 3

How

What do you need to apply this card?
How to apply this card.



Picnic equipment

Divide students into groups, each group brings a picnic blanket to set on



Picnic healthy food



Teacher can pack her/his teaching tools with the picnic basket

Card 6 4

How

What do you need to apply this card?
How to apply this card.

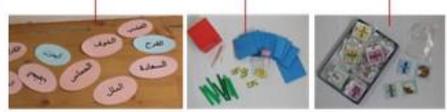
How to apply this idea.

1. Create a picnic mood by creating a toolkit for going outside the classroom physically. Pack your picnic basket, picnic blanket, teaching tools and healthy picnic food.



Picnic equipment

Create a picnic mood by creating a toolkit for going outside classroom physically: pack your picnic basket, picnic blanket, teaching tools and healthy picnic food



Teaching tool

Card 6 5

How

What do you need to apply this card?
How to apply this card.

2. Teacher can ask students to cook healthy food to bring to the picnic and create a competition between students for the best recipe.



Teacher can ask students to cook healthy food to bring them in the picnic, and make competition between students for the best recipe



3. Teachers can use the food as a teaching tool.

Teachers can use the food as a teaching tool



For example: using food counting and learning numbers

1 2 3 4 5 + - =

Card 6 6

How

What do you need to apply this card?
How to apply this card.

4. Teacher could use a cooperative teaching strategy by asking each group of students to sit on a blanket.

Teacher could use cooperative teaching strategy by asking each group of students to sit on a blanket



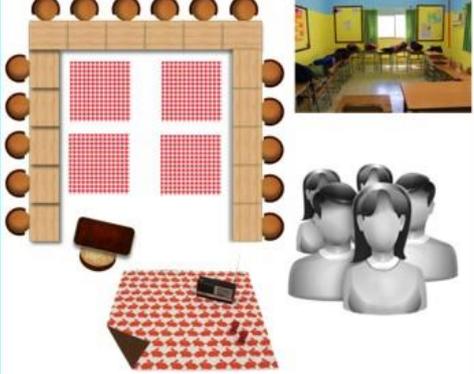
5. If the weather means the teacher cannot go outside, she/he can use this idea inside the classroom, organising the tables and chairs in a U-shape and sitting on the floor on the picnic blanket.

Card 6 7

How

What do you need to apply this card?
How to apply this card.

If the weather did not help teacher to go outside, she/he can apply this idea inside classroom by organising the tables and chairs in U-shape and set on the floor using the picnic blanket



Card 6 8

What

What do teachers expect when using this card?
How might the learning space look?

Since this card idea can be applied outside the classroom space, there is no image to show what teacher s might expect when using this card or how the classroom space might look.

Card 6 9

Apply and Share

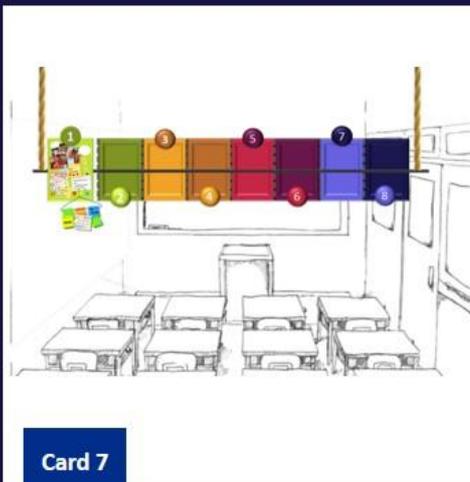
#Classroom_Design_Recipes
#Outside_Classroom_Physically #your_name



To share your work, please send it to this email
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<http://classroomrecipe.blogspot.co.uk>

Card 6 10

Set of Cards 7: Classroom Timeline



Card 7

Classroom Timeline

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users' will get when they use this card:

- Creating an interactive wall or ceiling display
- Visualise students' learning experience
- Students can learn from the wall or ceiling display without the need for a teacher
- Recording students' best memories, feelings about classroom activities and the learning experience

Card 7 2

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Using wall/ceiling displays to support teaching and learning
- Stimulating students by giving them the opportunity to display their photos, offer their opinions and express their feelings
- Creating a different mode of classroom display
- Helping students to reflect on what they have done during school time

Card 7 3

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this idea?

- Students' work
- Students' photos
- Sticky notes
- Timeline

Card 7 4

How

What do you need to apply this card?
How to apply this card.

Students' work



Students' photos



Sticky notes



Timeline
Teacher can design her/his timeline or ask students to design it



Card 7 5

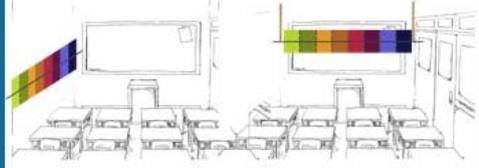
How

What do you need to apply this card?
How to apply this card.

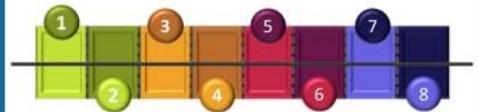
How to apply this idea?

1. Draw a timeline on the classroom wall or suspend a timeline from the classroom ceiling
2. Divide the timeline into months

Draw a timeline on classroom wall or suspend a timeline from classroom ceiling



Divide the timeline into months



Card 7 6

How

What do you need to apply this card?
How to apply this card.

3. Ask students to capture their best moments during classroom daily activities by taking photos, making drawings and writing on the sticky notes.

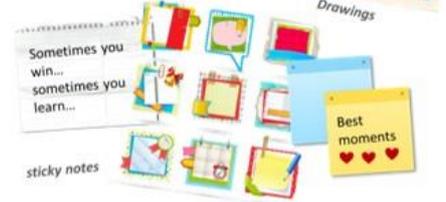
photos



Drawings



sticky notes



Card 7 7

How

What do you need to apply this card?
How to apply this card.

4. Collect the best student's work each month.
5. Teacher writes a summary of what students learn in the month.

Collect best student's work of each month



Teacher writes a summary of what students learn in the month

6. Create a classroom timeline for each month. The timeline can capture what happens in the classroom each month: for example, students' best work, teachers' summary of what students have learned this month, students' best classroom moments in photos and words.

Card 7 8

How

What do you need to apply this card?
How to apply this card.

Create a classroom timeline for each month

1 the timeline would capture what happen in classroom each month for example: students' best work, teachers' summary of what students have learn in this month, students' best classroom moments in photos and words

Card 7 9

What

What do teachers expect when using this card?
How might the learning space look?

Card 7 10

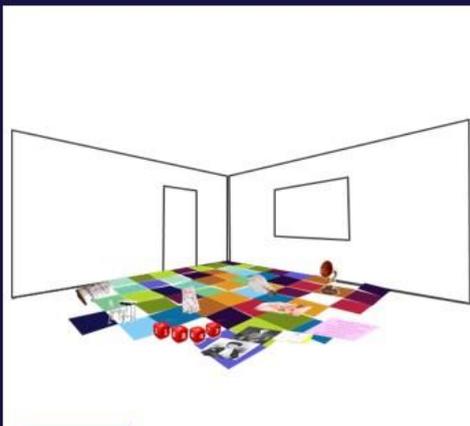
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#Classroom_Timeline #your_name

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Card 7 11

Set of Cards 8: Flooring Story Telling



Card 8

Floor Storytelling

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users' will get when they use this card:

- Creating an interactive floor.
- Using classroom flooring to support teachers' teaching strategy.
- Designing a colourful patterned floor.
- Visualising teacher's storytelling teaching strategy in order to stimulate students and respond to their divers learning styles.
- Changing the classroom space according to the curriculum.
- Turning classroom flooring into a 3D curriculum.
- Involving students in telling curriculum stories.
- Creating a different learning experience.

Card 8 **2**

How

What do you need to apply this card?
How to apply this card.

Applying this card depends on:

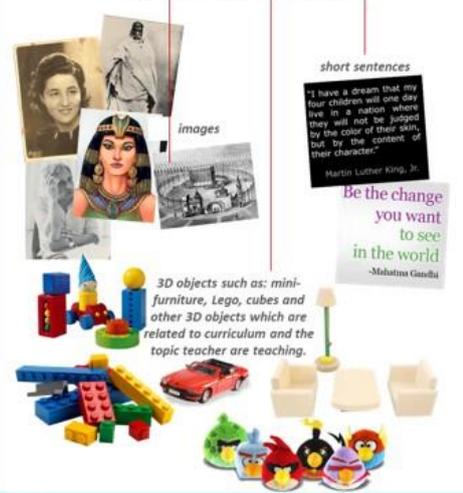
1. Turning the curriculum into a visual story and telling students the story using images, short sentences and 3D objects such as: mini-furniture, Lego, cubes and other 3D objects which are related to the curriculum and the topics teachers are teaching.
2. Involving students in telling the story by asking them to draw some of the images or to bring some of the objects.
3. Arranging the classroom tables and chairs in a U-shape.
4. Arranging the images, words, 3D objects on the floor and telling students the story by linking it to what is on the floor.

Card 8 **3**

How

What do you need to apply this card?
How to apply this card.

Turning the curriculum or the topic teacher are teaching into a visual story and tells students the story using:



images

short sentences

"I have a dream that my four children will one day live in a nation where they will not be judged by the color of their skin, but by the content of their character."
-Martin Luther King, Jr.

Be the change you want to see in the world
-Mahatma Gandhi

3D objects such as: mini-furniture, Lego, cubes and other 3D objects which are related to curriculum and the topic teacher are teaching.

Card 8 **4**

How

What do you need to apply this card?
How to apply this card.

Involving students in telling the story by asking them to create some of the images or to bring some of the objects

Arranging the classroom tables and chairs into U-shape

“Games, quizzes, and trivia enliven this tour through the land of the pharaohs.”

Arranging the images, words, 3D objects on the floor and start telling students the story by linking it to what is on the floor

5

How

What do you need to apply this card?
How to apply this card.

This card could be applied in diverse ways but here is one suggestion of how to apply this card. For example, if the lesson is about a character such as Thomas Edison you could apply the card in this way:

- The lesson could be divided into sections: the year he was born, difficulties he faced in life, where he lived, what he invented, what he said, and his photo.

Thomas Edison

The lesson can be divided into sections:

year he was born _____

difficulties he faced in life _____

where he lived _____

what have he invent _____

quotes he have said _____

his photo _____

Then turn each section into visuals for example:

6

How

What do you need to apply this card?
How to apply this card.

- Then turn each section into visuals: for example, use cube numbers to show the year he was born; use images and objects to make students think about difficulties he faced in his life; use a map to show where he lived, bring in objects he invented; write in sticky note his quotes; bring in his photo.

He was born in 1847

use cube numbers to show the year he was born

Schooling problems

Edison developed hearing problems at an early age

use images and objects to make students think about difficulties he faced in his life

Edison obtained the exclusive right to sell newspapers on the road

use a map to show where he lived

bring objects he invent

write in sticky note his quotes

bring his photo

7

How

What do you need to apply this card?
How to apply this card.

- After that, cut out rainbow coloured squares using colourful cardboard and spread them on the floor.

After that cut rainbow colour squares using colourful cardboards, and spreaded them on the floor

- Finally, the teacher can spread her/his visuals on the rainbow squares. For example, the teacher can hide some visuals under the squares and put others on the squares.

8

How

What do you need to apply this card?
How to apply this card.

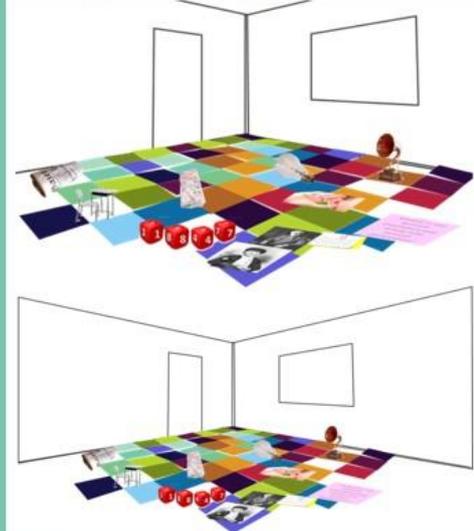
Finally, teacher can spread her/his visuals on the rainbow squares, for example teacher can hide some of visuals under the squares and others she/he can put them on the square.



Card 8 9

What

What do teachers expect when using this card?
How might the learning space look?



Card 8 10

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Card 8 11

Set of Cards 9: Classroom Café



Card 9

Classroom Café

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users' will get when they use this card:

- Creating a tool that will aid teachers in applying diverse teaching strategies such as brain storming, problem solving and cooperative teaching strategies.
- Involving students in designing the classroom space.
- Motivating and stimulating students to use the classroom space through competitions.
- Creating another space within the classroom space.

Card 9 2

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Connecting the learning process and the curriculum with reality.
- Connecting students with the outside classroom space.
- Students participating in decision-making through voting.
- Creating different seating arrangements in the classroom space.
- Using space to support teaching and learning.
- Providing a learning experience that responds to diverse students' learning styles.
- Designing an interactive wall and flooring in the space.

Card 9 3

How

What do you need to apply this card?
How to apply this card.

In order to apply this card, the teacher with her/his students first needs to:

Create a café structure inside the classroom space or in the corridor.



Card 9 4

How

What do you need to apply this card?
How to apply this card.



The café structure is created outside the classroom space in the corridors, the teacher can connect it with the classroom space through the flooring.



Card 9 5

How

What do you need to apply this card?
How to apply this card.

How to use the café structure.

The café structure can be an effective teaching tool and there are unlimited ways in which the café structure can be used in order to support diverse teaching strategies. For example:

Card 9 6

How

What do you need to apply this card?
How to apply this card.

1. Teachers can create a competition among students on “**Design Your Café**”. Each student or group of students design a logo for the café and choose colours for it. After that, competitors’ work is displayed on the walls and students vote for the best café. Finally, the teacher and students work together to apply the winning idea. This involves students in designing parts of their own classroom space and gives them the opportunity to make decisions.

1 Teacher can do a competition between students about “**Design Your Café**” each student or each group of students

design a logo for the café



choose its colours



Card 9 7

How

What do you need to apply this card?
How to apply this card.

after that competitors’ work displayed on the walls



students can vote for the best café.

Card 9 8

How

What do you need to apply this card?
How to apply this card.

2. Ask students to cook at home and bring in what they have cooked to sell in the café. The money raised can be used to support other classroom activities. However, cooking and selling are also useful learning processes where students can learn to solve real problems instead of proposed ones; teachers can also connect this process with the teaching curriculum by, for example: addition and subtraction while selling what they have cooked; learning how to count money through selling; experiencing the mixing of different cooking ingredients; and learning about weights and measurements.

Card 9 9

How

What do you need to apply this card?
How to apply this card.

3. Creating different seating arrangements around the café structure. This can be used to enhance socialisation amongst students.



Card 9 10

How

What do you need to apply this card?
How to apply this card.

4. The café structure could be used to teach students how to start a business. Each student or group of students could be given a small amount of money and they can choose something to sell in the café.

5. A library can be added to the café structure by hanging up bookshelves, and creating a reading or eating area.



Card 9 11

How

What do you need to apply this card?
How to apply this card.

6. The idea of the corridor café can be extended; more shops can be opened to create a corridor mall.



Card 9 12

What
 What do teachers expect when using this card?
 How might the learning space look?

Card 9 13

What
 What do teachers expect when using this card?
 How might the learning space look?

Card 9 14

What
 What do teachers expect when using this card?
 How might the learning space look?

Card 9 15

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Card 9 16

Set of Cards 10 Nature inside the Classroom



Card 10

Nature inside the Classroom

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users will get when they use this card:

- Inspiring teachers with different interior design tips in order to create an interesting classroom space
- Responding to students' different learning styles.
- Creating a change in classroom space
- Improving teachers' awareness of interior design elements in a space
- Designing an interactive learning space
- Bringing real nature elements into classroom space
- Motivating students to contemplate in the nature elements
- Designing the classroom space as a 3D curriculum

Card 10 **2**

How

What do you need to apply this card?
How to apply this card.

Nature inside the classroom space

Bring natural elements into the classroom space and connect them with the curriculum in order to support your teaching strategy. This can make the classroom space work as a 3D curriculum.

Additionally, teachers can ask pupils to contemplate natural elements around them.

Card 10 **3**

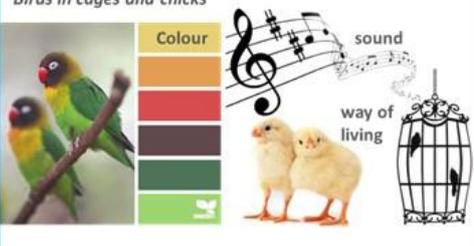
How

What do you need to apply this card?
How to apply this card.

For instance, teachers can ask pupils to think of colours, sounds and ways of living. Also, different elements from nature can be brought into the classroom space such as:

- Birds in cages and chicks
- Fish bowls or fish aquaria
- Indoor gardening
- Indoor fountain

Birds in cages and chicks



Card 10 **4**

How

What do you need to apply this card?
How to apply this card?

Fish bowl or fish aquarium



Colour



Way of living



Indoor gardening



Colour



way of living

Teacher can stick students photos on the pots

Card 10 5

How

What do you need to apply this card?
How to apply this card?

Indoor fountain



Sound



Colour



Card 10 6

What

What do teachers expect when using this card. How might the learning space look?

Nature inside the classroom space



Card 10 7

Apply and Share

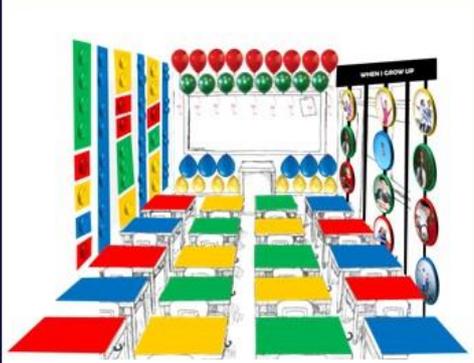
#Classroom_Design_Recipes
#Nature_Classroom #your_name



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Card 10 8

Set of Cards 11 Classroom Party



Card 11

Classroom Party

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users will get when they use this card:

- Inspiring teachers with different interior design tips in order to create an interesting classroom space
- Responding to students' different learning styles
- Creating a change in classroom space
- Improving teachers' awareness of interior design elements in a space
- Designing an interactive learning space
- Offering diverse ways for display in the classroom space

Card 11 2

How

What do you need to apply this card?
How to apply this card.

Classroom Party

Create simple party decorations using simple decorating elements such as:

balloons, decorative lighting and colourful decoration papers. These simple ideas help teachers to create a change in the space.



In addition, parties usually have themes so everything in the party, such as food, cards, dresses and decorations, can support this theme.

Card 11 3

How

What do you need to apply this card?
How to apply this card.

Compare this concept with what happens in the classroom space. In the classroom space, teachers' curricula also have different themes and so everything in the classroom space, such as activities, displays and teaching tools, can support the curriculum theme. Thus, teachers can think of the curriculum theme as a party theme and design everything in the classroom space to support this theme.

Here are some different examples of party themes:

Card 11 4

How

What do you need to apply this card?
How to apply this card.

Alice in Wonderland Party Theme



Picture Reference:
<http://www.merelymothers.com/2012/07/09/top-ten-tuesday-timeless-birthday-party-themes/>

Card 11 5

How

What do you need to apply this card?
How to apply this card.

Alice tea party



Alice playing cards

Card 11 6

How

What do you need to apply this card?
How to apply this card.

Circus Party Theme



Picture Reference:
<http://www.merelymothers.com/2012/07/09/top-ten-tuesday-timeless-birthday-party-themes/>

Card 11 7

How

What do you need to apply this card?
How to apply this card.

Circus dresses

Circus games

Circus cards

Circus colours

Parties usually have themes, and everything in the party, such as food, cards, dresses and decorations, can support this theme.

In the classroom space, teachers' curricula also have different themes and everything in the classroom space, such as activities, displays and teaching tools, can support the curriculum theme. Thus, teachers can think of the curriculum theme as a party theme and design everything in the classroom space to support this theme

Card 11 8

How

What do you need to apply this card?
How to apply this card.

LEGO Party Theme



Picture Reference:
<http://www.andersnufft.com/custom-printable-papillon/wp-content/uploads/2011/08/lego2-06-s40x914.jpg>

Picture Reference:
<http://www.mamapicks.com/category/ideas/>

Picture Reference:
<http://www.karaspartyideas.com/>



LEGO Blocks
LEGO colours
LEGO characters

Card 11 9

How

What do you need to apply this card?
How to apply this card?

Example of applying the LEGO theme in the classroom space



Tissue paper
Colourful balloons
Colourful plates
Colourful cardboard

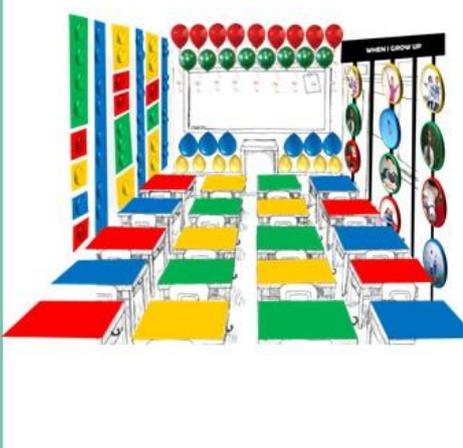
What students want to be when they grow up?
WHEN I GROW UP
Stick their photos on a colorful plates

Card 11 10

What

What do teachers expect when using this card?
How might the learning space look?

Classroom party



Card 11 11

Apply and Share

#Classroom_Design_Recipes
#Classroom_Party #your_name



To share your work, please send it to this email
Classroom.Recipe@gmail.com
<http://classroomrecipe.blogspot.co.uk>

Card 11 12

Set of Cards 12 Collage Wallpaper



Card 12

Collage Wallpaper

<http://classroomrecipe.blogspot.co.uk>



Why

Why use this card? Benefits classroom users will get when they use this card:

- Inspiring teachers with different interior design tips in order to create an interesting classroom space
- Responding to students' different learning styles
- Creating a change in classroom space
- Improving teachers' awareness of interior design elements in a space
- Designing an interactive learning space
- Attracting and motivating students in the space
- Offering diverse ways for display in the classroom space

Card 12 2

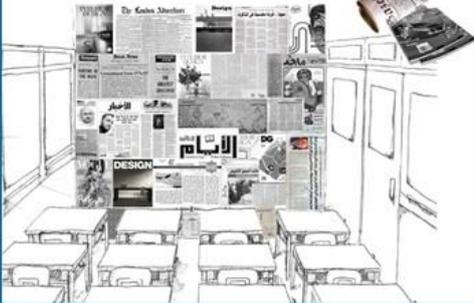
How

What do you need to apply this card?
How to apply this card.

Collage wallpaper

The idea of collage wallpaper can be applied in different ways using different materials. For example:

Create collage wallpaper by sticking discarded black and white magazines and newspapers on the full wall height.



Card 12 3

How

What do you need to apply this card?
How to apply this card.

Teachers could ask students to look for words and different designs of typography. In addition, students can draw on this wallpaper and personalise it.



Card 12 4

How

What do you need to apply this card?
How to apply this card.

Create collage wallpaper by sticking students' work on the full wall height.



Card 12 5

How

What do you need to apply this card?
How to apply this card.

Create collage wallpaper by sticking students' photos on the full wall height to create a memory wall.



Card 12 6

How

What do you need to apply this card?
How to apply this card.

In addition, students could talk about their memories and best classroom moments using sticky notes and speech bubbles.



Card 12 7

How

What do you need to apply this card?
How to apply this card.

In addition, students could talk about their memories and best classroom moments using sticky notes and speech bubbles.



Card 12 8

What

What do teachers expect when using this card?
How might the learning space look?

Collage wallpaper

Card 12 9

What

What do teachers expect when using this card?
How might the learning space look?

Collage wallpaper

Card 12 10

What

What do teachers expect when using this card?
How might the learning space look?

Collage wallpaper

Card 12 11

Apply and Share

#Classroom_Design_Recipes
#Collage_Wallpaper #your_name

To share your work, please send it to this email
Classroom.Recipe@gmail.com
<http://classroomrecipe.blogspot.co.uk>

Card 12 12

Set of Cards 13 Stimulating the Senses

Card 13

Stimulating the Senses

<http://classroomrecipe.blogspot.co.uk>

Why

Why use this card? Benefits classroom users will get when they use this card:

- Inspiring teachers with different interior design tips in order to create an interesting classroom space
- Responding to students' different learning styles
- Creating a change in classroom space
- Improving teachers' awareness of interior design elements in a space
- Designing an interactive learning space
- Stimulating students' senses through space design
- Attracting and motivating students in the space
- Designing the classroom space as a 3D curriculum

Card 13 **2**

How

What do you need to apply this card?
How to apply this card.

Stimulate the Senses

Stimulate students' senses through the design of the space. Teachers can apply this concept in the classroom space by thinking of the five senses while planning the space, bringing in different elements that stimulate these senses.

Card 13 **3**

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that teachers can bring to their classroom space in order to stimulate students' senses.

Card 13 **4**

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of hearing.

Ears → Hearing

SOUND 

Provide classroom space with objects that create sounds that will stimulate ears

For example:

The sound of water  The sound of birds 

Music  Sound System 

Card 13 5

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of sight.

Eyes → Sight



VISUALS

Provide your classroom space with a rich variety of visuals, even if you think they are not directly related to your curriculum. Encourage students to contemplate what is around them.

For example:

Images  Colours  3D objects 

Card 13 6

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of touch.

TOUCH

For example:

| | | |
|---|--|--|
| Nature images  | Colourful images  | Balloons  |
| Animals  | Colourful papers  | LEGO  |
| Art work  | Colourful paint  | Mini furniture  |
| Colourful furniture  | Leaves  | Candles  |

Card 13 7

How

What do you need to apply this card?
How to apply this card.

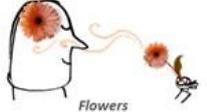
Examples of different elements that stimulate the sense of smell.

Nose → Smell

SMELL 

Use different smells in different classroom sessions. This can stimulate students' sense of smell and can help students to relate different classroom topics with different smells.

For example:

Perfumes  Flowers 

Perfumed Candles 

Card 13 8

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of touch.



Provide your classroom space with a rich variety of materials and objects with different textures, even if you think it is not related to your curriculum. Encourage students to touch and feel the different texture of materials and objects around them.
For example:

Objects with different textures  Materials with different textures 

Card 13 9

How

What do you need to apply this card?
How to apply this card.



Leaves 

Leather 

Furniture
For example:
Wooden desk and chair 

Wood 

Natural rugs 

Tiles 

Shells 

Stones 

Different fabric textures 

Beads 

Card 13 10

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of taste.



Provide your classroom space with different types of food and use them as a learning tool in order to stimulate students' sense of taste.
For example:

Diverse types of food with diverse tastes, colours and textures 

Card 13 11

Apply and Share

#Classroom_Design_Recipes
#Stimulating_Senses #Your_Name



To share your work, please send it to this email
Classroom.Recipe@gmail.com
<http://classroomrecipe.blogspot.co.uk>

Card 13 12

Set of Cards 14: Template Create Your Own



Card

Create your Own

Download template form
<http://goo.gl/147Zof>



Card



Why

 Why use this card? Benefits classroom users' will get when they use this card:

Your card name Page Number

How

 What do you need to apply this card?
How to apply this card.

Your card name Page Number

 **What**

What do teachers expect when using this card?
How might the learning space look?

Your card name Page Number

 **Apply and Share**

#Classroom_Design_Recipes #My_Recipe
#YourCardName #Your_Name

Could you please send your card idea on this email
classroom.recipe@gmail.com

<http://classroomrecipe.blogspot.co.uk>

Your card name Page Number

APPENDIX 7: Set of Cards

This appendix explains the rest of set of cards, from number four to eleven which not explained in the tool development chapter.

Set of Cards 4 “Outside Classroom Virtually”

Different inspirations from students’ drawings were connected with problems mentioned by users or known from their thoughtless acts while observing space supported by literature review were built on each other to create this set of cards, the process of building these thoughts is explained in one thinking map shown in Figure 445, next this map will be divided into sections and explained into details.

Table 14: shows thinking elements of set of cards 4 "Outside Classroom Virtually"

| | 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice |
|---|---|---|---|---|--|
| Cards 4 “Outside Classroom Virtually” | Lippman (2010) claimed that technology can be used as tool that stimulate learning opportunities. However, according to Weiss (2007), none of the past or present technologies are being fully integrated into learning | <p>Outside classroom in students’ drawings</p> <p>The concept of going outside classroom space</p> <p>respond to the diversity in the world around us in students drawings</p> <p>interaction between students and imaginary worlds</p> <p>Students also change the teaching tools and furniture of classroom space in relation to the space for example the shark is the white board in under the sea</p> <p>Observation questions</p> <p>instead of doing changes in space teachers wanted to go to</p> | <p>Angry Birds game to teach students physics lessons (Dwyer, 2011)</p> <p>smart ways of using available technologies</p> <p>student tweeted that she would do anything to go to Hogwarts (Harry potter school) to have a magical education</p> | <p>Google map fans used</p> <p>Google map to travel around the state virtually using Google map program, projector and computer</p> <p>art work done by Adam Martinakis</p> <p>Students’ drawings</p> | <p>Outside Classroom Virtually</p> <p>users can move and learn into diverse worlds virtually using available technology</p> <p>simple available technology can create magical space yet users are not aware of its uses’ potential</p> <p>designing different learning experiences responding to different learning styles using available technologies</p> <p>turning physical space elements to teaching tools using design skills</p> <p>showing teachers how to design space to be a silent curriculum</p> <p>comparison between teachers’ classroom space</p> |

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| | | | | | |
|--|--|--|--|--|--------------------------------------|
| | | <p>another environment</p> <p>limitation in the ways teachers' use available technologies in the space</p> <p>limitation in the learning experiences that they can offer to students</p> | | | <p>and students' classroom space</p> |
|--|--|--|--|--|--------------------------------------|

In this set of cards students' drawings helped to explore and communicate the design of classroom from different angle, when students where ask to draw classroom of their dreams they moved space to diverse imaginary and real worlds. Students illustrated that classroom space should respond to the diversity in the world around them and encourage them to interact with the imaginary world of cartoons and fairy tale stories as shown in Figure 448. Students also change the teaching tools and furniture of classroom space in relation to the space for example the shark is the white board in under the sea classroom and the mermaid is a teacher, while in the garden classroom trees are their notebook, and clouds are tables and chairs in the sky classroom. Detailed explanation of these drawings is mentioned in Finding Chapter section 3. Moving Beyond the Classroom, these drawings and the shift they created in the meaning of classroom space were the beginning inspiration of set of cards number four "Outside Classroom Virtually", Figure 446 and Figure 447 show examples of the classroom of students' dreams.



Figure 447: Students' Dream Classroom outside Classroom Space

To respond to what students called classroom of their dreams, the drawings were reflected on questions raised during observation in the first stage which are: How the classrooms affect the practice of teacher? How the classroom is being used during lessons? To what extent teachers are in control of their physical classroom environment? Do they use it deliberately? Questions and drawings are illustrated in Figure 448. Another inspiration came from savvy science teachers who used Angry Birds game to teach students physics lessons (Dwyer, 2011), this explained how some teachers used famous games cartoons as a teaching tool.

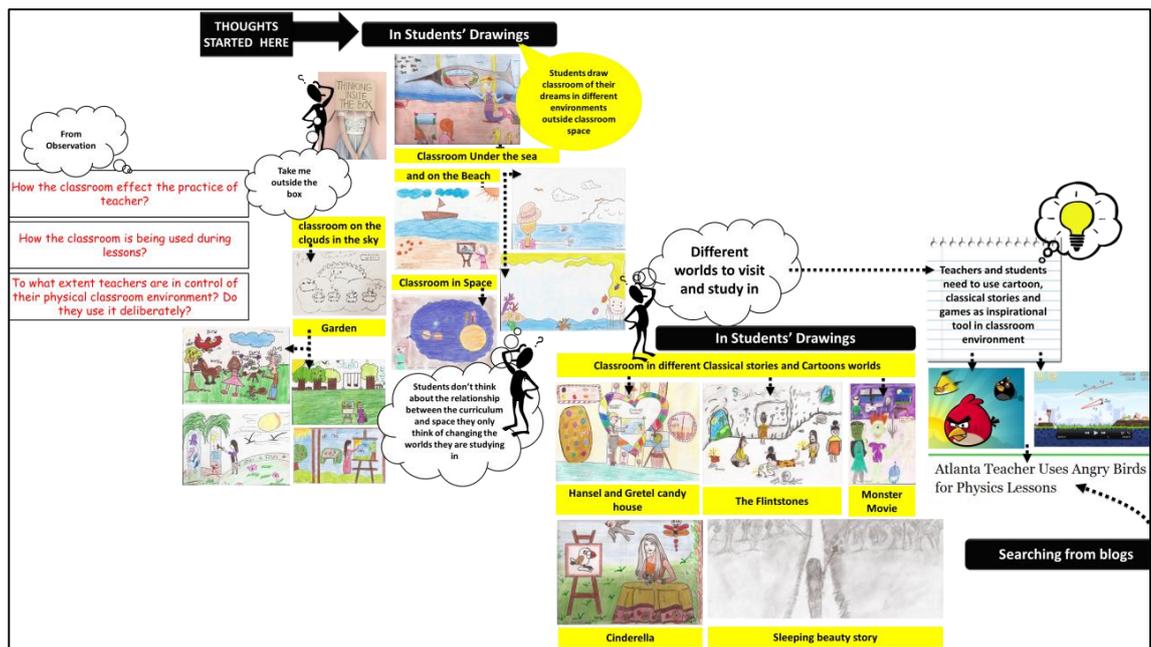


Figure 448: Students' Drawings Inspiration of Set of Cards Number 4

In the second stage fieldwork when the teachers were asked about how do they change classroom space teachers claimed that instead of doing changes in space they wanted to go to another environment and teach there, teachers' claims are shown in Figure 449.

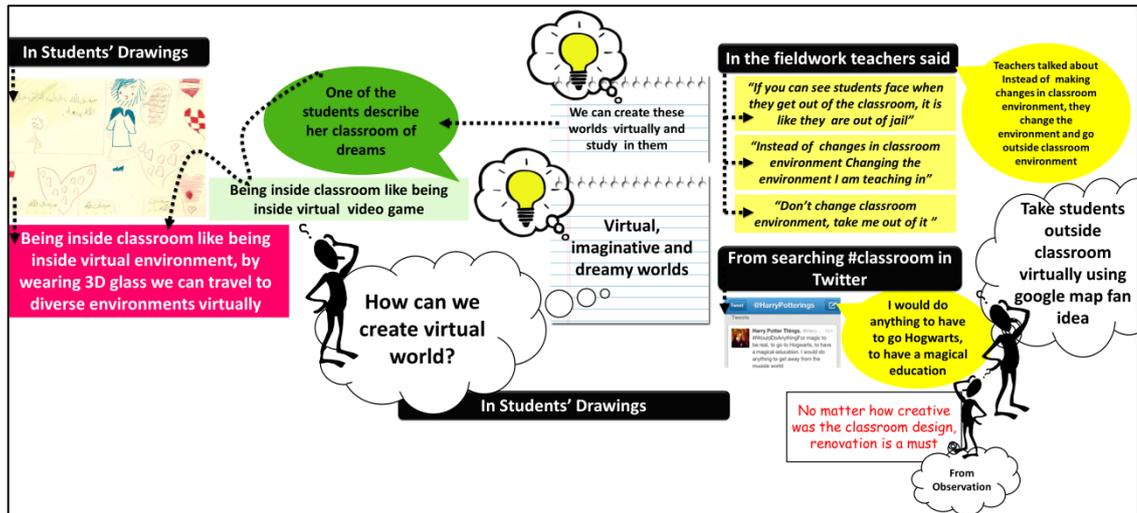


Figure 449: Thinking Map Development "Outside Classroom Virtually"

One of the teachers said: *"instead of making changes in classroom space, I prefer changing the space I am teaching in"* another teacher claimed that *"if you can see students faces when they go out of the classroom space, it is like they are out of jail"* and one of the teacher argued *"don't change classroom space take me out of it"*. Currently most of classroom spaces share the same plan and the same technologies which are: projector, sound system and computer, using these available technologies users can move and learn into diverse worlds virtually, however currently these technologies are used mainly to present PowerPoint presentations. However, users said that they need to know smart ways of using these technologies. Therefore, the idea of this set of cards were developed to solve problems and respond to users request of a classroom space that take them to diverse worlds, a space that changes every time because according to classroom users no matter how classroom space is creative and beautiful changing space is a must. Additionally, simple available technology can create magical space yet users are not aware of its uses' potential, searching #classroom in Twitter where space users usually share their thoughts about this important space a student tweeted that she would do anything to go to Hogwarts (Harry potter school) to have a magical education; the tweet is shown in Figure 449. In another interesting drawing a student illustrated her classroom dream is being inside virtual environment, by wearing three-dimensional glass to be able to travel to diverse environments, this drawing is shown in Figure 449. Developing the idea of using available technology to go outside classroom virtually two questions were asked: How can we show teachers how to create different virtual worlds inside classroom space? And how this virtual world can help teachers to overcome other common problems?

As illustrated in Figure 450, technology in term of projector, sound system and projector was mentioned by users as an important design element in space, and researchers such as Lippman (2010) claimed that technology can be used as tool that stimulate learning opportunities. However, according to Weiss (2007), none of the past or present technologies are being fully integrated into learning, the findings clarified that one of the reasons behind this is that teachers limited awareness of different ways for using available technologies. Therefore, this set of cards attempts to show teachers different ways of integrating these technologies with their teaching and learning methods while responding to their request for changing the world they are learning in and moving to diverse worlds.

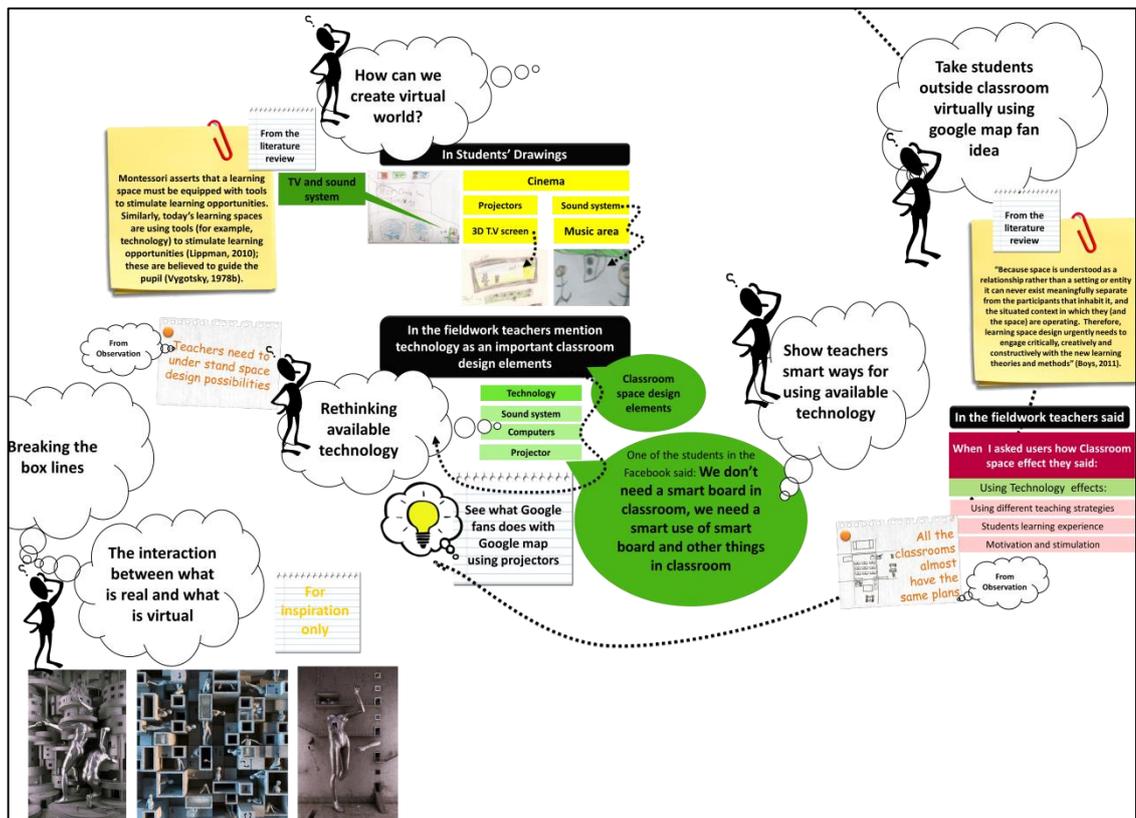


Figure 450: Developing the Idea of "Going Outside Classroom Virtually"

Two main inspirations helped to develop this set of cards. First inspiration came from Google map fans that used Google map to travel around the state virtually using Google map program, projector and computer, Figure 451 shows traveling using Google map.



Figure 451: Traveling Using Google Map

Source: <https://www.youtube.com/watch?v=Ab1fkBr5Md4>

The second inspiration came from an art work done by Adam Martinakis, his artworks were an inspiration for the interaction between users and virtual space, Figure 452 shows some of Adam Martinakis artwork.



Figure 452: Adam Martinakis Artwork

Source: <http://adamakis.blogspot.com/>

Continuously, developing the idea of creating a virtual world developed to show users different ways of using available technologies in order to create a frequent change in classroom space which was a problem mentioned by users and a gap missing in the literature. Additionally, as explained in Figure 453 teachers claimed that resources such as technology effect users' creativity, imagination, way of thinking and learning experience. However, the finding revealed limitation in the ways teachers' use of these resources.

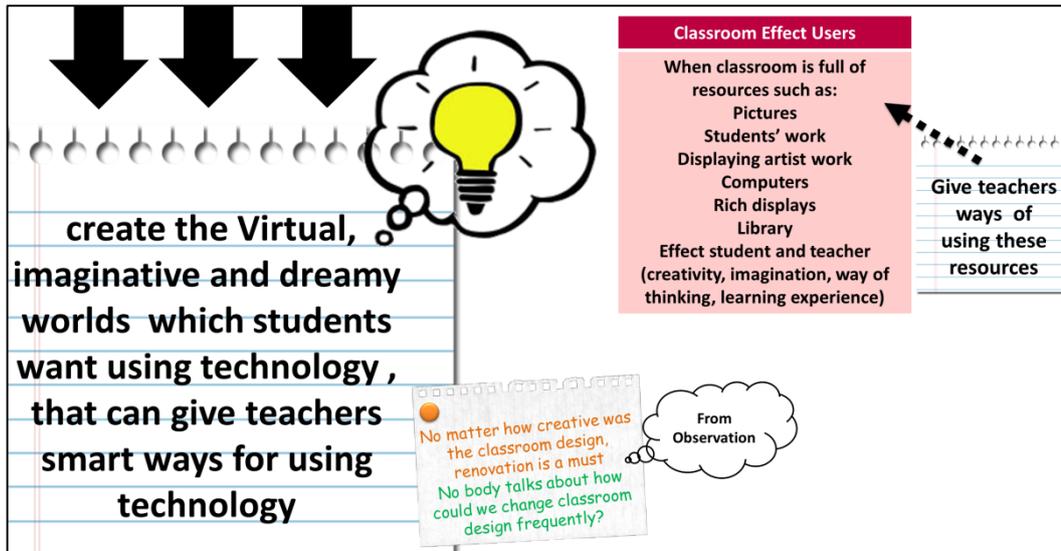


Figure 453: Thinking Map Development of Set Number Four

Finally, as illustrated in Figure 454 “Outside Classroom Virtually” set of cards developed a toolkit using three available technologies which are projector, computer and sound system to go outside classroom space virtually by suggesting three different virtual experience: (1) Create a cinema mood, (2) Go to an imaginary world and (3) Travel to diverse environments.

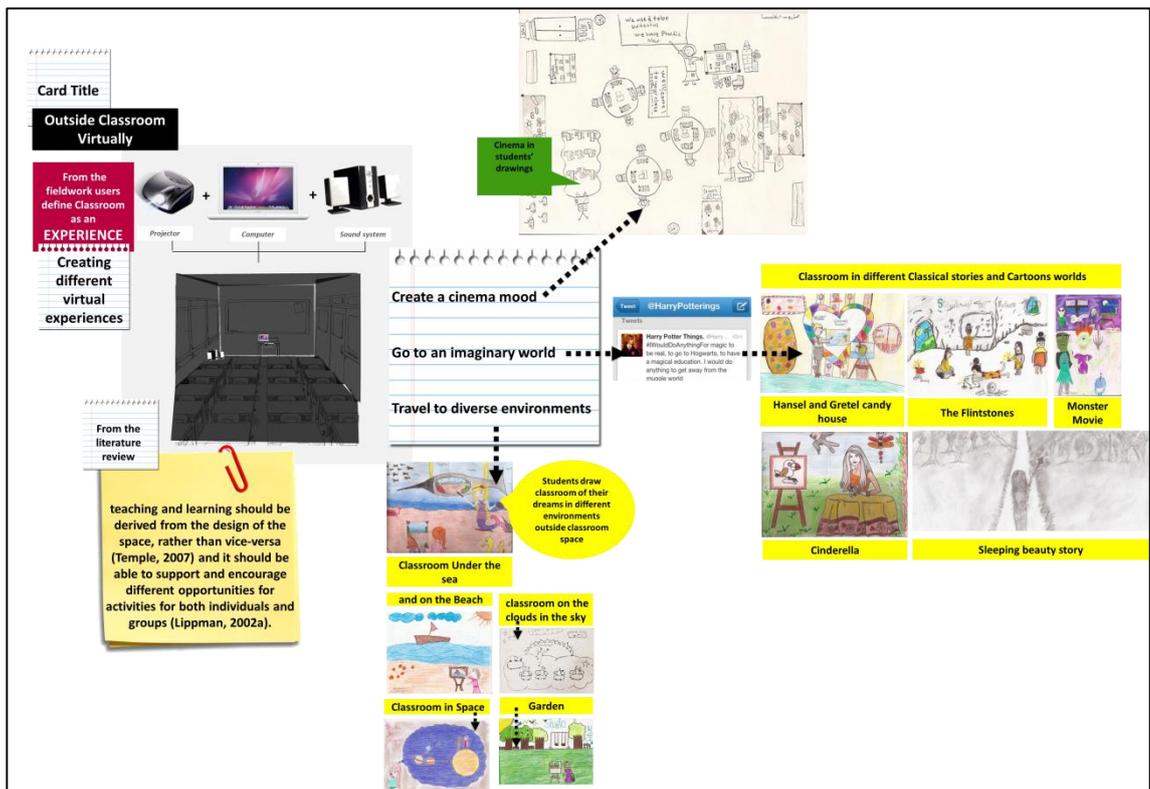


Figure 454: Final Development of Outside Classroom Virtually Set of Cards

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These virtual experiences aids teachers to enrich their teaching experience, because according to teachers there is a limitation in the learning experiences that they can offer to students. Additionally, “Outside Classroom Virtually” can increase the connection between classroom space and outside environments virtually which can motivate and stimulate students to learn in classroom space. Each one of these virtual experience brought its concept from a group of students’ drawings illustrated in Figure 454.

The first suggestion is (1) Create a cinema mood as shown in Figure 455, in this idea teachers create a cinema mood environment using suggested toolkit, researcher have explained different ways for motivating and teaching students depending on teachers ways of teaching and motivating students which were explained in the Finding Chapter, because teachers have asserts that they face difficulties in stimulating and motivating students to learn in classroom space for example: connecting movies with real life experience, allowing students to eat popcorn while watching movie that can respond to students’ diverse learning style, using cinema tickets as a teaching tool where students can evaluate the movie and express their feelings about the movie. Figure 456 shows example of the movie tickets that can enrich teachers’ teaching aids.

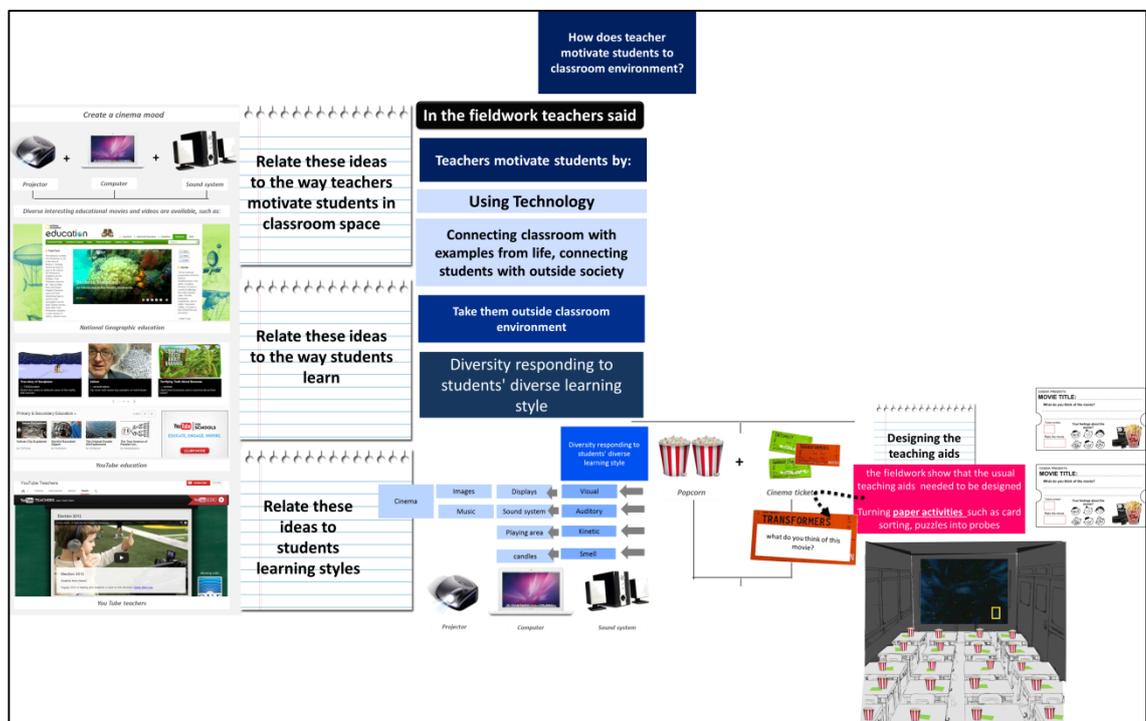


Figure 455: Create a Cinema Mood

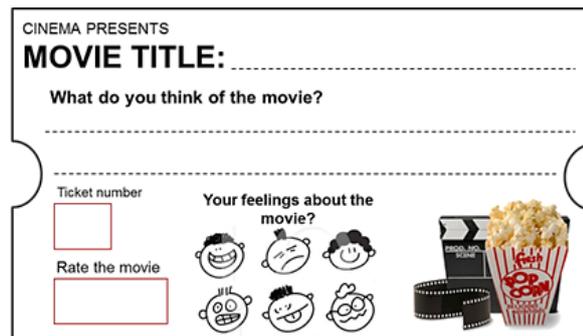


Figure 456: Movie Tickets

The second suggestion is (2) Go to imaginary world, as illustrated in Figure 457 this section helps teacher to travel with the students to the rich imaginary of cartoons and kids movies such as: Harry Potter and Tangled and teach them there. This section suggests that teachers can benefit from these worlds by enriching their imagination, and using elements of these worlds as teaching tools. For example if teachers chose going to Harry Potter imaginary world she/he can ask students to wear Harry Potter glass which are on their tables to be ready for the mission, use his map that they can display on the wall for writing instruction or questions related to curriculum, writing teaching questions or homework as a secret letters to students and hide it under the table then ask students to find it, Figure 458 explains using elements from Harry Potter world as a teaching tool. Furthermore, these ideas show how to use classroom space elements (tables and wall) as a teaching tools that inspired from imaginary world that motivate and stimulate students to space and help teachers to use space as a silent curriculum.

The third suggestion is (3) Travel to divers environments, as explained in Figure 459 this section inspired from users strong relation with nature which was explained in the finding chapter (*Displays design features- Nature elements*) Nature elements wear a strong inspiration in users' decoration, however teachers communicate inspiration from nature by displaying images of elements of nature, while students reflect inspiration by nature by bringing real elements of nature inside classroom space. Therefore, this section suggests travelling to different natural environment using the projector, computer, sound system and images from different natural environments. After that this idea developed to solve common teachers' common problems that were mentioned in this chapter in 1.6Tool Purpose. Additionally, this section idea supported with ideas that add teaching and learning value to the design of classroom space for example: bringing real leaves and tree twigs to classroom space and using them as a teaching tool where teachers can hang

questions and surprise boxes on them, distributing the leaves and using them for counting. Additionally, bringing real birds and indoor fountain in order to bring real garden sound inside classroom space that can motivate students hearing sense which stimulate students' with auditory learning style. Figure 460 explains adding learning values to the design of classroom space.

Go to imaginary world



Projector + Computer + Sound system

play videos from cartoons and movies such as:



How does teacher motivate students to classroom environment?

In the fieldwork teachers said

Teachers motivate students by:

Using Technology

Connecting classroom with examples from life, connecting students with outside society

Take them outside classroom environment

Diversity responding to students' diverse learning style

Diversity responding to students' diverse learning style

| | | | |
|--------|--------|--------------|----------|
| Cinema | Images | Displays | Visual |
| | Music | Sound system | Auditory |
| | | Playing area | Kinetic |
| | | Candles | Scent |

Designing the teaching aids

the fieldwork show that the usual teaching aids needed to be designed

Turning paper activities, such as card sorting, puzzles into probes

From the literature review

Lachman and Butterfield (1979) defined cognitivists as concerned about: how people take in information, recode it and remember it; how people transform their internal knowledge states; and how they translate these states into behavioural outputs

the fieldwork showed that classroom activities need to be designed

Harry potter Hat: Teacher can put a specific request which related to her/his curriculum in the hat and hide and ask students to look for the hat under the staircase or any space outside classroom when you find it, do what the hat asks you to do



The broom: Teacher can hang the broom from the ceiling with questions for students to answer after the find the broom with their name on.



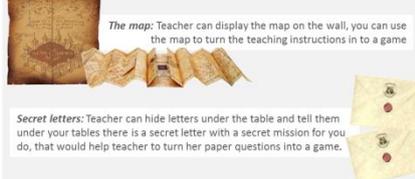
Harry Potter glass: Teacher can use Harry potter glass to add more drama to her teaching strategy, she/he can tell students by wearing this glasses you will be ready for this mission.



The map: Teacher can display the map on the wall, you can use the map to turn the teaching instructions in to a game



Secret letters: Teacher can hide letters under the table and tell them under your tables there is a secret letter with a secret mission for you do, that would help teacher to turn her paper questions into a game.



Relate these ideas to the way teachers motivate students in classroom space

Relate these ideas to the way students learn

Relate these ideas to students learning styles

In the fieldwork teachers said: Classroom environments as a supportive method for teaching

For example

Hiding something in the classroom and search for it

Figure 457: Go To Imaginary World

497

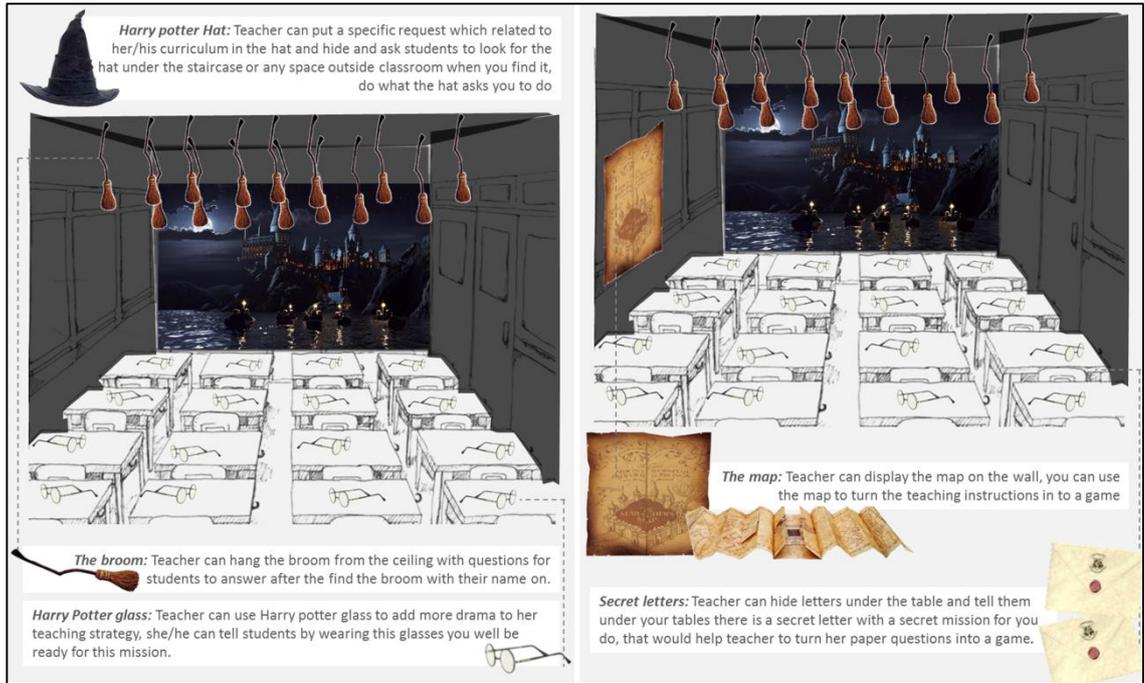


Figure 458: Using Elements from Harry Potter World as a Teaching Tool

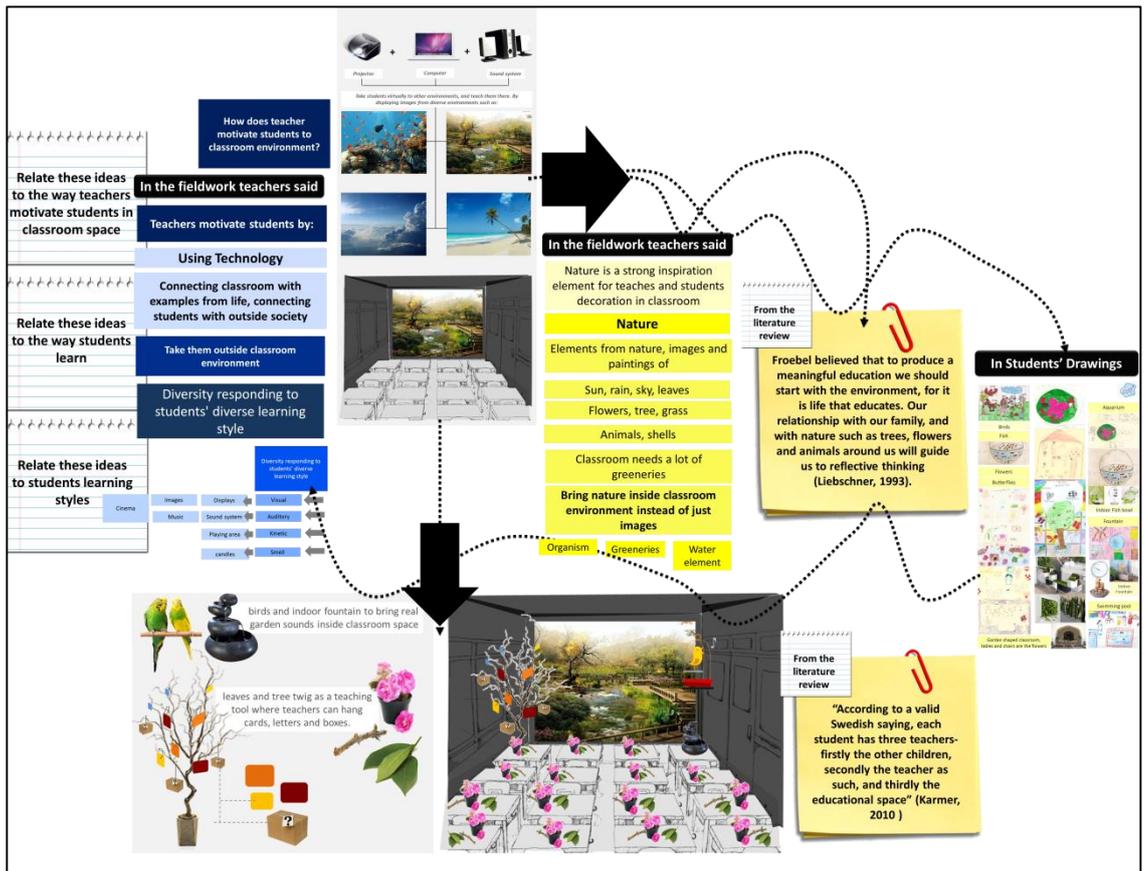


Figure 459: Travel To Divers Environments

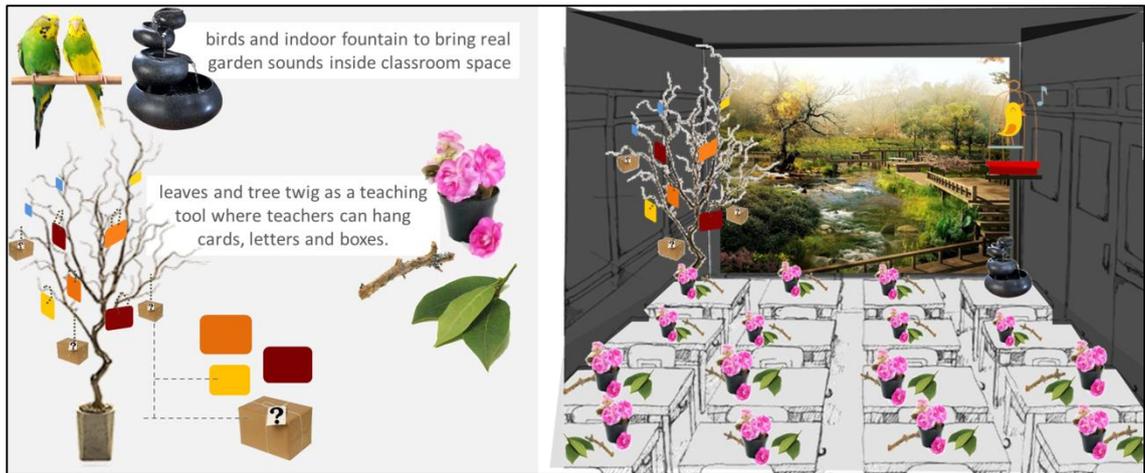


Figure 460: Adding Learning Values To the Design of Classroom Space

Why

Why use this card? The benefits classroom users' will get when they use the “*Outside the Classroom Virtually*” set of cards:

- Motivating students and offering them different learning experiences by taking students outside the classroom space virtually.
- Stimulating students through different ways of using available technology.
- Responding to students' diverse learning styles by using different teaching tools and strategies, for example: responding to visual learning styles using images with projectors; responding to auditory learning styles by playing music, bird sounds and other sounds using sound systems; and responding to kinaesthetic learning styles by creating movement in the space by playing with the teaching tools.
- Turning elements from nature into teaching tools
- Bringing real natural elements, such as birds, leaves and an indoor fountain, inside the classroom space.

How

The main elements that the teacher needs in order to apply Card 4 “*Outside Classroom Virtually*” set of cards:

- Projector
- Computer
- Sound system

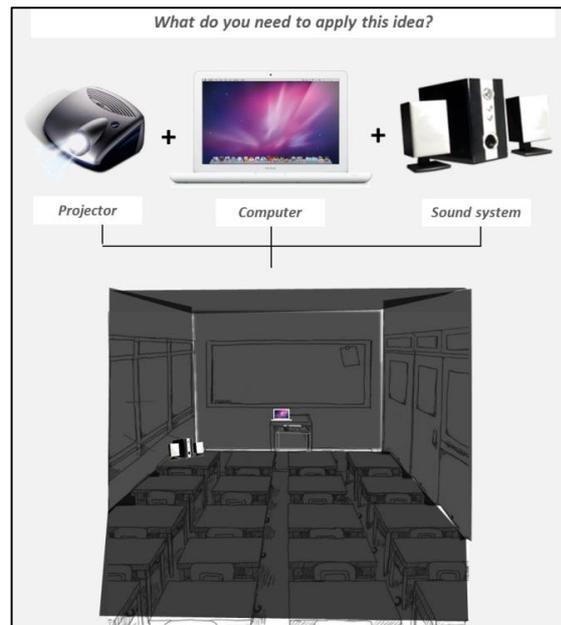


Figure 461: what do teachers need to apply set 4 “Outside Classroom Virtually”

How to apply this set of cards? There are many ways to apply this card which are about taking the students outside of the classroom virtually. Here are three examples:

1. **Create a cinema mood**
2. **Go to an imaginary world**
3. **Travel to diverse environments**

1. **Create a cinema mood:** using a projector, computer and sound system, the teacher can play educational movies. Diverse interesting educational movies and videos are available, such as: National Geographic education (<http://education.nationalgeographic.co.uk>), YouTube education (<http://www.youtube.com/education>) and You Tube teachers (<http://www.youtube.com/teachers>). In addition, teachers can enhance the cinema mood learning experience with popcorn and cinema tickets. Cinema tickets can be used as a teaching tool where teachers can write questions for students to think about while watching the movie. After answering them, teachers can display the cinema tickets on classroom walls. Figure 462 describe the idea of *Create a cinema mood* section in set of cards number 4 “Outside Classroom Virtually”.

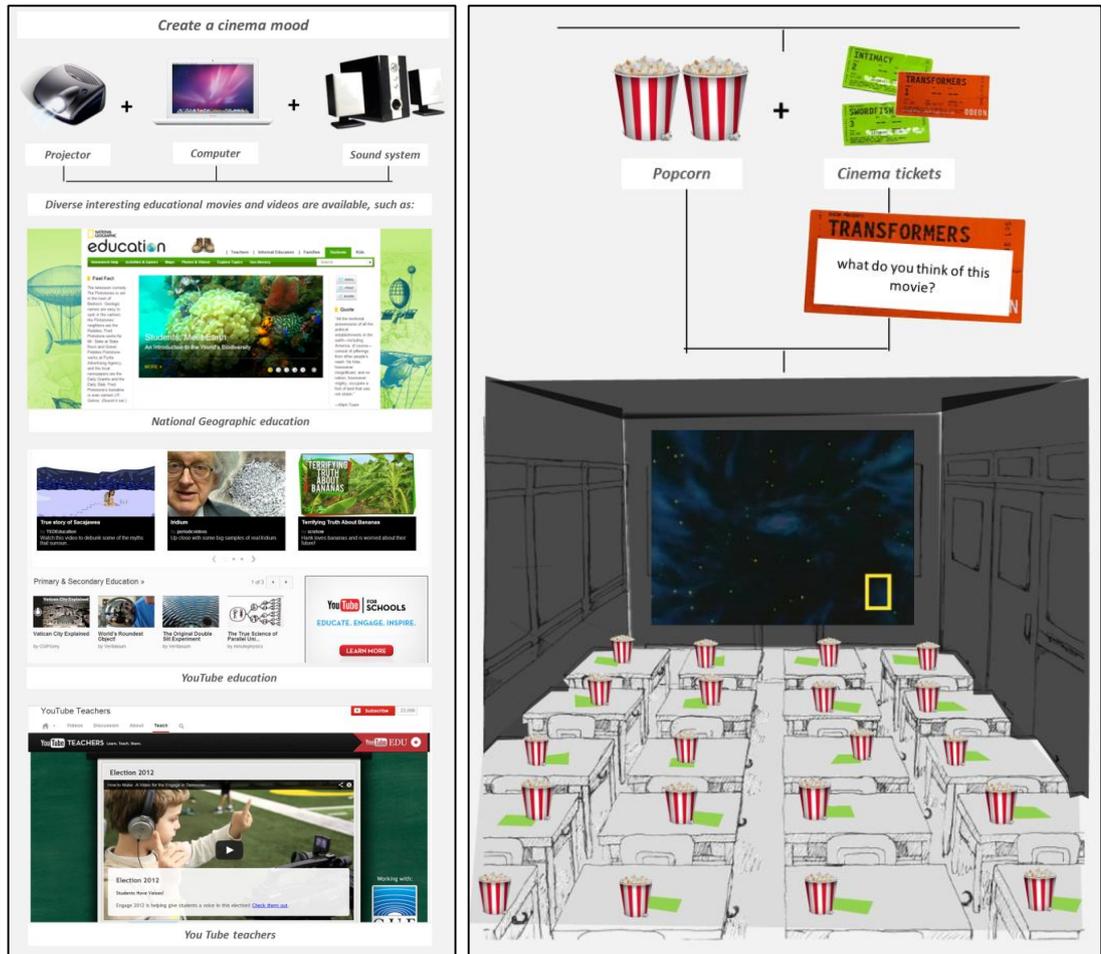


Figure 462: The Idea of Create a Cinema Mood

Go to an imaginary world: Using a projector, computer and sound system, teachers can play videos (e.g. cartoons and movies that stimulate students). These can take students into an imaginary world and be taught there. Also, teachers can create teaching tools using elements from a movie, using characters and objects from the film to support the curriculum. For example: Using a Harry Potter (2001-2011) movie, teachers can use the idea of working in groups in the Harry Potter movie to support cooperative teaching strategies. Furthermore, teachers can replace paper teaching tools with the props used in this movie, such as using Harry Potter’s hat, broom, glasses, map, secret letter and other probes as teaching tools. Figure 463 explains how to apply the idea of *Go to an imaginary world* section in set of cards number 4 “*Outside Classroom Virtually*”, Figure 464 show the idea of using Harry Potter hat, broom, glass, map, secret letter and other probes as a teaching tool. Each one of these props can support teachers’ teaching strategies differently. For example:

- **A hat:** The teacher can put a specific request related to her/his curriculum in the hat, hide it and ask students to look for the hat under the staircase or any space outside classroom. When they find it, they must do what the hat asks them to do.
- **A broom:** The teacher can hang one broom or more from the ceiling with questions for students to answer after they find the broom with their name on.
- **Harry Potter’s glasses:** The teacher can use Harry Potter’s glasses to add more drama to his/her teaching strategy. She/he can tell students, “By wearing these glasses you will be ready for this mission”.
- **A map:** The teacher can display a map on the wall and use it to turn the teaching instructions into a game.
- **Secret letters:** The teacher can hide letters under the table and tell them, “Under your tables there is a secret letter with a secret mission for you to do”. This will help the teacher to turn paper questions into a game.

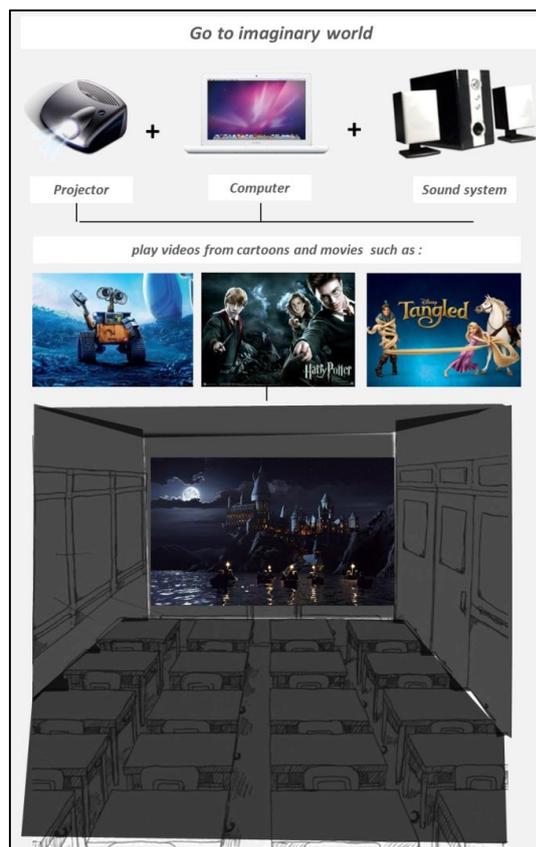


Figure 463: How to Apply the Idea of Go to an Imaginary World

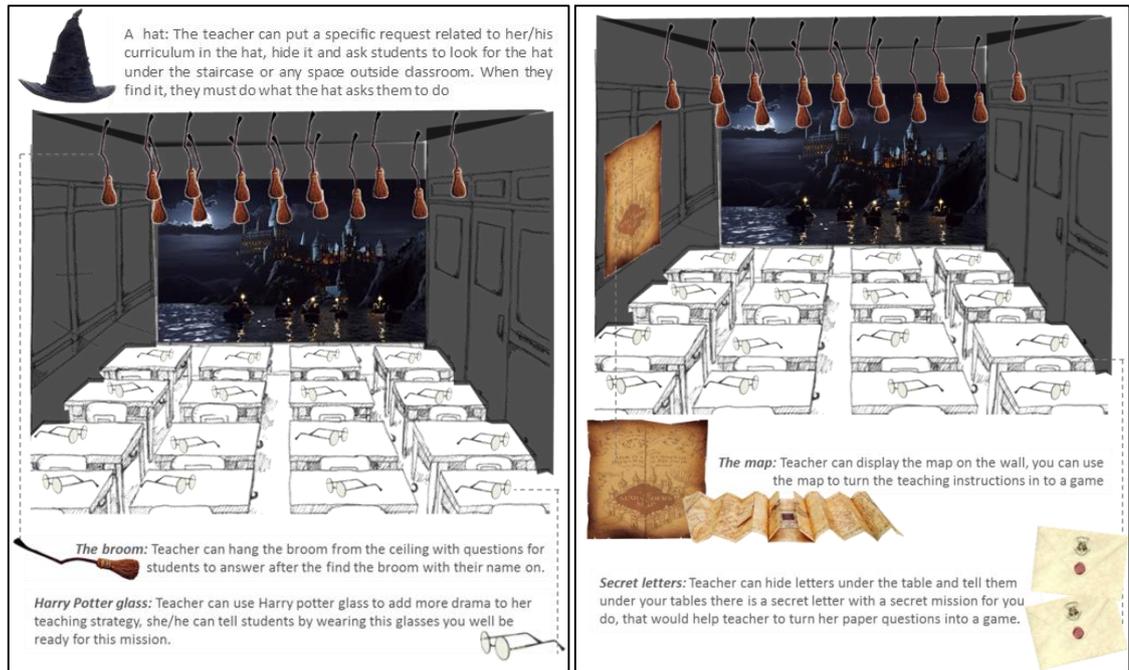


Figure 464: The Idea of Using Harry Potter Probes as a Teaching Tool

2. Travel to diverse environments: Using a projector, computer and sound system, teachers can take students virtually to other environments and teach them there by displaying images from diverse environments such as under the sea, in the garden, sky and beach. Additionally, teachers can utilise different elements of the chosen environment to support their teaching strategies. Also, they can create teaching props using elements from the chosen environment. Figure 465 and Figure 466 show examples of how to apply the “*Travel to diverse environments*” idea. For example, teachers can use images from a garden and use elements such as birds and an indoor fountain to bring real garden sounds inside the classroom space. Leaves and twigs can be used as teaching tools from which teachers can hang cards, letters and boxes.

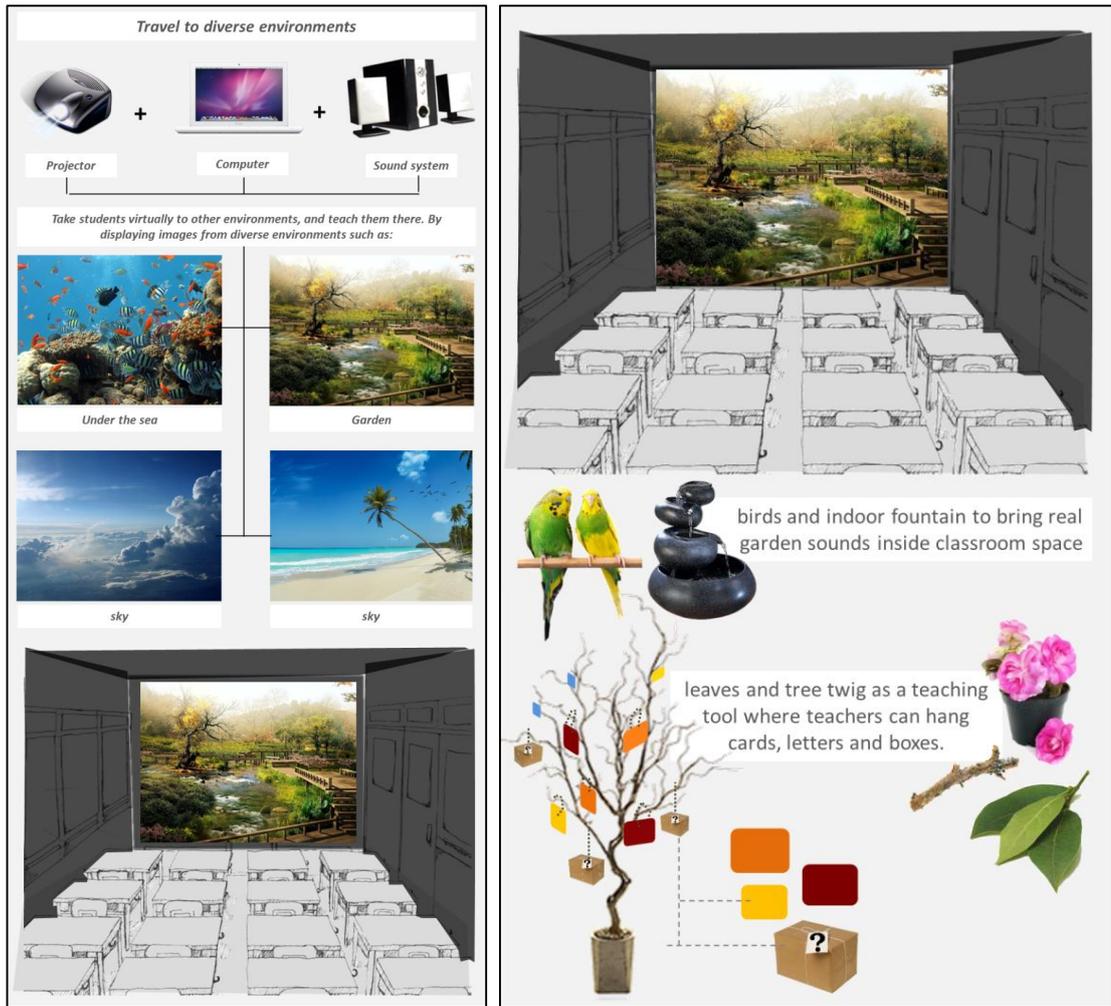


Figure 465: Applying The “Travel To Diverse Environments” Idea



Figure 466: Applying The “Travel To Diverse Environments” Idea

What

Figure 467 shows what the teacher should expect when she/he applies this card and how the learning space would look.

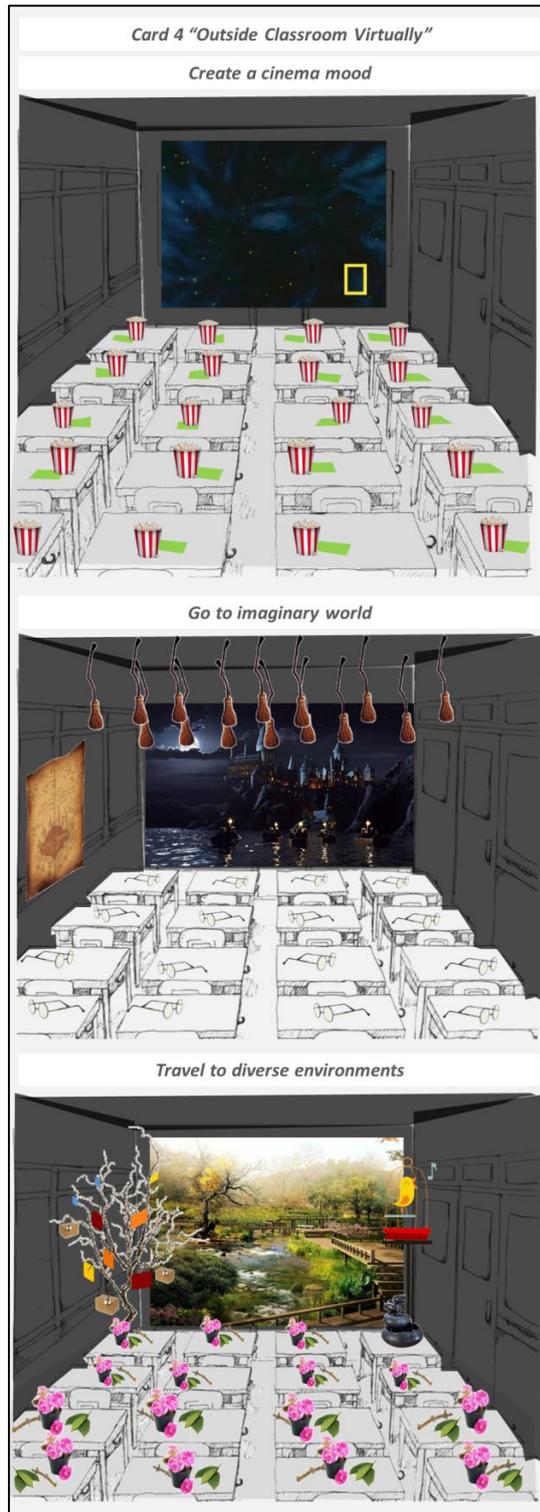
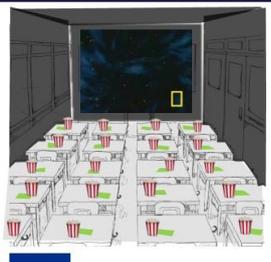


Figure 467: What the Learning Space Would Look When Applying This Card

Final Set of Cards 4 “Outside Classroom Virtually”



Card 4

Outside the Classroom Virtually

<http://classroomrecine.blogspot.co.uk>



Why

Why use this card? Benefits classroom users' will get when they use this card:

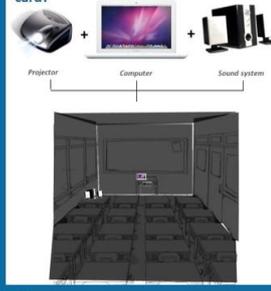
- Motivating students and offering them different learning experiences by taking students outside the classroom space virtually.
- Stimulating students through different ways of using available technology.
- Responding to students' diverse learning styles by using different teaching tools and strategies, for example: responding to visual learning styles using images with projectors; responding to auditory learning styles by playing music, bird sounds and other sounds using sound systems; and responding to kinetic learning styles by creating movement in the space by playing with the teaching tools.
- Turning elements from nature into a teaching tool.
- Bringing real natural elements, such as birds, leaves and an indoor fountain, inside the classroom space.

Card 4 2

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this card?



Card 4 3

How

What do you need to apply this card?
How to apply this card.

How to apply this idea.

There are many ways to apply this card which is about taking students outside the classroom virtually. Here are three examples:

1. Create a cinema mood
2. Go to an imaginary world
3. Travel to diverse environments

1. Create a cinema mood: using a projector, computer and sound system, the teacher can play educational movies. Diverse interesting educational movies and videos are available, such as: National Geographic education (<http://education.nationalgeographic.co.uk/st/?ar=a=4>), YouTube education (<http://www.youtube.com/education>) and You Tube teachers (<http://www.youtube.com/teachers>).

Card 4 4

How

What do you need to apply this card?
How to apply this card.

Examples of how to create a cinema mood



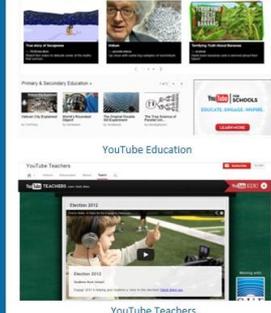
Diverse interesting educational movies and videos are available, such as:

National Geographic education

Card 4 5

How

What do you need to apply this card?
How to apply this card.

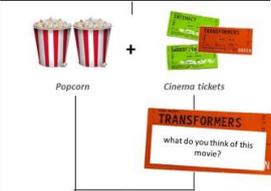


Card 4 6

How

What do you need to apply this card?
How to apply this card.

In addition, teachers can enhance the cinema mood learning experience with popcorn and cinema tickets. Cinema tickets can be used as a teaching tool where teachers can write questions for students to think about while watching the movie. After answering them, teachers can display the cinema tickets on classroom walls.



Card 4 7

How

What do you need to apply this card?
How to apply this card.



Applying the cinema mood idea in the classroom space

Card 4 8

How

What do you need to apply this card?
How to apply this card.

2. Go to an imaginary world: using a projector, computer and sound system, teachers can play videos (e.g. cartoons and movies that stimulate students). These can take students into an imaginary world and be taught there. Also, teachers can create teaching tools using elements from a movie, using characters and objects from the film to support the curriculum.

Go to imaginary world



play videos from cartoons and movies such as:

Card 4 9

How

What do you need to apply this card?
How to apply this card.

For example: Using a Harry Potter movie, teachers can use the idea of working in groups in the Harry Potter movie to support cooperative teaching strategies.



Card 4 10

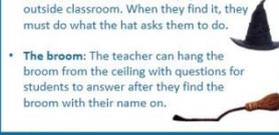
How

What do you need to apply this card?
How to apply this card.

Furthermore, teachers can replace paper teaching tools with the probes used in this movie, such as using Harry Potter's hat, broom, glasses, map, secret letter and other probes as teaching tools.

Each one of these probes can support teachers' teaching strategies differently. For example:

- **The hat:** The teacher can put a specific request related to her/his curriculum in the hat, hide it and ask students to look for the hat under the staircase or any space outside classroom. When they find it, they must do what the hat asks them to do.
- **The broom:** The teacher can hang the broom from the ceiling with questions for students to answer after they find the broom with their name on.

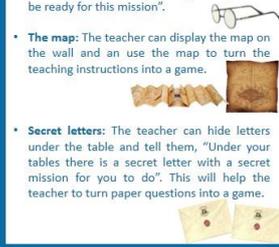


Card 4 11

How

What do you need to apply this card?
How to apply this card?

- **Harry Potter's glasses:** The teacher can use Harry Potter's glasses to add more drama to his/her teaching strategy. She/he can tell students, "By wearing these glasses you will be ready for this mission".
- **The map:** The teacher can display the map on the wall and use the map to turn the teaching instructions into a game.
- **Secret letters:** The teacher can hide letters under the table and tell them, "Under your tables there is a secret letter with a secret mission for you to do". This will help the teacher to turn paper questions into a game.

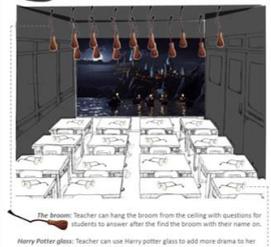


Card 4 12

How

What do you need to apply this card?
How to apply this card.

Harry Potter Hat: Teacher can put a specific request which related to her/his curriculum in the hat and hide and ask students to look for the hat under the staircase or any space outside classroom when you find it, do what the hat asks you to do.



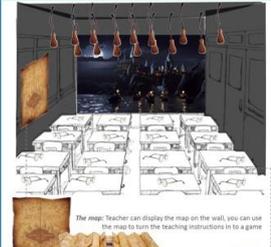
The broom: Teacher can hang the broom from the ceiling with questions for students to answer after they find the broom with their name on.

Harry Potter glasses: Teacher can use Harry Potter glasses to add more drama to her teaching strategy. She/he can tell students by wearing this glasses you will be ready for this mission.

Card 4 13

How

What do you need to apply this card?
How to apply this card.



The map: Teacher can display the map on the wall, you can use the map to turn the teaching instructions into a game.

Secret letters: Teacher can hide letters under the table and tell them under your tables there is a secret letter with a secret mission for you to do, that would help teacher to turn her paper questions into a game.

Card 4 14

How

What do you need to apply this card?
How to apply this card?

3. Travel to diverse environments: using a projector, computer and sound system, teachers can take students virtually to other environments and teach them there by displaying images from diverse environments such as under the sea, in the garden, sky and beach.



Take students virtually to other environments, and teach them there by displaying images from diverse environments such as:



Card 4 15

How

What do you need to apply this card?
How to apply this card?



Applying travel to the diverse environment idea



Card 4 16

How

What do you need to apply this card?
How to apply this card.

Additionally, teachers can utilize different elements of the chosen environment to support their teaching strategies. Also, they can create teaching probes using elements from the chosen environment.



Applying travel to the idea of diverse environments in the classroom space

Card 4 17

How

What do you need to apply this card?
How to apply this card.

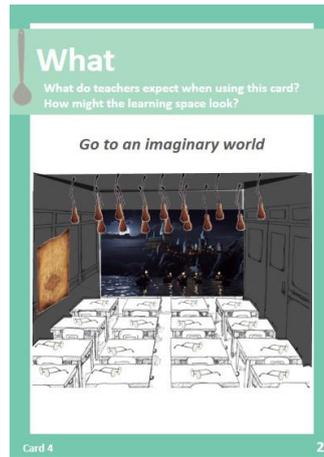
For example, teachers can use images from a garden and use elements such as birds and an indoor fountain to bring real garden sounds inside the classroom space. Leaves and twigs can be used as teaching tools from which teachers can hang cards, letters and boxes.



birds and indoor fountain to bring real garden sounds inside classroom space

leaves and tree twig as a teaching tool where teachers can hang cards, letters and boxes.

Card 4 18



Set of Cards 5 “Students P.O Box”

The theoretical background of this set of cards was built upon questions raised during analysis of first and second stage of research, as literature review emphasis on the socialising and social interaction and its effect on learning which should be encouraged through space design, usually architects respond to this by designing a group seating arrangements. However, during analysing classroom space in first and second stage these questions were raised: How could social interaction designed in the space? How could we add teaching value to the design of social interaction that happens in learning space? And how can we translate the theoretical learning concept of social interaction to design? This theory is explained in Socio-constructivism learning theory in Chapter One, according to this theory knowledge is the result of social interaction, Socio-constructivism suggests that the learning of humans is based on their interactions with the social and culture environment. The basic concept of this theory is that students learn most effectively by engaging in carefully selected cooperative activities under the

supervision of instructors (Vygotsky, 1978b). This theoretical background was related to inspirations found in student’s drawing and teachers’ teaching tool and connected with benefits teachers wanted from the design of learning space mentioned by users in the second stage or known from their thoughtless acts while observing space, the process of building these thoughts is explained in one thinking map shown in Figure 468. Next this map will be divided and the process of this thinking map will be explained in details.

Table 15: shows thinking elements of Set of Cards 5 "Students' P.O Box"

| | 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice |
|--------------------------------------|--|--|---|---|--|
| Cards 5 "Students P.O Box" | <p>literature review emphasis on socialising and social interaction and its effect on learning</p> <p>limited design respond to socialising value in classroom (group seating arrangements)</p> <p>Socio-constructivism learning theory</p> <p>students learn most effectively by engaging in carefully selected cooperative activities under the supervision of instructors (Vygotsky, 1978b)</p> | <p>classroom space offers activities encourage interaction between students</p> <p>Teachers’ claims about classroom space and its activities</p> <p>users’ concept of attractive and stimulated display</p> <p>how to use classroom displays as learning and teaching tools?</p> | <p>Teachers’ teaching tools</p> <p>using letters as a teaching tool</p> <p>the concept of Tweeting and Twitter from virtual social network to the physical classroom and used it as a teaching tool</p> | <p>post office area in students’ drawings</p> <p>adventure calendar</p> | <p>How social interaction could be designed in the space?</p> <p>How could we add teaching value to the design of social interaction in learning space?</p> <p>translate the theoretical concept of Socio-constructivism to design element</p> <p>how people socialise in social network</p> <p>comparing social network virtual space to users’ understanding of classroom physical space</p> <p>P.O Box responds to common problems mention by teachers</p> <p>Embracing values through space design</p> |

The beginning thoughts of this set of cards was from a student's drawing, she draw the classroom space as a space that offers diverse activities to students and a post office area is one of them where students can send letters to each other, Figure 469 shows post office area in student's drawing. However, this idea supports teachers' request for a classroom space that offers activities that encourage interaction between students, which can translate the theoretical concept of Socio-constructivism to design element in the learning space. The beginning thoughts of "Students' P.O Box" set of cards are explained in Figure 470. Furthermore, as illustrated in Figure 470 another inspiration came from one of the teachers' blog who shared her idea of using letters as a teaching tool, however this inspiration was connected to another inspiration which is the adventure calendar found in <http://liebesbotschaft.blogspot.com/> that, this idea suggests displaying boxes on the wall with calendar dates on them that allow space users to interact with the wall while discovering what is hidden and the box, Figure 470 shows an image of the adventure calendar.

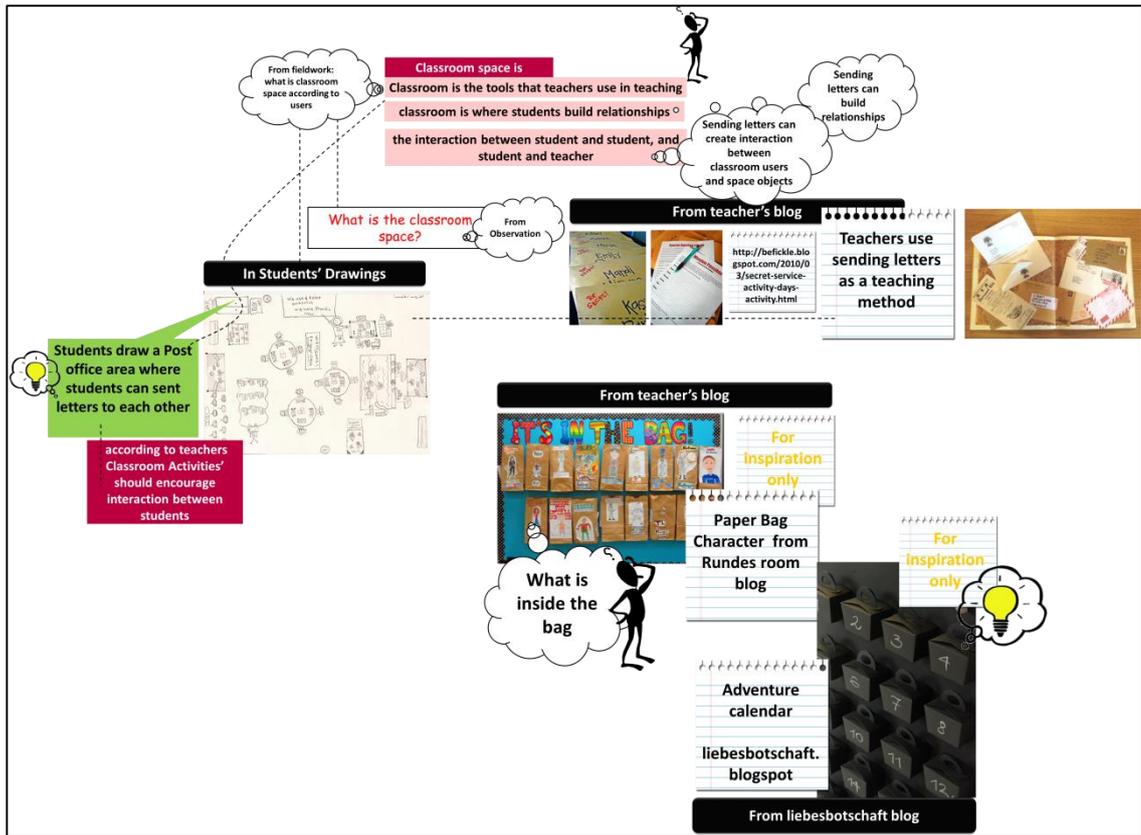


Figure 470: The Beginning Thoughts of "Students' P.O. Box"

Moreover, one of the teachers brought the concept of Tweeting and Twitter from virtual social network to the physical classroom and used it as a teaching tool, figure shows teacher's tweet board. This made the researcher think of the way social networks creates connections, and encourages interaction and built relationship between its users, because these where limitations of the current learning space design.



Figure 471: Teacher's Tweet Board

Source: <http://classroomsimple.blogspot.com/2011/03/actual-twitter-board.html>

Thinking how people socialise in social network such as: Facebook, Twitter, Pinterest, and Instagram. In social networks people have their own space to personalize, to express themselves, identify their self to others, can share with others what they like, give their opinion on what others share, receive comments from others on what they share. However, while comparing social network virtual space to users understanding of classroom physical space (explained in Finding Chapter Pink section (2) Create Understanding of Classroom Space) researcher found that the virtual space of social network have achieved what users wanted physical classroom space to achieve, Figure 472 explains thoughts about social network space. For example, some teachers said classroom space is where students learn to accept their differences and build relationships; they assert that classroom space is the interaction between students and students, and students and teachers. Furthermore, when teachers were asked about classroom activities they said that best classroom activities were those which enable students to interact with each other. Additionally, comparing teachers understanding of classroom space and researchers learning claims about what the design of classroom space should offer to its users with the design of social network space shows that social network space was more successful in achieving these claims than classrooms pace, and the reason is that social network space have designed to its users' different tools that help them to achieve these claims while classrooms space design did not. Therefore, this set of cards offers a tool that help users to achieve these claims in classroom space.

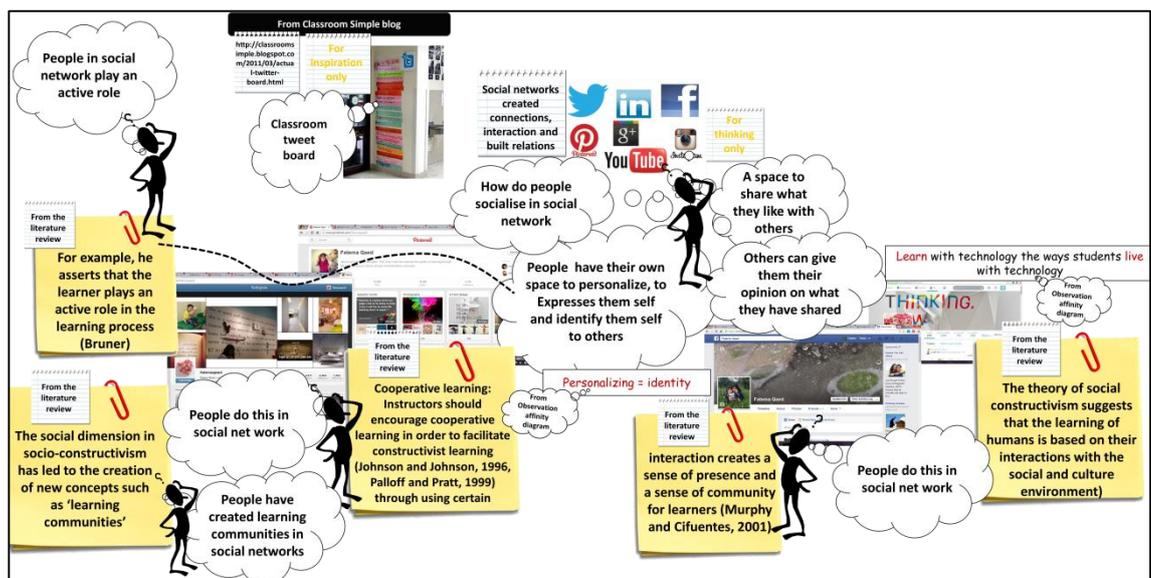


Figure 472: Thoughts about Social Network Space

This set of cards suggests designing a P.O Box for each student, and explains to teachers how to use this P.O Box as a teaching tool. Moreover, this P.O Box responds to common problems mentioned by teachers such as: Teachers stated that they need help in designing classroom space displays in order to stimulate and motivate students in the classroom space; they want to design an interactive and playful display. However, the findings showed that many teachers did not know how to display students' work. Additionally, classroom is where students learn how to socialise, build relationships, accept their differences, identify their self and discover their talents. Teachers wanted to know how to embrace these values through space design and finally solving the problem of limited interaction and communication between students, teachers and space, Figure 473 explains the final idea of "students' P.O Box". Additionally, the idea of the P.O Box was developed to offer different activities that according to teachers motivate students in the classroom space, for example: celebrating students' achievements, encouraging competitions between students, enabling students to express their selves, promote students work by prizes and rewards, and displaying students work and commenting on each other's work. Additionally, students like to display their work and their photos because displaying students' work and photos enhances their affiliation with the place, helping students to learn from each other and improve their work.

Furthermore, the P.O Box design was related to users' concept of attractive and stimulated display and explained to users how to add learning and teaching value to their way of display in classroom space. Classroom display analysis is explained in Finding Chapter section: [Classroom Display](#). Additionally, this set of cards supports teachers' claims about classroom displays; according to teachers displays should be interactive, communicative, enjoyable, and personalised. Also, diversity is an important keyword in designing classroom displays, for example: Diverse colours, materials, textures, and ways of displays, patterns and diversity in responding to different learning styles. It is important to note that the fieldwork results showed that most of the teachers presently do not know how to use classroom displays as learning and teaching tools, and not all of them know how to decorate classroom space. Moreover, Students' drawings have shown that it is important to provide students a space to personalise it in the classroom. However, some students said on Facebook, when I asked them about "best classroom memories", their best memories of classroom space are their personal corners, corners that they personalise by themselves.

How

What do teachers need in order to apply this set of cards, and how to apply them?

Firstly, what do teachers need in order to apply this set of cards?

- Shoe box
- Stick
- A4 size cardboard Figure 474 shows what do teachers need to apply card 5 “*Students P.O Box*”

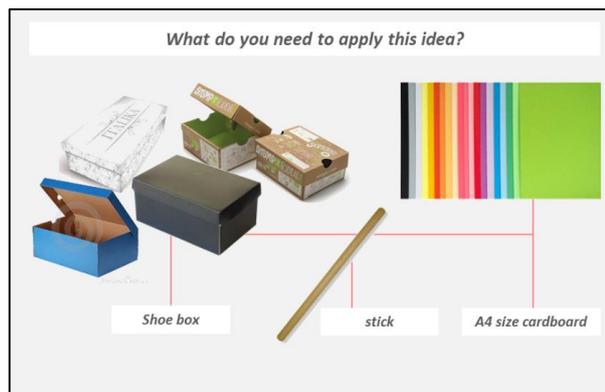


Figure 474: what do teachers need to apply card 5 “*Students P.O Box*”

How to apply this card?

1. Ask each student to bring into class an old shoe box.
2. Ask each student to personalise her/his box. For example: colour it, cover it with wrapping paper, cover it with colourful patterned paper or use any other ideas using different materials with different textures such as: sack cloth, wool, silk, cotton, fabrics, feathers, glass, aluminium, tiles, shells, leather, paper plates. Ask students to be creative in designing their box.
3. Glue any sort of stick you choose to A4 size cardboard.
4. Ask students to define themselves on this A4 size paper. Ask them: “How would you like to define yourself to others?”
5. Use the side of the box to reward students. For example, stick a gold star on their box when they do something good; the winning student is the one with the highest number of stars.
6. Teachers could use the box as a mediator between them and their students. For example: teachers could send messages to them or hide questions and puzzles in the box and ask students to look for them.

Students can be given the opportunity to send letters to each other via the box. Figure 475- **Error! Reference source not found.** explain how teachers can apply card 5 “*Students P.O Box*”.

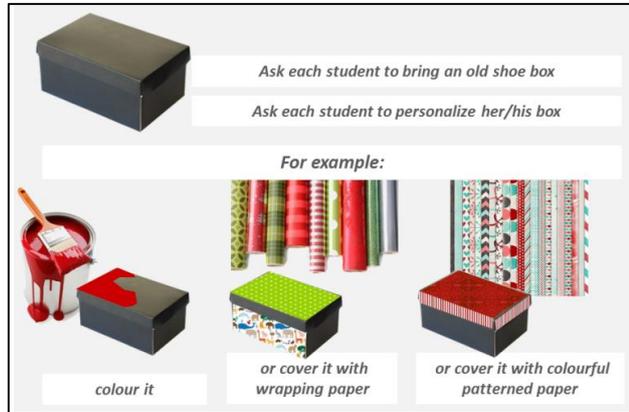


Figure 475: How Teachers Can Apply Card 5 “*Students P.O Box*”

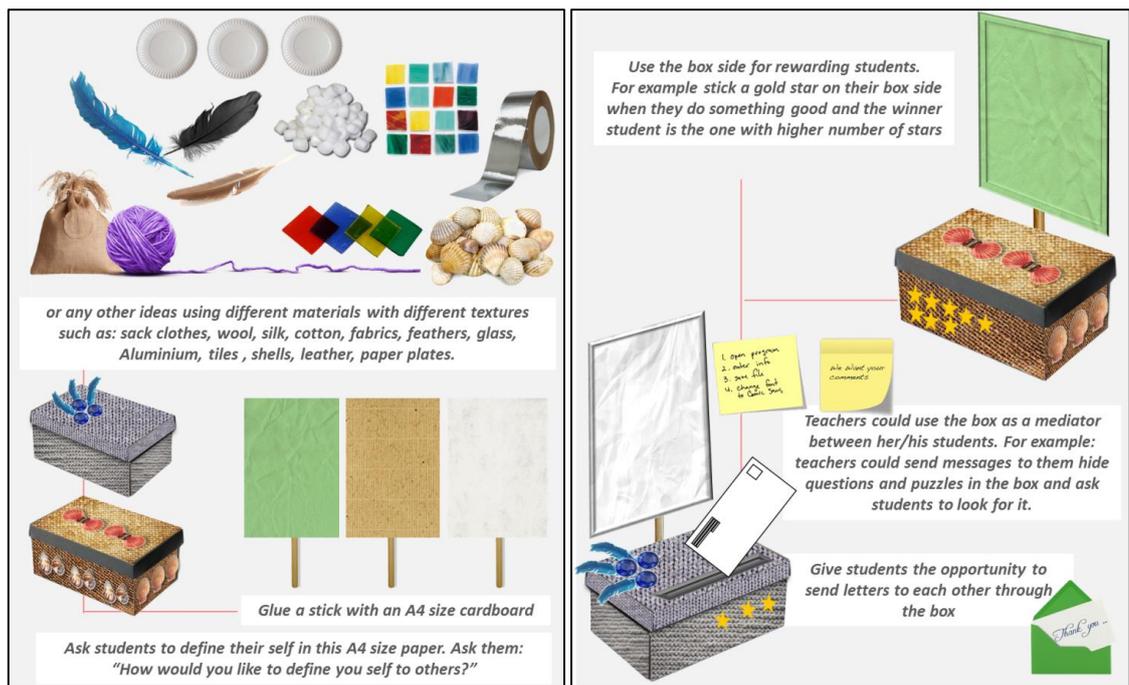


Figure 476: How Teachers Can Apply Card 5 “*Students P.O Box*”

What

What does the teacher expect when she/he is using this card? What would the learning space look like? Figure 477 shows examples of how students P.O Box can look like and how the classroom space can look like when teachers apply card 5 “*Students P.O Box*”.

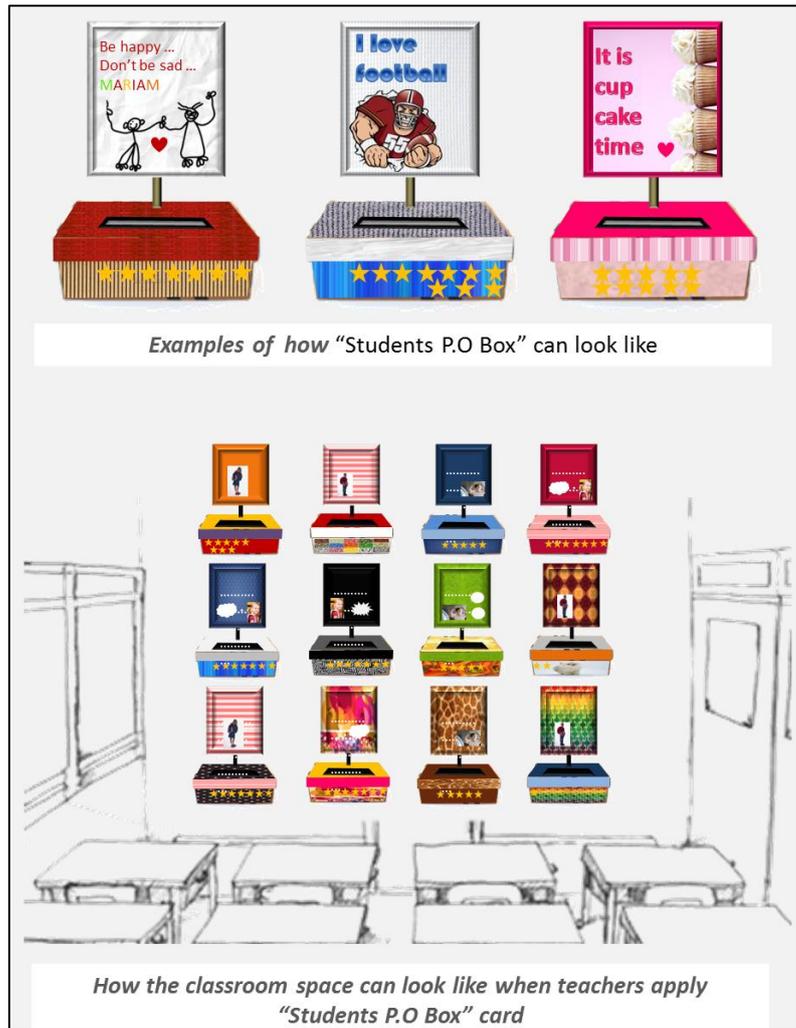


Figure 477: Classroom Space after Applying Card 5 "Students P.O Box"

Final Set of Cards 5 "Students P.O Box"

Card 5

Student's P.O. Box

<http://classroomrecipe.blogspot.co.uk>

Why

Why use this card? Benefits classroom users' will get when they use this card.

- Motivating students to interact with each other through their P.O boxes.
- Enhancing classroom users' interaction with the space. Besides, classroom walls will not be a solid rigid boundary around students any more because this card will make the classroom wall communicate with its users.
- Supporting teachers' communication with students. Teachers will be able to communicate with their students' through their P.O boxes.
- Helping students to define and express themselves to other students. (How do they want others to see them?)
- Creating a 3-dimensional classroom display.
- Providing a space for students to personalise.
- Providing teachers with an area to reward students and appreciate their work.
- Teachers could use the box as a mediator between them and their students.

Card 5 2

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this idea?

- Shoe box
- Stick
- A4 size cardboard

Card 5 3

How

What do you need to apply this card?
How to apply this card.

How to apply this idea.

1. Ask each student to bring an old shoe box.



*Ask each student to bring an old shoe box
Ask each student to personalize her/his box*

2. Ask each student to personalise her/his box. For example: colour it, cover it with wrapping paper or use any other ideas using different materials with different textures such as: sack cloth, wool, silk, cotton, fabrics, feathers, glass, aluminium, tiles, shells, leather, paper plates. Ask students to be creative in designing their box.

Card 5 4

How

What do you need to apply this card?
How to apply this card.

For example:



colour it *or cover it with wrapping paper* *or cover it with colourful patterned paper*



or any other ideas using different materials with different textures such as: sack clothes, wool, silk, cotton, fabrics, feathers, glass, Aluminium, tiles, shells, leather, paper plates.

Card 5 5

How

What do you need to apply this card?
How to apply this card.

3. Glue a stick to A4 size cardboard.
4. Ask students to define themselves on this A4 size paper. Ask them: "How would you like to define yourself to others?"



Glue a stick with an A4 size cardboard

Ask students to define their self in this A4 size paper. Ask them: "How would you like to define you self to others?"

5. Use the side of the box to reward students. For example, stick a gold star on their box when they do something good; the winning student is the one with the highest number of stars.

Card 5 6

How

What do you need to apply this card?
How to apply this card.

Use the box side for rewarding students. For example stick a gold star on their box side when they do something good and the winner student is the one with higher number of stars



6. Teachers could use the box as a mediator between them and their students. For example: teachers could send messages to them or hide questions and puzzles in the box and ask students to look for them.
7. Students can be given the opportunity to send letters to each other via the box.

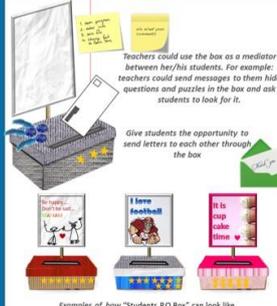
Card 5 7

How

What do you need to apply this card?
How to apply this card.

Teachers could use the box as a mediator between her/his students. For example: teachers could send messages to them hide questions and puzzles in the box and ask students to look for it.

Give students the opportunity to send letters to each other through the box



Examples of how "Students P.O Box" can look like

Card 5 8

What

What do teachers expect when using this card?
How might the learning space look?

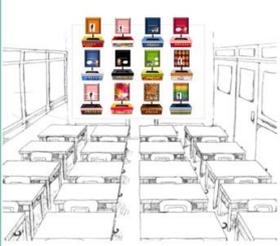


How the classroom space can look like when teachers apply "Students P.O Box" card

Card 5 9

What

What do teachers expect when using this card?
How might the learning space look?



Card 5 10

Apply and Share

#Classroom_Design_Recipes
#Student's_P.O_Box #your_name



To share your work, please send it to this email
Classroom.Recipe@gmail.com
<http://classroomrecipe.blogspot.co.uk>

Card 5 11

Set of Cards 6 “Physically Outside the Classroom”

Literature review had highlighted the importance of taking students outside classroom space and its learning benefits, additionally teachers in the second stage had emphasis on the importance of learning outside classroom space, yet they don't go outside classroom

space. Although teachers assert instead of making changes in the classroom space, they want to change space they are teaching in and go outside classroom space. Because going outside classroom space helps teacher to apply diverse teaching strategies in order to create different learning experience. However, creating diverse learning experiences using different teaching strategies will help teachers to break everyday routine because as teachers said routine is a killer for students, teachers and learning process which can stimulate students to learning space and motivate them. However, when teachers were asked about different classroom activities some of the teachers said that classroom activities should encourage students to interact with outside classroom students, school stuff and society. Therefore, this set of cards designed to help teachers go outside classroom space physically; design thinking process of this set is recorded in a thinking map illustrated in Figure 478.

Table 16: shows thinking elements of Set of Cards 6 “Physically outside the Classroom”

| | 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice |
|--|--|--|-------------------------|--|---|
| Cards 6 “Physically Outside the Classroom” | <p>the importance of talking students outside classroom</p> <p>Loughlin and Suina (1982b) claimed that teachers only see part of the available space and overlooking the rest</p> <p>importance of designing a learning space that support social activities</p> | <p>the importance of learning outside classroom</p> <p>routine in learning is a killer for whole learning system</p> <p>classroom activities should encourage students to interact with outside classroom</p> <p>thoughtless acts: classroom is about teaching aid</p> | | <p>IDEO brainstorm box</p> <p>Students’ drawings: food was important element in classroom space</p> <p>The relationship between food and group work in students’ drawings</p> <p>Using food as a teaching tool</p> | <p>Packing classroom in a box</p> <p>“Take me outside classroom” part of the way designers think of designing space</p> <p>teachers take their teaching aids outside classroom space</p> <p>picnic basket as a box where teachers pack what they need to teach and go outside classroom space</p> <p>picnic tools as a teaching tool</p> <p>picnic inside classroom space</p> |



Figure 478: Thinking Map of Set 6 “Physically Outside the Classroom”

This set of card was inspired from IDEO brainstorm box, which offers a toolkit for applying brainstorm thinking method. However, this inspired the researcher to design a box that has everything teachers need to go outside classroom, to think of designing a

toolkit in a box for going outside classroom space. This toolkit can help teachers to pack their classroom in a box; Figure 479 explains beginning thoughts of “physically outside the classroom” set of cards.

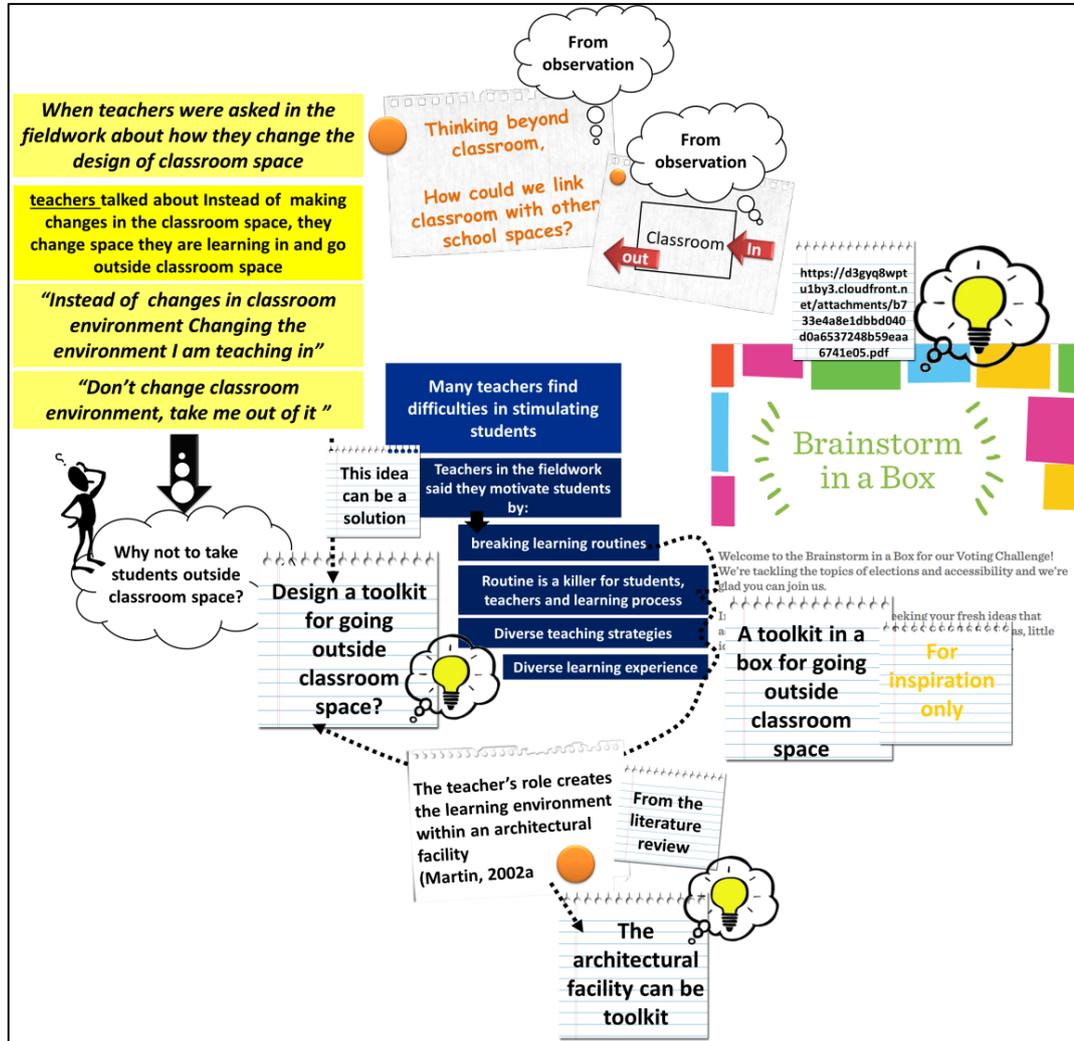


Figure 479: Thoughts of “Physically Outside the Classroom” Set Of Cards

Loughlin and Suina (1982b) claimed that teachers only see part of the available space and overlooking the rest, thinking of what are other available spaces led to emphasis more on outside classroom pace as a part of the available space. Additionally, a teacher in the second stage claimed that “Take me outside classroom” should be part of the way designers think of designing space. However, connecting these claims with going outside classroom toolkit was the base of this set of cards. Thinking of how to design a toolkit in a box make researcher think of the picnic basket as a box where teachers pack what they need to teach and go outside classroom space. Additionally, explaining users’ understanding of classroom space in the fining chapter (1.Classroom Space Is a Tool, 2.

Classroom 1 and classroom 2) showed that teachers can take their teaching aids and teach outside classroom space as many teachers claimed that classroom is about teaching aid, therefore teaching aids can be packed in the picnic basket, the development of the picnic basket as a toolkit for going outside classroom space illustrated in Figure 480.

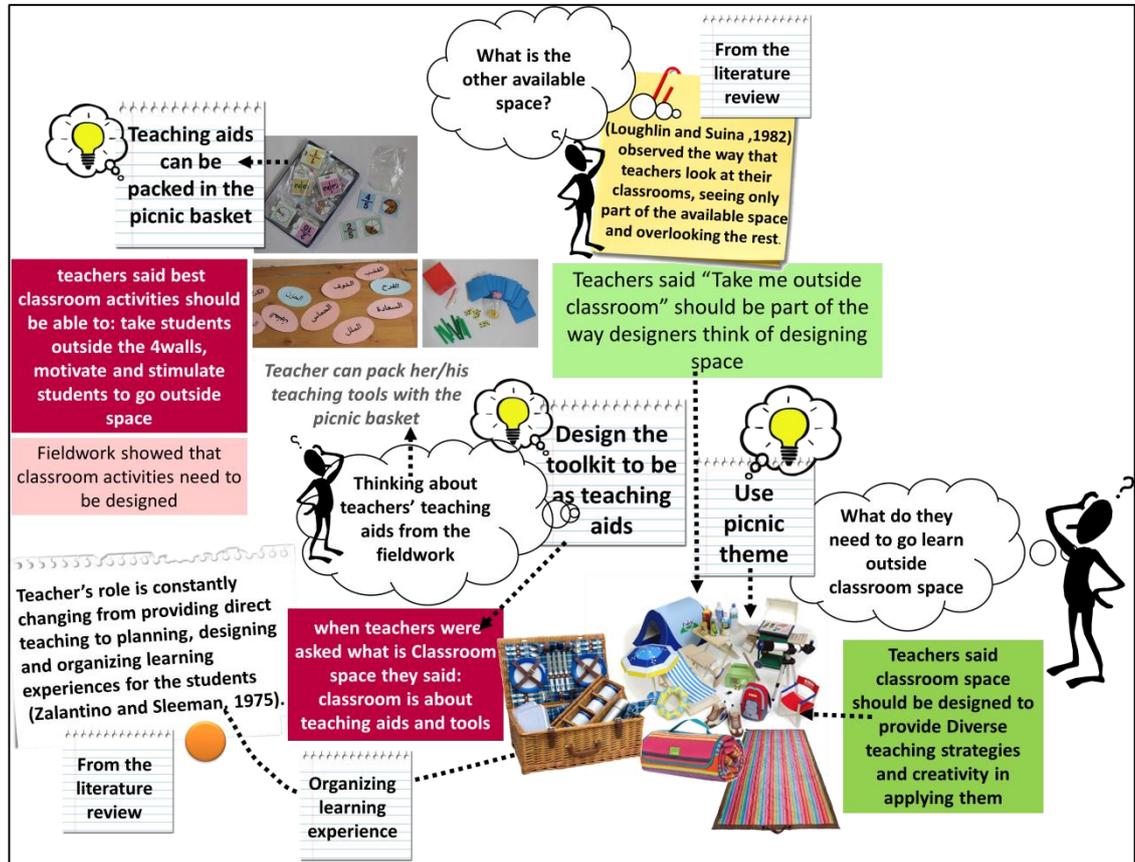


Figure 480: The Development of the Picnic Basket as a Toolkit

Furthermore, teachers said that classroom space should be designed to provide diverse teaching strategies and support creative ways for applying them; however researcher in this set suggests different teaching strategies ideas through the picnic basket. Additionally, for both users' students and teachers food was important element in classroom space, as shown in Figure 481 food in students drawings stimulate students in the space to gather around and usually it is in the middle of the group work, and sometimes it is an inspiration for furniture design.

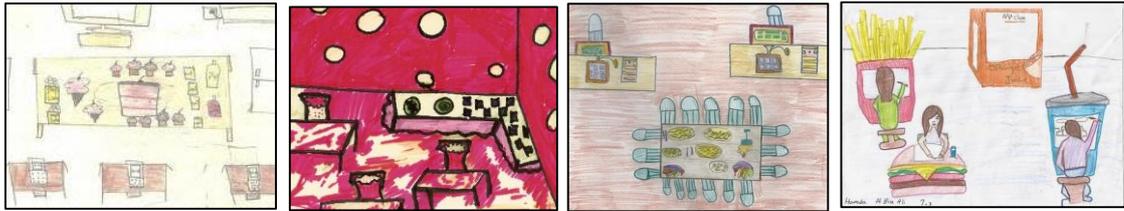


Figure 481: Different Food Forms in Students' Drawings

For teachers food can be used as a teaching tool as shown in Figure 482, therefore food could be added to the picnic basket toolkit in order to stimulate students and apply different teaching strategies by teachers.

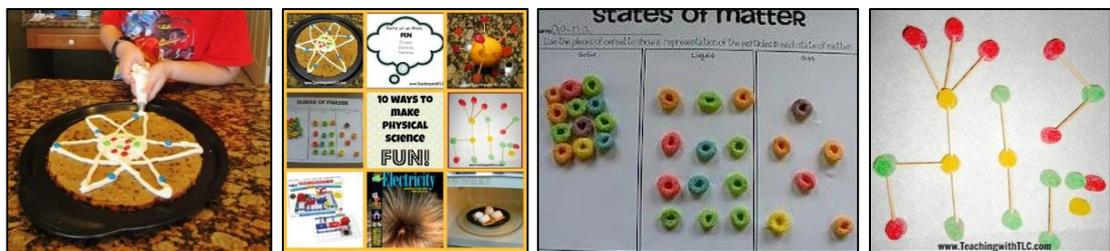


Figure 482: Teachers Used Food as a Teaching Tool

Furthermore, this set of cards will suggest different group learning activities in order to encourage students to socialise, because literature have emphasis on the importance of designing a learning space that support social activities, however current learning space respond to this concept mainly by designing different group work sittings. Finally, this set of cards develops the concept of the picnic inside classroom space if the weather did not allow teachers to take students outside classroom space. Figure 483 shows thinking map development of “physically outside the classroom” set of cards.



Figure 483: Thinking Map Development of “Physically Outside the Classroom” Set of Cards

Why

Why use this card? The benefits classroom users’ will get when they use this card responds to problems and requests mentioned by users in the second stage or claims mentioned in the literature reivev **Error! Reference source not found.** shows the Why section in “*Physically outside the Classroom*” set of cards:

- Creating outside classroom activities.
- Making going outside the classroom easier.

- Breaking everyday routine and offering new learning experiences.
- Extending classroom space and connecting students with what is outside the classroom.
- Stimulating and motivating students by creating a kinetic activity.

How

What do teachers need to do in order to apply this set of cards, and how to apply them?

Firstly, what do teachers need to do in order to apply this set of cards?

- Picnic equipment.
- Divide students into groups with each group bringing a picnic blanket to sit on.
- Teacher can pack her/his teaching tools in the picnic basket.
- Picnic with healthy food. Figure 484 shows what do teachers need to apply card 6 “*Physically outside the Classroom*”



Figure 484: What Do Teachers Need To Apply Cards 6 “*Physically Outside the Classroom*?”

How to apply this set of cards, Figure 485 and Figure 486 show how teacher can apply card 6 “*Outside Classroom Physically*” :

1. Create a picnic mood by creating a toolkit for physically going outside the classroom. Pack your picnic basket, picnic blanket, teaching tools and healthy picnic food.
2. The teacher can ask students to cook healthy food to bring to the picnic and create a competition between students for the best recipe.
3. Teachers can use the food as a teaching tool.
4. Teachers could use a cooperative teaching strategy by asking each group of students to sit on a blanket.
5. If the weather means the teacher cannot go outside, she/he can use this idea inside the classroom, organising the tables and chairs in a U-shape and sitting on the floor on the picnic blanket.

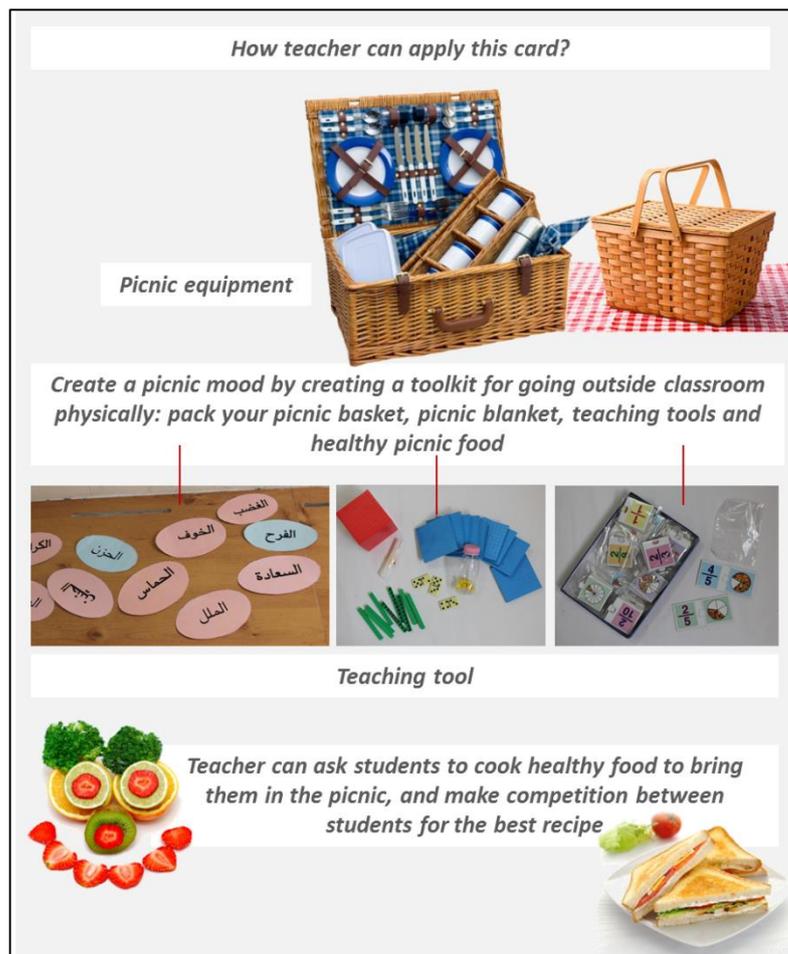


Figure 485: how the teacher can apply card 6 “*Physically outside the Classroom*”

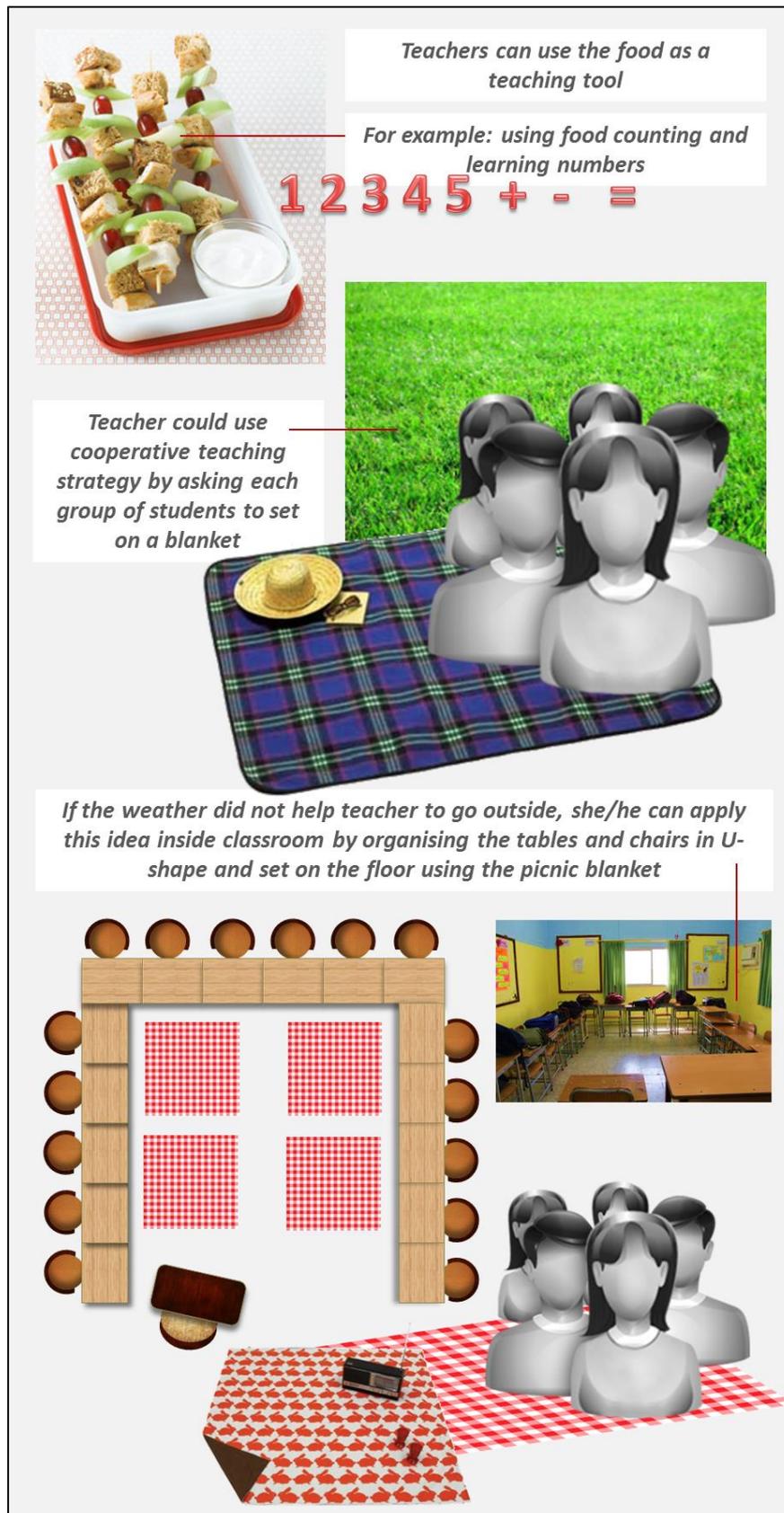


Figure 486: How the Teacher Can Apply Card 6 “Physically Outside The Classroom”

What

Since this card idea can be applied outside the classroom space, there is no image to show what teachers might expect when using this card or how the classroom space might look.

Final Set of Cards 6 “Outside Classroom Physically”

Card 6

Physically Outside the Classroom

<http://classroomscene.blogspot.co.uk>

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Creating outside classroom activities.
- Making going outside the classroom easier.
- Breaking everyday routine and offering new learning experiences.
- Extending classroom space and connecting students with outside the classroom.
- Stimulating and motivating students by creating a kinetic activity.

Card 6 **2**

How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this idea?

- Picnic equipment.
- Divide students into groups with each group bringing a picnic blanket to sit on.
- Teacher can pack her/his teaching tools in the picnic basket.
- Picnic with healthy food.

Card 6 **3**

How

What do you need to apply this card?
How to apply this card.

Picnic equipment

Divide students into groups, each group brings a picnic blanket to set on

Picnic healthy food

Teacher can pack her/his teaching tools with the picnic basket

Card 6 **4**

How

What do you need to apply this card?
How to apply this card.

How to apply this idea.

1. Create a picnic mood by creating a toolkit for going outside the classroom physically. Pack your picnic basket, picnic blanket, teaching tools and healthy picnic food.

Picnic equipment

Create a picnic mood by creating a toolkit for going outside classroom physically: pack your picnic basket, picnic blanket, teaching tools and healthy picnic food

Teaching tool

Card 6 **5**

How

What do you need to apply this card?
How to apply this card.

2. Teacher can ask students to cook healthy food to bring to the picnic and create a competition between students for the best recipe.

Teacher can ask students to cook healthy food to bring them in the picnic, and make competition between students for the best recipe

3. Teachers can use the food as a teaching tool.

Teachers can use the food as a teaching tool

For example: using food counting and learning numbers

1 2 3 4 5 + - =

Card 6 **6**

How

What do you need to apply this card?
How to apply this card.

4. Teacher could use a cooperative teaching strategy by asking each group of students to sit on a blanket.

Teacher could use cooperative teaching strategy by asking each group of students to sit on a blanket

5. If the weather means the teacher cannot go outside, she/he can use this idea inside the classroom, organising the tables and chairs in a U-shape and sitting on the floor on the picnic blanket.

Card 6 **7**

How

What do you need to apply this card?
How to apply this card.

If the weather did not help teacher to go outside, she/he can apply this idea inside classroom by organising the tables and chairs in U-shape and set on the floor using the picnic blanket

Card 6 **8**

What

What do teachers expect when using this card?
How might the learning space look?

Since this card idea can be applied outside the classroom space, there is no image to show what teacher s might expect when using this card or how the classroom space might look.

Card 6 **9**



Set of Cards 7 “Classroom Timeline”

This set of cards came from connecting users’ understanding of classroom space, their thoughtless acts in the space and how they changed and adapt with the space. This connection happened while comparing and reflecting on the four finding sections together which are: Comprehend Changes in Classroom Space, Create Understanding of Classroom Space, Classroom Space Design Elements and The Relationship between Classroom Design and Teaching Strategy. The comparison of these four sections are have been done in the thinking map of Set of Cards 7 “Classroom Timeline”, Next this thinking map will explain in details.

Table 17: Shows Thinking Elements of Set of Cards 7 “Classroom Timeline”

| | 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice |
|---|---|--|-------------------------|--|--|
| Cards 7: “Classroom Timeline” | classroom space should encourage interaction between teachers, students and space physical elements the importance of interactive learning to allow the development of higher-level learning and social skills, and to help develop personalised meanings (Ally, 2003) | Comprehend Changes in Classroom Space Create Understanding of Classroom Space Classroom Space Design Elements The Relationship between Classroom Design and Teaching Strategy | | Judy Pfaff art installation work teachers’ planning book records what happens in classroom space students’ drawings, recording memories on classroom walls | students don’t participate with teachers in recording what happens in classroom classroom displays design opportunities memories worth recording Classroom timeline Designing and interactive timeline and |

| | | | | | |
|--|--|--|--|--|--|
| | | <p>classroom resources</p> <p>classroom space should encourage interaction between teachers, students and space physical elements</p> <p>displays revealed many opportunities to improve the design of classroom displays which teachers are not aware off</p> <p>all classrooms almost have the same plan</p> | | | <p>using it as a teaching tool</p> <p>Designing probes to encourage interaction and add learning value to the timeline</p> |
|--|--|--|--|--|--|

In Create Understanding of Classroom Space section of the findings users have explained how classroom space effect students, they claimed that when classroom space is rich with resources such as pictures, students’ work, artist work and other educational displays then space will effect students’ imagination, way of thinking, learning experience and creativity. However, the findings show that teachers faced problem in designing interactive rich displays to their students, teachers’ display are usually limited to sticking pictures and words on the wall. In addition, teachers’ claimed that the design of classroom space should encourage interaction between teachers, students and space physical elements such as furniture and walls. However, although teachers emphasise on the importance of interaction for learning, findings revealed that teachers’ did not know how to design interactive learning activities in the space using available resources in space, Figure 488 shows reflection on teachers’ Understanding of Classroom Space. In the other hand, the literature review highlighted the importance of interactive learning to allow the development of higher-level learning and social skills, and to help develop personalised meanings (Ally, 2003), yet it does not explain to teachers how to design an interactive classroom space. To solve this problem, researcher looked for an inspiration from different art installation works for example Judy Pfaff work where she designed different ways of interaction between space physical elements such as wall, ceilings and

floor through her artwork, which offers interesting experience for visitors and allow them to interact with the wall and floor through the artist work. Figure 487 shows examples of Judy Pfaff art installation work.



Figure 487: Judy Pfaff art installation work

Source: <http://www.judypfaffstudio.com/>

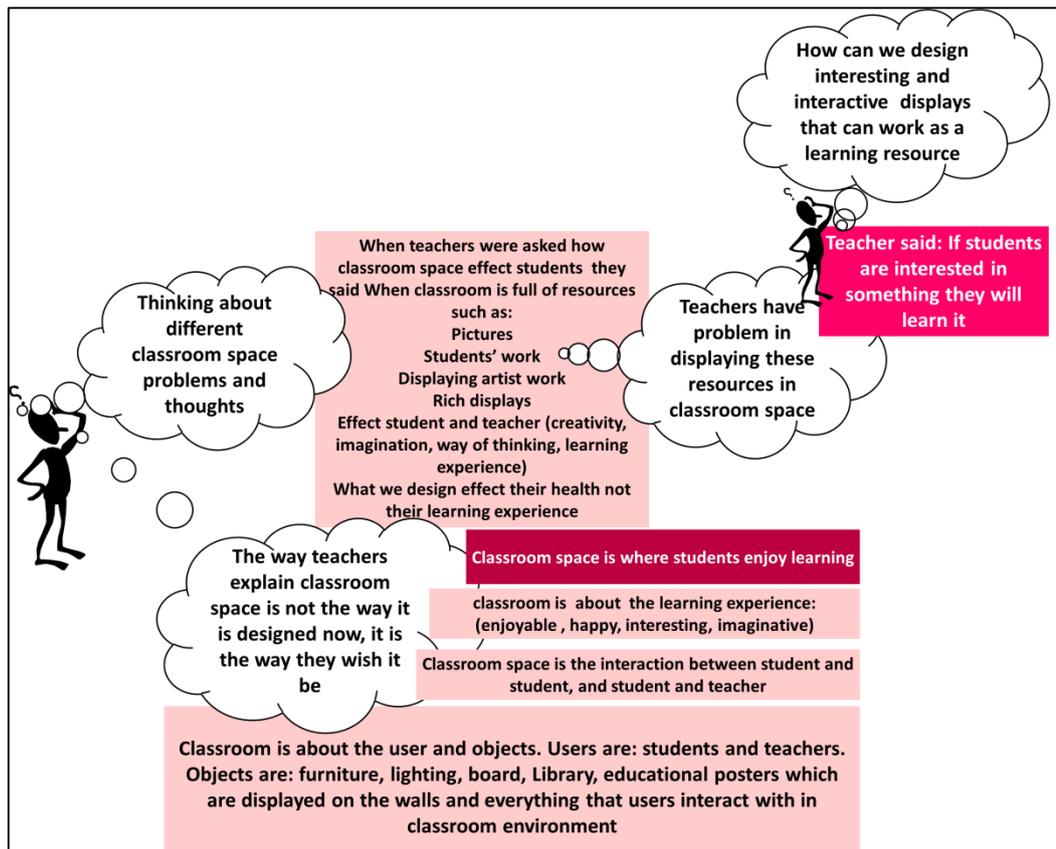


Figure 488: Reflection on Teachers' Understanding of Classroom Space

Additionally, reflecting on the Relationship between Classroom Design and Teaching Strategy section in Figure 489, teachers claimed that there is a strong relationship among space design, teaching strategy and curriculum and classroom design elements should be used as a supportive method for teaching, although the observation showed that current

teachers’ use of classroom space does not reflect these claims. Additionally, teachers’ record this relationship in the planning book, in term of the teaching strategy they use, how the classroom space is changed according to their strategy, and how the students respond to this. However, students don’t record with teachers and they don’t participate with teachers in recording what is happening in classroom space. Furthermore, as shown in Figure 489 connecting this reflection with the comparison between what teachers claimed about classroom displays in Comprehend Changes in Classroom Space section in the finding chapter with what they display in the classroom space revealed that there are many opportunities to improve the design of classroom displays which teachers are not aware off. This led the researcher to think of classroom displays design opportunities.

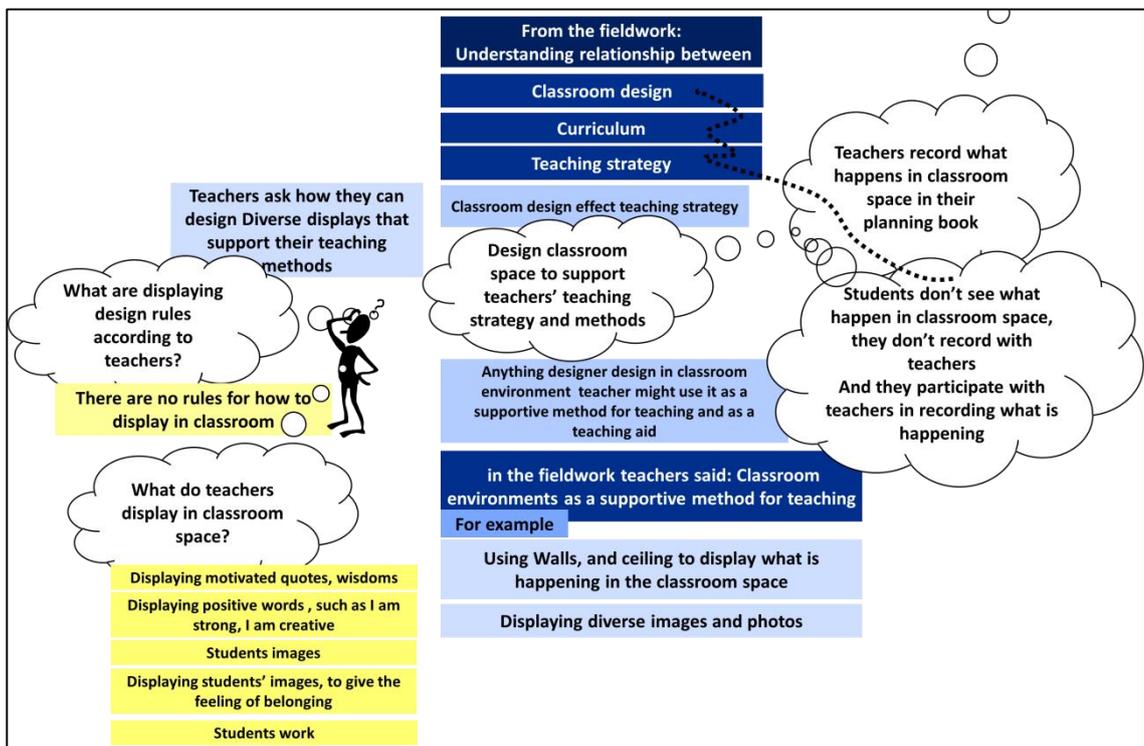


Figure 489: Reflecting on the Relationship between Classroom Design and Teaching Strategy

Conversely, as shown in Figure 490 different types of displays explained in the finding chapter in “Classroom Display” section, students’ displays were important displays. Additionally, the observation affinity diagram revealed that all classrooms almost have the same plan and what really differentiate between them are their displays.

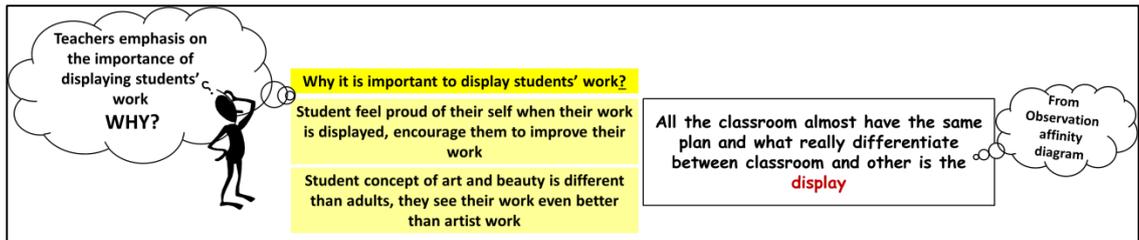


Figure 490: Displays in Classroom Space

The inspiration of set of cards number 7 “Classroom Timeline” came from students’ drawings, in many drawings students have drawn and write their memories of classroom activities on the walls, Figure 491 shows inspiration of “Classroom Timeline” in the thinking map. In addition, looking at photos collected in the fieldwork there was rich memories in these photos which are worth recording; Figure 491 shows photos from the fieldwork. Therefore, this set of cards suggest for teachers different ways of displaying these memories in a timeline and advise teachers to allow students to record their memories throw the timeline display which will encourage users interaction with each other and with space.



Figure 491: Inspiration of “Classroom Timeline” in the Thinking Map

Moreover, as explained in Figure 492 this set of cards idea developed to show teachers different ways of creating an interactive timeline and using it as a teaching tool that support their teaching strategies, and by adding different probes and showing teachers

how to apply them in space this set of cards will solve common problems mention by users in the second stage.

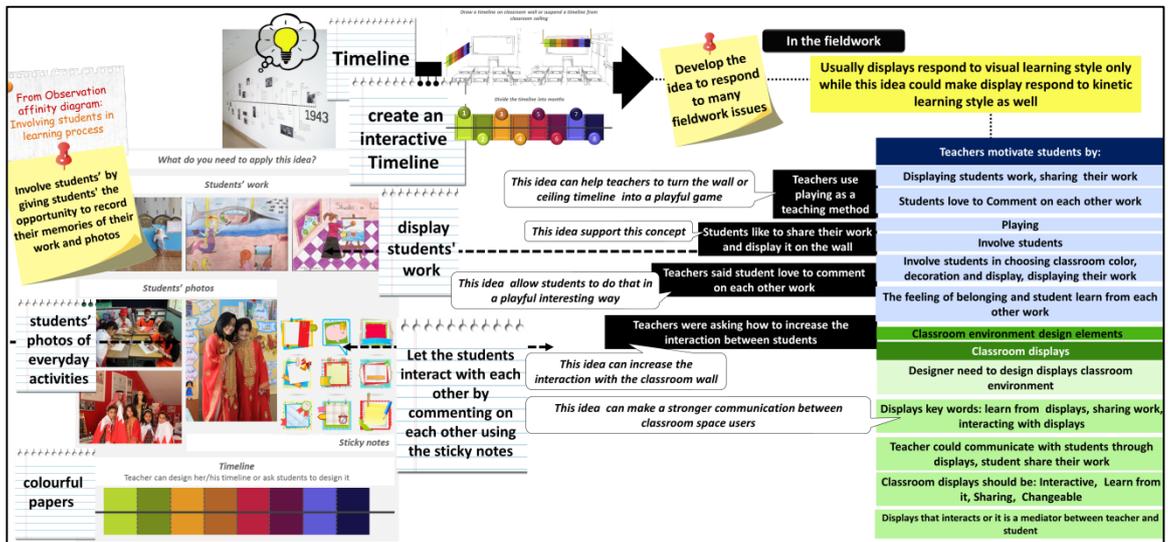


Figure 492: Development of Ideas for Set of Cards "Classroom Timeline"

For example: using probes such as sticky notes to allow students reflecting on their classroom activities and comment on each other while interacting with the timeline displayed on the wall or hanged from the ceiling will help teachers to encourage communication and interaction between students each other, the sticky notes will add a learning value to the timeline displayed on the walls. More examples of how this set idea is developed in the thinking map to add learning value to the timeline idea and to respond to issues mentioned in the finding chapters is explained in Figure 492 and Figure 493.

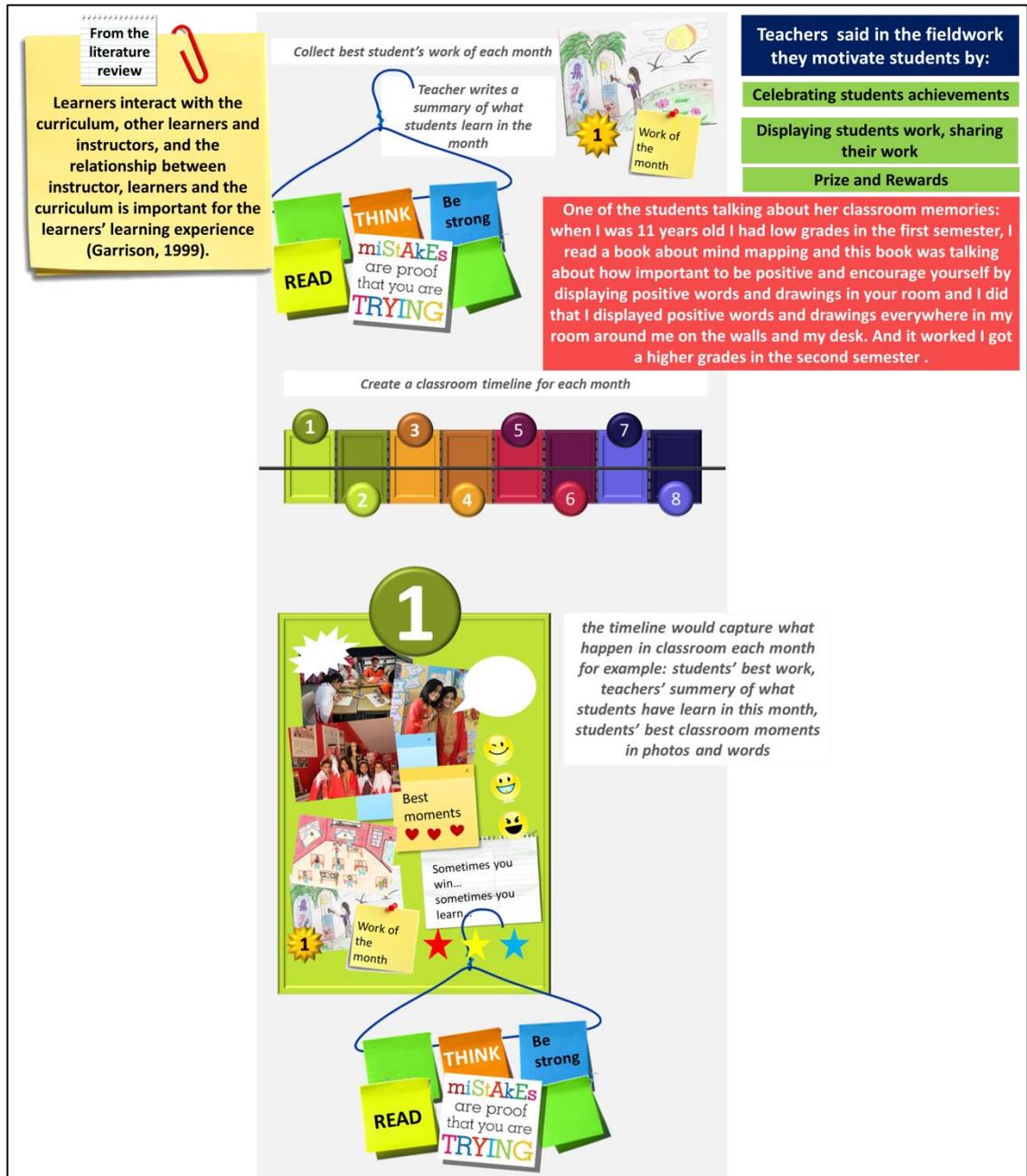


Figure 493: Development of Ideas for Set of Cards "Classroom Timeline"

Why

Why use this card? The benefits classroom users' will get when they use this card are:

- Creating an interactive wall or ceiling display
- Visualise students' learning experience
- Students can learn from the wall or ceiling display without the need for a teacher
- Recording students' best memories, feelings about classroom activities and the learning experience
- Using wall/ceiling displays to support teaching and learning

- Stimulating students by giving them the opportunity to display their photos, offer their opinions and express their feelings
- Creating a different mode of classroom display
- Helping students to reflect on what they have done during school time

How

What do teachers need in order to apply this set of cards, and how to apply them? Firstly, what do teachers need in order to apply this set of cards? Students' work, Students' photos, Sticky notes and Timeline, Figure 494 shows what teachers need to apply card 7 "*Classroom Timeline*"

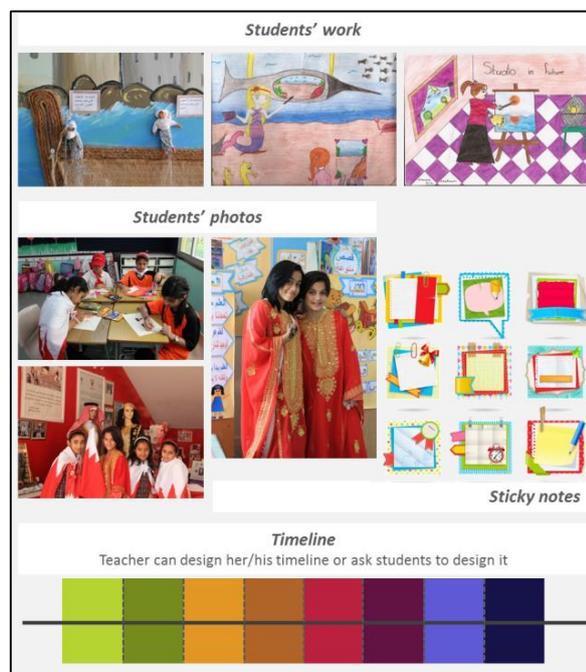


Figure 494: what teachers need to apply card 7 "*Classroom Timeline*"

How to apply this card?

1. Draw a timeline on the classroom wall or suspend a timeline from the classroom ceiling, then divide the timeline into months
2. Ask students to capture their best moments during classroom daily activities by taking photos, making drawings and writing on the sticky notes.
3. Collect the best student's work each month.
4. Teacher writes a summary of what students learn in the month.

5. Create a classroom timeline for each month. The timeline can capture what happens in the classroom each month: for example, students' best work, teachers' summary of what students have learned this month, students' best classroom moments in photos and words. Figure 495 and Figure 496 show how teacher can apply card 7 “Classroom Timeline”



Figure 495: How Teacher Can Apply Card 7 “Classroom Timeline”



Figure 496: how teacher can apply card 7 "Classroom Timeline"

What

What does the teacher expect to happen when she/he is using this card? What would the learning space look like? Figure 497 shows what teachers expect the classroom space to look like when applying card 7 “*Classroom Timeline*”.

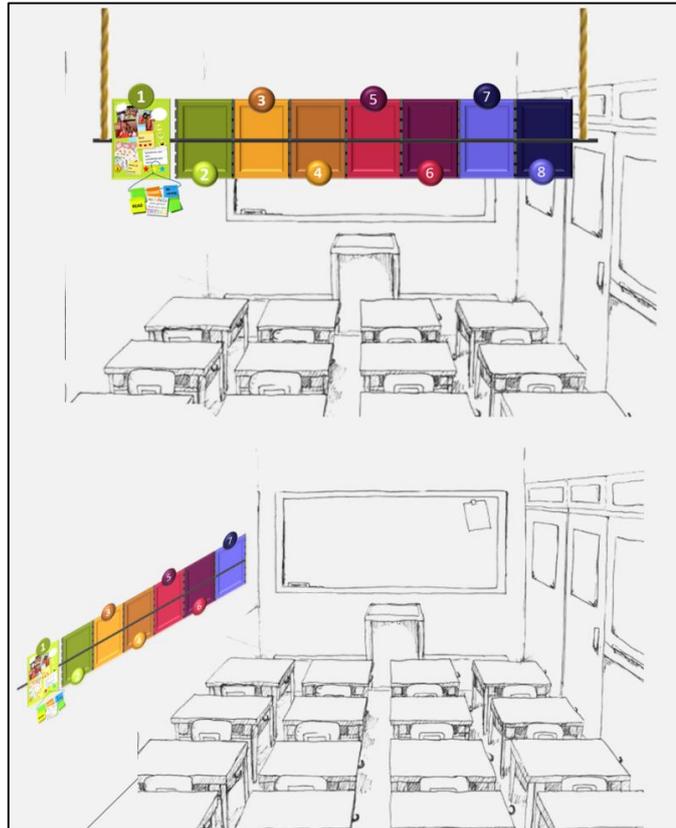
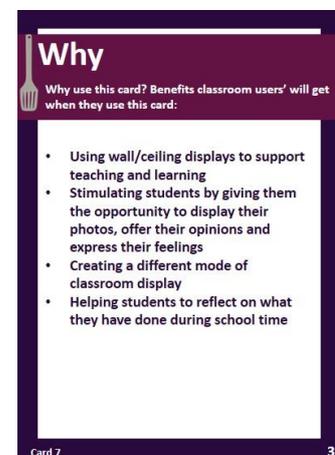
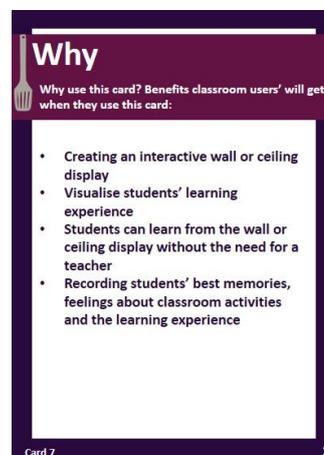


Figure 497: what teachers expect the classroom space to look like when applying card 7

Final Set of Cards 7 “Classroom Timeline”



How

What do you need to apply this card?
How to apply this card.

What do you need in order to apply this idea?

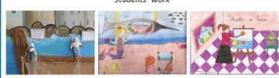
- Students' work
- Students' photos
- Sticky notes
- Timeline

Card 7 4

How

What do you need to apply this card?
How to apply this card.

Students' work



Students' photos



Sticky notes



Timeline
Teacher can design her/his timeline or ask students to design it



Card 7 5

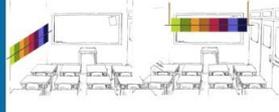
How

What do you need to apply this card?
How to apply this card.

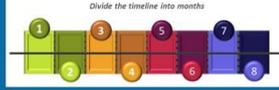
How to apply this idea?

1. Draw a timeline on the classroom wall or suspend a timeline from the classroom ceiling
2. Divide the timeline into months

Draw a timeline on classroom wall or suspend a timeline from classroom ceiling



Divide the timeline into months



Card 7 6

How

What do you need to apply this card?
How to apply this card.

3. Ask students to capture their best moments during classroom daily activities by taking photos, making drawings and writing on the sticky notes.

photos



Drawings



Sticky notes



Sometimes you win... sometimes you learn... Best moments

Card 7 7

How

What do you need to apply this card?
How to apply this card.

4. Collect the best student's work each month.
5. Teacher writes a summary of what students learn in the month.

Collect best student's work of each month

Teacher writes a summary of what students learn in the month



Work of the month

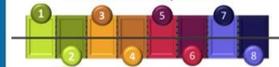
6. Create a classroom timeline for each month. The timeline can capture what happens in the classroom each month; for example, students' best work, teachers' summary of what students have learned this month, students' best classroom moments in photos and words.

Card 7 8

How

What do you need to apply this card?
How to apply this card.

Create a classroom timeline for each month



1

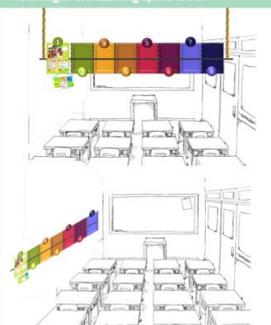


the timeline would capture what happen in classroom each month for examples: students' best work, teachers' summary of what students have learn in this month, students' best classroom moments in photos and words

Card 7 9

What

What do teachers expect when using this card?
How might the learning space look?



Card 7 10

Apply and Share

#Classroom_Design_Recipes
#Classroom_Timeline #your_name



To share your work, please send it to this email
Classroom.Recipe@gmail.com
<http://classroomrecipe.blogspot.co.uk>

Card 7 11

Set of Cards 8 “Floor Storytelling”

The thinking map of this set of cards starts with different theoretical concepts raised in the literature review, as many researchers note the importance of engaging space design with learning theories (Boys, 2011, Dudek, 2008, Harrison and Hutton, 2013) the

APPENDICES

researcher started to think how to translate them into design elements in classroom space for users' beneficial, Figure 498 explains thinking map of set of cards 8 "Floor Storytelling", next the thinking map will be divided and explained in details.

Table 18: Shows Thinking Elements of Set of Cards 8 "Floor Storytelling"

| | 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice |
|--|--|---|---------------------------------------|------------------------------------|---|
| Cards 8 "Floor Storytelling" | <p>the importance of engaging space with learning theories (Boys, 2011, Dudek, 2008, Harrison and Hutton, 2013)</p> <p>importance of interaction in the learning space (Ally, 2003, Heinich et al., 2002, Murphy and Cifuentes, 2001)</p> <p>learning space can be understood as a relationship (Boys, 2011, Dudek, 2008, Harrison and Hutton, 2013)</p> | <p>Limited interaction in classroom space</p> <p>Floor is overlooked by teachers in space</p> | <p>storytelling teaching strategy</p> | <p>interactive flooring design</p> | <p>how to translate classroom engagements into design elements`</p> <p>how to design a space that encourages interaction and how add teaching value to interaction happens between physical space and users</p> <p>design a toolkit for storytelling strategy that suggests to use classroom flooring as a teaching tool</p> <p>flooring a silent 3D curriculum</p> <p>Technology offers virtual probes that make users interact with flooring</p> <p>Physical probes versus virtual probes</p> |

Limited interaction in classroom space was a common problem, in the literature review there was a big emphasis on the importance of interaction in the learning space (Ally, 2003, Heinich et al., 2002, Murphy and Cifuentes, 2001), because learning space can be understood as a relationship rather than as a setting or object (Boys, 2011, Dudek, 2008, Harrison and Hutton, 2013) and this relationship built by interaction happens

between users themselves and space. Additionally interaction provides learning and teaching benefits for space users, Figure 499 shows different theoretical concepts raised in the literature review about interaction in classroom space and its value. However, literature did not explain how to design a space that encourages interaction and how to add learning and teaching value to the interaction that happens between physical space and users. Additionally, users highlighted the importance of interaction too, and they explained how interaction happens in space. However, students' drawings have illustrated different examples for how to design an interactive learning space.

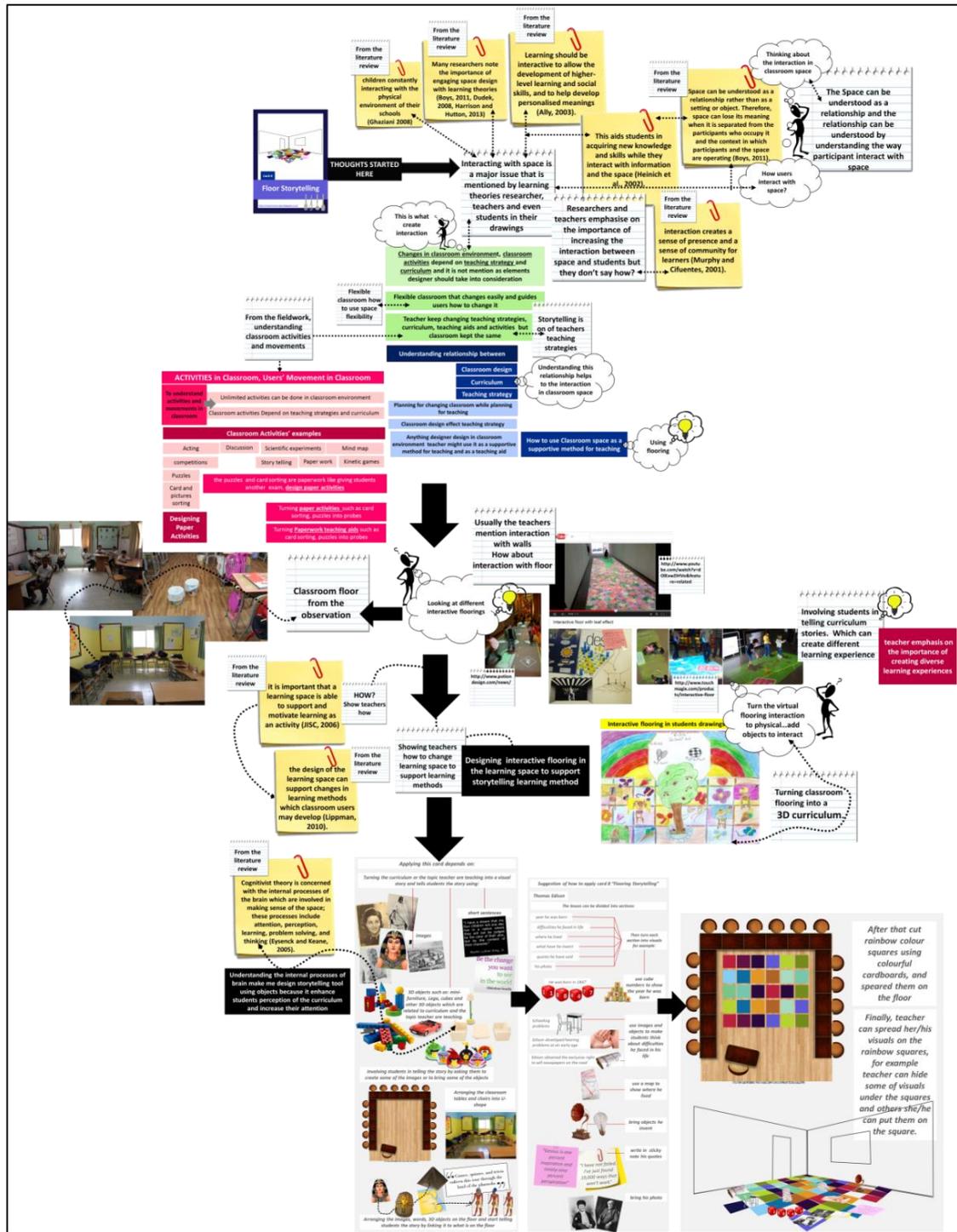


Figure 498: Thinking Map of Set of Cards 8 "Floor Storytelling"

Furthermore, many of users' claims in the finding chapter about classroom space have inspired this set of cards concept these claims were explained under the four sections which are: Comprehend Changes in Classroom Space, Create Understanding of Classroom Space, Classroom Space Design Elements and The Relationship between Classroom Design and Teaching Strategy. Figure 500 shows users' claims that inspired the concept of "Floor Storytelling" set of cards.

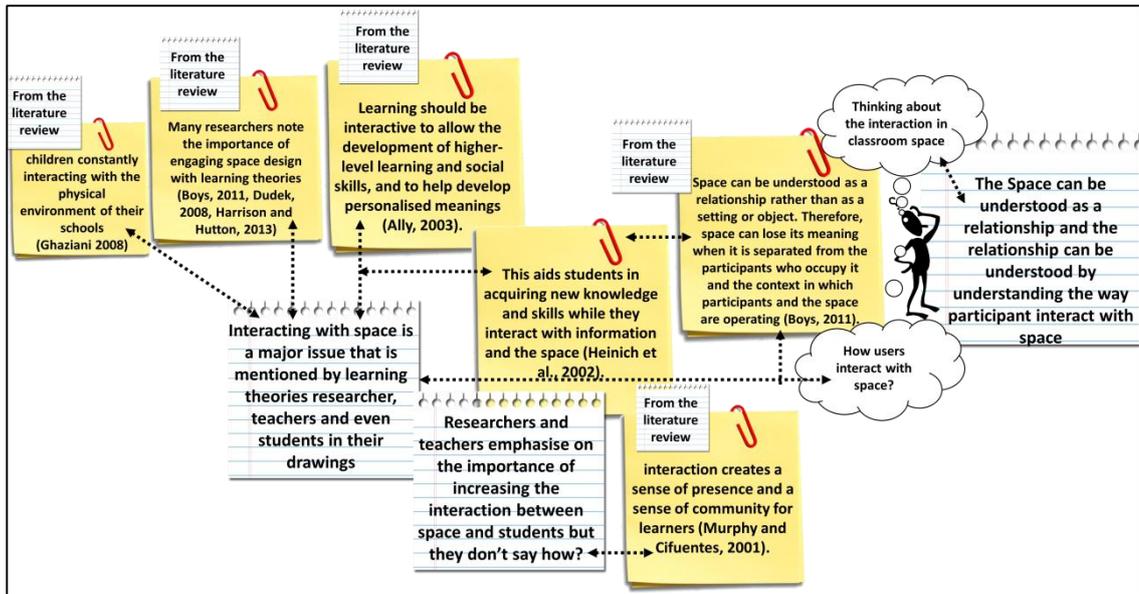


Figure 499: Different Theoretical Concept Rose in the Literature Review about Interaction

Claims mentioned in Figure 500 have inspired researcher to design a toolkit for storytelling strategy that suggest teachers to use classroom flooring as a teaching tool, which can make classroom flooring a silent 3D curriculum. Development of this idea is explained in Figure 501 , developing this idea by looking at observation photos from the first stage, the observation showed that flooring usually overlooked and not used as a teaching tool. Additionally, while teachers' mentioned the interaction with space walls they were not aware off the interaction with floor. However, as illustrated in Figure 501 students have designed in their drawings different interactive floorings.

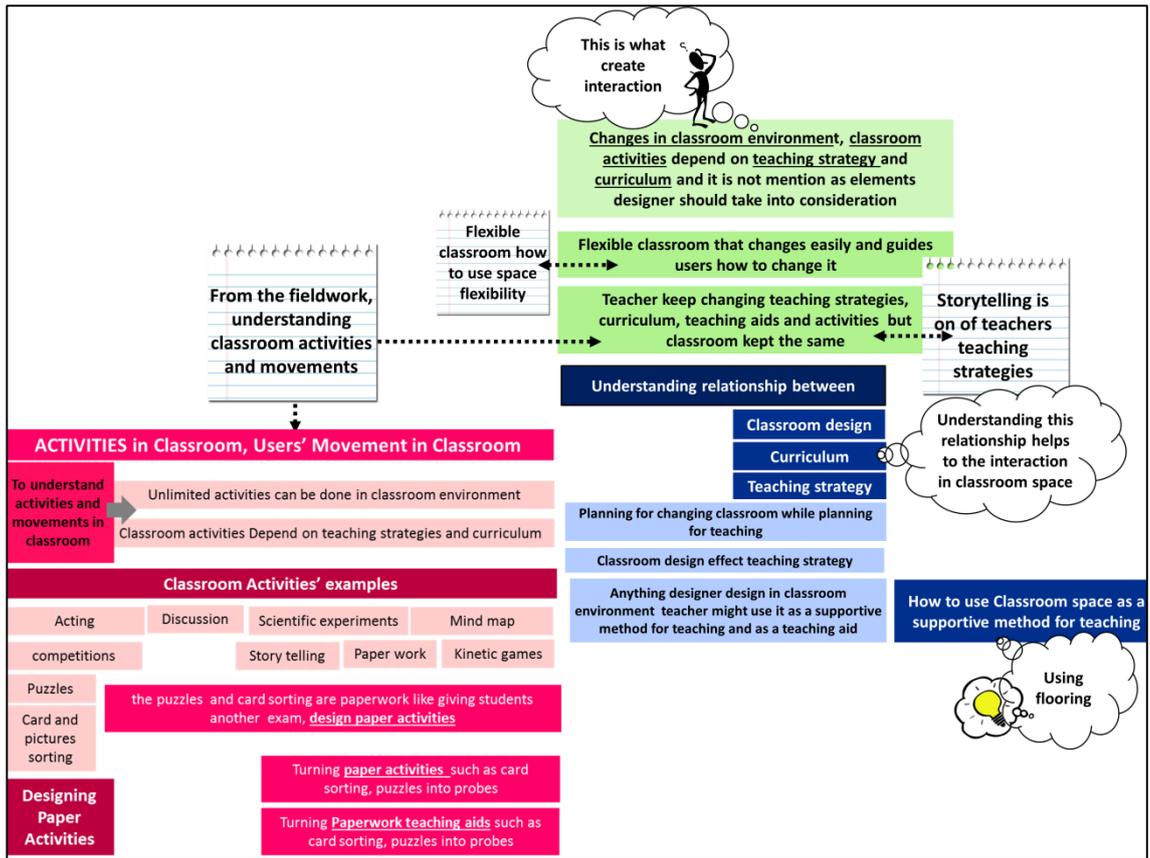


Figure 500: Users' Claims That Inspired the Concept of "Floor Storytelling" Set of Cards



Figure 501: Development Of "Floor Storytelling" Idea in the Thinking Map

Furthermore, looking for design inspiration researcher have looked at different interactive flooring designs, Figure 502 shows examples of interactive flooring design. However interactive floorings are designed using technology which is not available for most classroom space.



Figure 502: Examples of Interactive Flooring Design

The technology concept of offering virtual probes that make users interact with flooring was used to design this set of cards, but instead of virtual probes researcher looked for physical probes such as: photos, three dimensional objects, and as illustrated in Figure 503 suggest teachers to relate these probes to the curriculum while applying storytelling teaching strategy, and use the floor to tell the story which will engage students with the curriculum through floor storytelling and increase the interaction between space and its users. Finally, this idea is connected to different learning theories concepts in order to explain the design application of this theoretical knowledge. Figure 503 explains the thinking development of “Floor Storytelling” set of cards.

From the literature review

it is important that a learning space is able to support and motivate learning as an activity (JISC, 2006)

HOW? Show teachers how

From the literature review

Cognitivist theory is concerned with the internal processes of the brain which are involved in making sense of the space; these processes include attention, perception, learning, problem solving, and thinking (Eysenck and Keane, 2005).

Understanding the internal processes of brain make me design storytelling tool using objects because it enhance students perception of the curriculum and increase their attention

From the literature review

the design of the learning space can support changes in learning methods which classroom users may develop (Lippman, 2010).

Applying this card depends on:

Turning the curriculum or the topic teacher are teaching into a visual story and tells students the story using:

images

short sentences

"I have a dream that my four children will one day live in a nation where they will not be judged by the color of their skin, but by the content of their character."

Martin Luther King, Jr.

Be the change you want to see in the world

-Mahatma Gandhi

Suggestion of how to apply card 8 "Flooring Storytelling"

Thomas Edison

The lesson can be divided into sections:

year he was born

difficulties he faced in life

where he lived

what have he invent

quotes he have said

his photo

Then turn each section into visuals for example:

He was born in 1847

use cube numbers to show the year he was born

Schooling problems

Edison developed hearing problems at an early age

Edison obtained the exclusive right to sell newspapers on the road

use images and objects to make students think about difficulties he faced in his life

use a map to show where he lived

bring objects he invent

"Genius is one percent inspiration and ninety-nine percent perspiration"

"I have not failed. I've just found 10,000 ways that won't work"

bring his photo

Arranging the classroom tables and chairs into U-shape

Games, quizzes, and trivia enliven this tour through the land of the pharaohs.

Arranging the images, words, 3D objects on the floor and start telling students the story by linking it to what is on the floor

Figure 503: The Thinking Development of "Floor Storytelling" Set of Cards

Why

Why use this card? The benefits classroom users' will get when they use this card, which are:

- Creating an interactive floor.
- Using classroom flooring to support teachers' teaching strategy.
- Designing a colourful patterned floor.
- Visualising teacher's storytelling teaching strategy in order to stimulate students and respond to their diverse learning styles.
- Changing the classroom space according to the curriculum.

- Turning classroom flooring into a 3D curriculum.
- Involving students in telling curriculum stories.
- Creating a different learning experience.

How

Applying this card depends on:

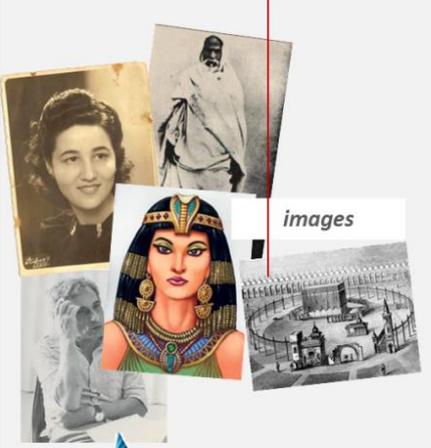
1. Turning the curriculum into a visual story and telling students the story using images, short sentences and 3D objects such as: mini-furniture, Lego, cubes and other 3D objects which are related to the curriculum and the topics the teachers are teaching.
2. Involving students in telling the story by asking them to draw some of the images or to bring into class some of the objects.
3. Arranging the classroom tables and chairs in a U-shape.
4. Arranging the images, words, 3D objects on the floor and telling students the story by linking it to what is on the floor.

Figure 504 explains what card 8 “*Floor Storytelling*” depend on.

Applying this card depends on:

Turning the curriculum or the topic teacher are teaching into a visual story and tells students the story using:

images



short sentences

"I have a dream that my four children will one day live in a nation where they will not be judged by the color of their skin, but by the content of their character."

-Martin Luther King, Jr.

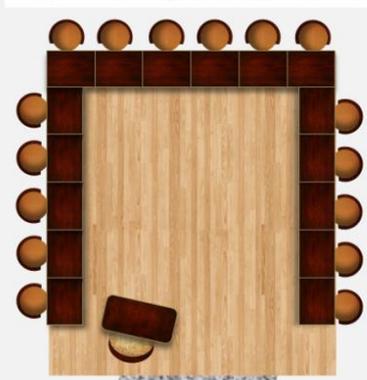
Be the change
you want
to see
in the world

-Mahatma Gandhi

3D objects such as: mini-furniture, Lego, cubes and other 3D objects which are related to curriculum and the topic teacher are teaching.



Involving students in telling the story by asking them to create some of the images or to bring some of the objects

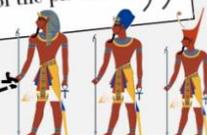


Arranging the classroom tables and chairs into U-shape





“Games, quizzes, and trivia enliven this tour through the land of the pharaohs.”



Arranging the images, words, 3D objects on the floor and start telling students the story by linking it to what is on the floor

Figure 504: what card 8 “Floor Storytelling” depend on

This card could be applied in diverse ways but here is one suggestion of how to apply this card. For example, if the lesson is about a character such as Thomas Edison you could apply the card in this way:

1. The lesson could be divided into sections: the year he was born, difficulties he faced in life, where he lived, what he invented, what he said, and his photo. Figure 505 suggests how to turn a lesson about Thomas Edison into visuals in order to apply card 8 “*Flooring Storytelling*”.
2. Then turn each section into visuals: for example, use cube numbers to show the year he was born; use images and objects to make students think about difficulties he faced in his life; use a map to show where he lived, bring in objects he invented; write on his quotes post-it notes; bring in his photo.
3. After that, cut out rainbow coloured squares using colourful cardboard and spread them on the floor.
4. Finally, the teacher can spread her/his visuals on the rainbow squares. For example, the teacher can hide some visuals under the squares and put others on the squares. Figure 506 explains how teacher could apply card 8 “*Flooring storytelling*”

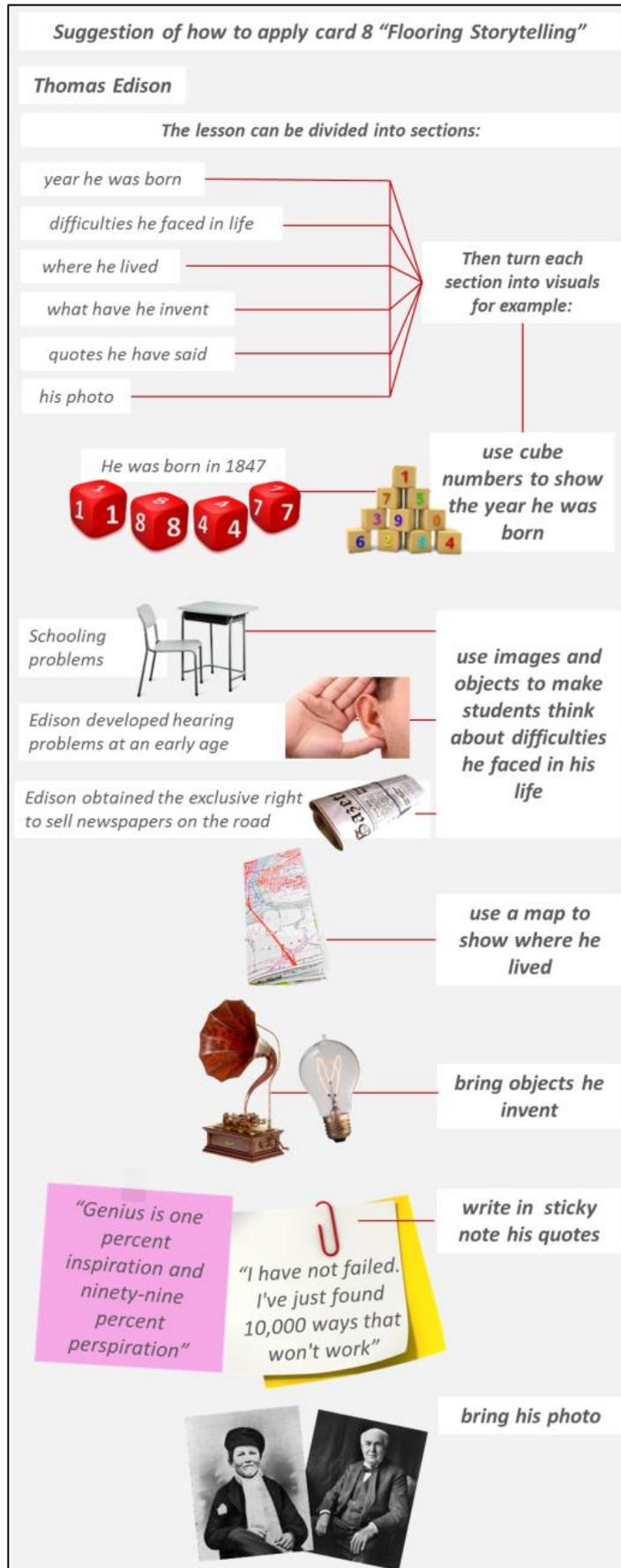


Figure 505: How to Turn a Lesson about Thomas Edison into Visuals

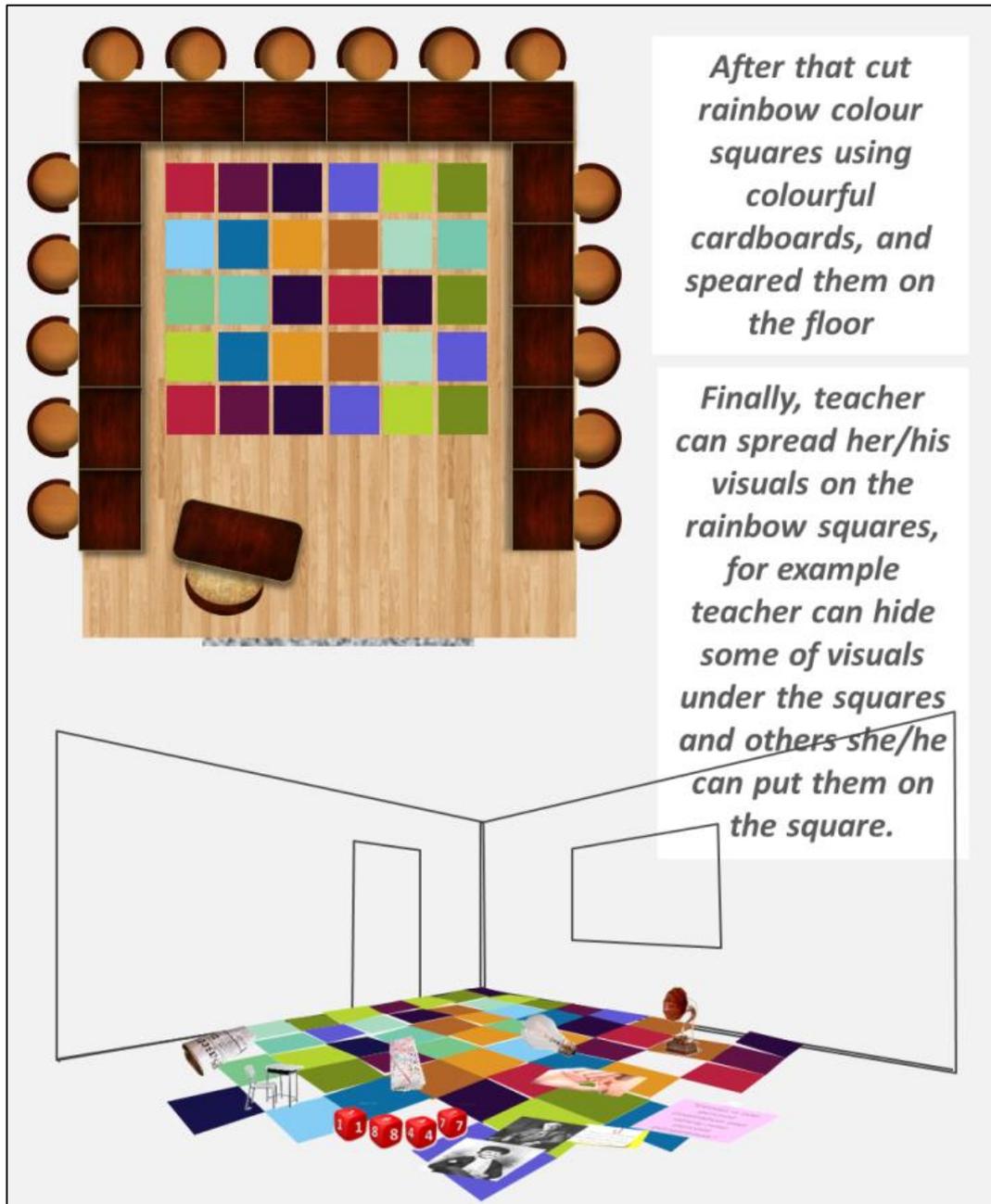


Figure 506: How Teacher Could Apply Card 8 “Flooring Storytelling”

What

What does the teacher expect when she/he is using this card? What would the learning space look like? Figure 507 shows how classroom space can look like when teacher apply card 8.



Figure 507: How Classroom Space Can Look Like When Teacher Apply Card 8

Final Card 8 “Floor Storytelling”

Card 8

Floor Storytelling

<http://classroomrecine.blogspot.co.uk>

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Creating an interactive floor.
- Using classroom flooring to support teachers' teaching strategy.
- Designing a colourful patterned floor.
- Visualising teacher's storytelling teaching strategy in order to stimulate students and respond to their divers learning styles.
- Changing the classroom space according to the curriculum.
- Turning classroom flooring into a 3D curriculum.
- Involving students in telling curriculum stories.
- Creating a different learning experience.

Card 8 2

How

What do you need to apply this card?
How to apply this card.

Applying this card depends on:

1. Turning the curriculum into a visual story and telling students the story using images, short sentences and 3D objects such as: mini-furniture, Lego, cubes and other 3D objects which are related to the curriculum and the topics teachers are teaching.
2. Involving students in telling the story by asking them to draw some of the images or to bring some of the objects.
3. Arranging the classroom tables and chairs in a U-shape.
4. Arranging the images, words, 3D objects on the floor and telling students the story by linking it to what is on the floor.

Card 8 3

How

What do you need to apply this card?
How to apply this card.

Turning the curriculum or the topic teacher are teaching into a visual story and tells students the story using:

- Images
- short sentences
- Be the change you want to see in the world!
- 3D objects such as: mini-furniture, Lego, cubes and other 3D objects which are related to curriculum and the topic teacher are teaching.

Card 8 4

How

What do you need to apply this card?
How to apply this card.

Involving students in telling the story by asking them to create some of the images or to bring some of the objects

Arranging the classroom tables and chairs into U-shape

Arranging the images, words, 3D objects on the floor and start telling students the story by linking it to what is on the floor

Card 8 5

How

What do you need to apply this card?
How to apply this card.

This card could be applied in diverse ways but here is one suggestion of how to apply this card. For example, if the lesson is about a character such as Thomas Edison you could apply the card in this way:

1. The lesson could be divided into sections: the year he was born, difficulties he faced in life, where he lived, what he invented, what he said, and his photo.

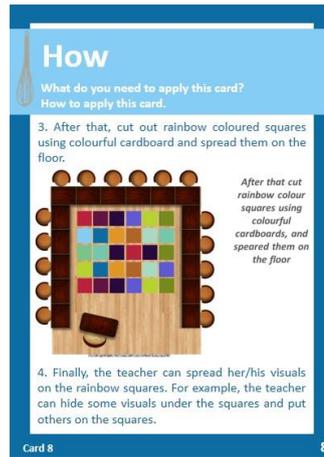
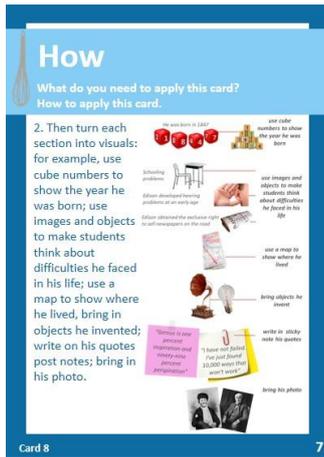
Thomas Edison

The lesson can be divided into sections:

- year he was born
- difficulties he faced in life
- where he lived
- what have he invent
- quotes he have said
- his photo

Then turn each section into visuals for example:

Card 8 6



Set of Cards 9 “Classroom Café”

Both literature review and users concentrate on the importance of socialising in learning space, its effect on building relationship between users, building a community of learners and the learning and teaching impact that cooperative learning activities have on students, yet the space design respond to this theoretical knowledge was usually only by designing a group of settings which through observing users thoughtless acts not enough for building relationship through space design. This set of cards asks for more design solution in space that encourages users to socialise, interacted with each other and builds relationships. Additionally, “classroom café” set offers a design solution that help teachers to use learning space as a cooperative teaching tool. However, it is important to mention that the theoretical base for this set of cards explained in the literature review chapter in sections: 1.3.1.4 Constructivism, 1.3.1.4.1 Socio constructivism and 1.5.5.1

Variety of Learning Groups. And in the finding chapter it is explained in finding chapter in section 1.3.2.1 What Does Classroom space Mean to Users?

An opportunity to respond to previous theoretical knowledge in addition to the tool main aim was seen in what users called “classroom extension” which is the corridors, courtyards and under stair case area, as users’ in the second stage asked how to link these spaces to classroom space. Users’ movements and how they currently utilize these spaces where analysed and compared with what users’ said they wish to happen in these areas. The analysis of classroom users’ movements in these spaces is explained in the finding chapter in section 2.Changes Outside Classroom, but Inside School, and illustrated in Figure 508 “How Users Use Classrooms Extensions”.



Figure 508: How Users Use Classrooms Extensions

Table 19: Shows Thinking Elements of Set of Cards 9 “Classroom Café”

| | 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice |
|--|---------------------|----------------------|------------------|---------------|---------------------|
|--|---------------------|----------------------|------------------|---------------|---------------------|

| | | | | | |
|--|---|---|--|--|--|
| <p>Cards 9 "Classroom Café"</p> | <p>the importance of socialising in learning space and its effects</p> <p>Socio constructivism</p> <p>Variety of Learning Groups</p> <p>Values of cooperative learning activities (Johnson and Johnson, 1996, Palloff and Pratt, 1999)</p> <p>Group work helps pupils to develop critical thinking skills through working collaboratively (Romiszowski, 1997)</p> | <p>space design respond to socialising value by designing group of settings which is observing users thoughtless acts not enough for building relationship</p> <p>users' thoughtless acts ask for design solution to encourages users to socialise</p> <p>How Users Use Classrooms Extensions</p> <p>Users' not interacting with classroom extension displays</p> | <p>teachers teaching tools contained different food images</p> | <p>Thinking beyond classroom, how could we link classroom to other school spaces?</p> <p>Bunting (2004) classroom that attracts pupils are designed similar to cafes are designed</p> <p>aesthetic principles for learning space included CAFEBAR design principles (Souter et al., 2009)</p> <p>In students' drawings: students socialising around food</p> | <p>use learning space as a cooperative teaching tool</p> <p>teachers claims about corridors explains that it can be used as a teaching aid where cooperative learning methods can be applied, if teachers' knew how to do that</p> <p>creating a café structure</p> <p>Designing the café structure to be a teaching and learning tool</p> |
|--|---|---|--|--|--|

The thinking journey began with a question raised during observation, the question was: Thinking beyond classroom, how could we link classroom to other school spaces? To this question knowing how users currently use other school spaces which they called classrooms extensions was important, the answer of this question illustrated in Figure 508. Reflecting on Figure 508, teachers claimed that corridors are classroom extension, where students can learn, socialize, display their work and can be used as an open exhibition. However, these claims showed that corridors can be used as a teaching aid where cooperative learning methods can be applied, if teachers' knew how to do that. Additionally, linking users' claims about classroom extension with learning theories claims such as: Instructors should encourage cooperative learning in order to facilitate constructivist learning (Johnson and Johnson, 1996, Palloff and Pratt, 1999) through using certain learning activities. Group work helps pupils to develop critical thinking skills through working collaboratively (Romiszowski, 1997). Teachers' are aware of these theoretical benefits, yet they are not aware how to design a space that aid teachers to encourage cooperative learning activities in order to get these benefits, figure shows connecting teachers' claims with literature review.

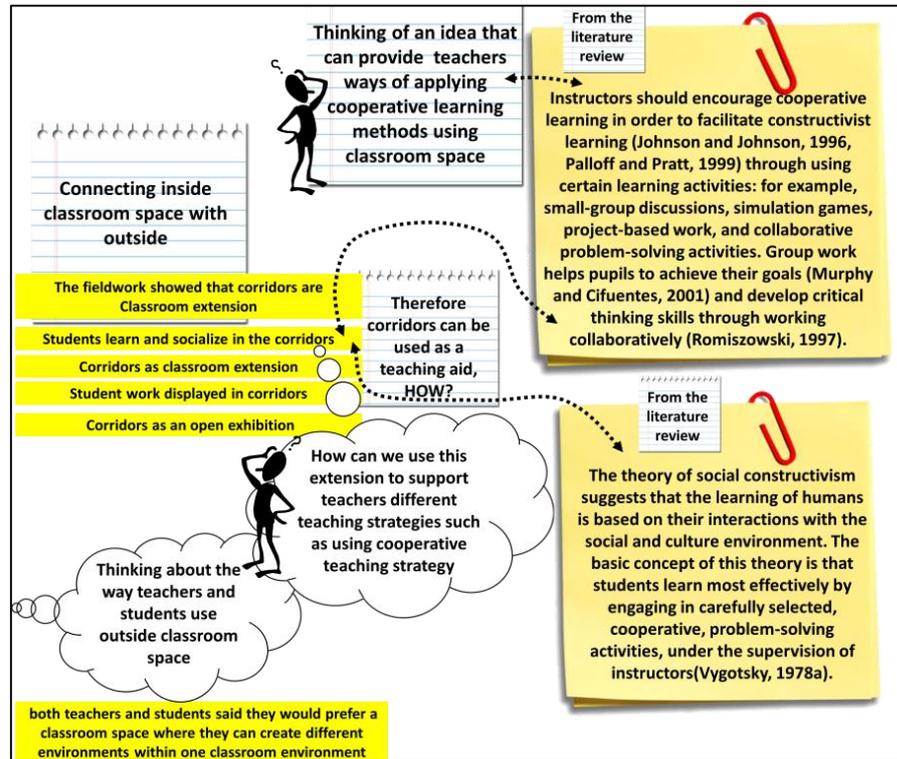


Figure 509: Connecting Teachers' Claims with Literature Review

Although there are many activities happens in classroom extension illustrated in Figure 508 students thoughtless acts showed that they don't socialise or interact with them, which was a problem mentioned by users in the second stage. Furthermore, reflecting on users' understanding of classroom space that was explained in the finding chapter have revealed design opportunities inspired this set of cards, Figure 510 shows users' reflecting on users' understanding of classroom space.

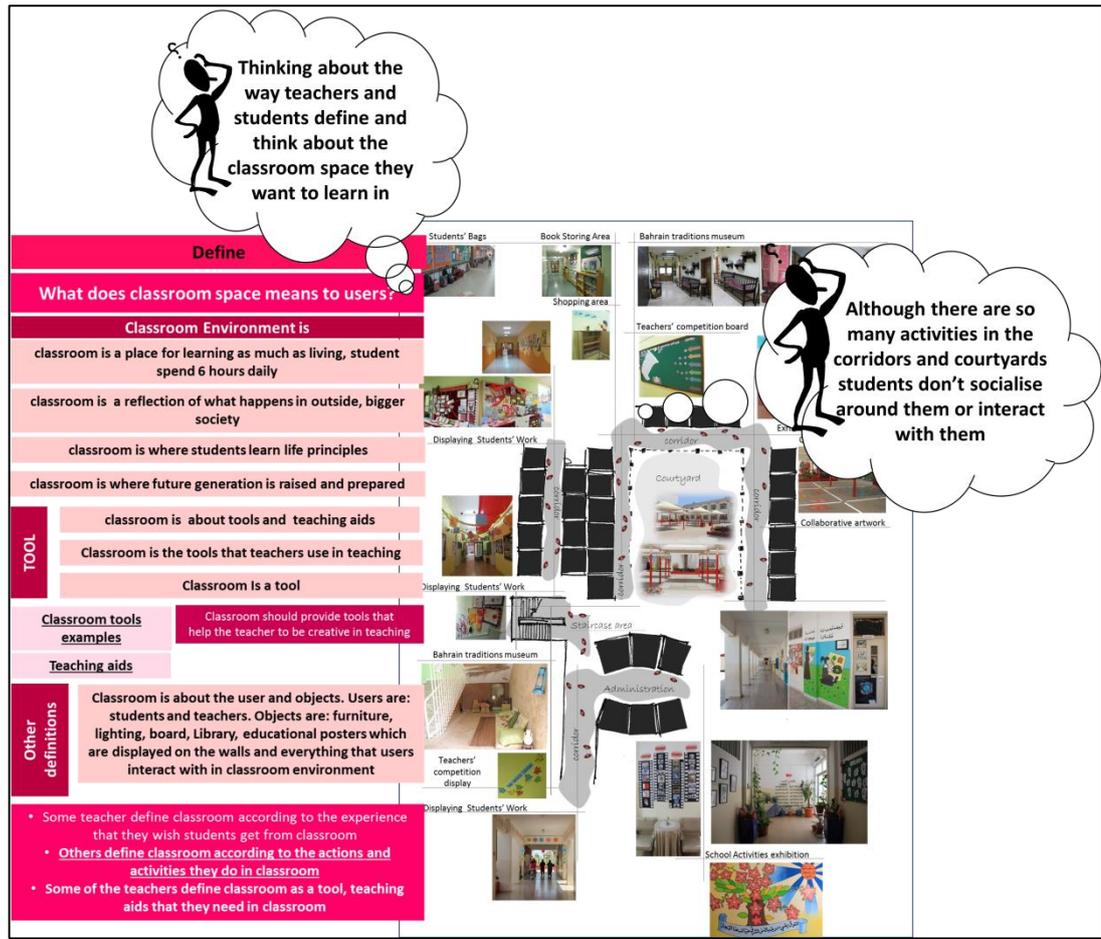


Figure 510: Users' Reflecting on Users' Understanding of Classroom Space

The inspiration of “classroom café” cards came from literature review, students’ drawings and teachers’ teaching tool. In the literature Bunting (2004) claimed that learning spaces that attracts pupils are the one which are designed similar to the way cafes are designed. Additionally, the SKG Project proposed aesthetic principles for learning space design which included symmetry, harmony, simplicity and fitness for purpose (Souter, 2010), incorporating CAFEBAR design principles (Souter et al., 2009). Students’ drawings illustrated students’ socialising around food, they have drawn group of setting around dining tables, buffet, café and food courts, Figure 511 shows inspirations from literature review and students drawings. Additionally, teachers teaching tools contained different food images; Figure 512 shows the use of food in teaching tools. Responding to previous problems and inspired by these concepts the idea of this set of card suggests to teachers creating a café structure with her/his students inside classroom space or in the corridor. After that, the cards explain different ideas for using this café as a teaching tool and applying different cooperative learning activities, figure shows the development of “classroom café” idea.

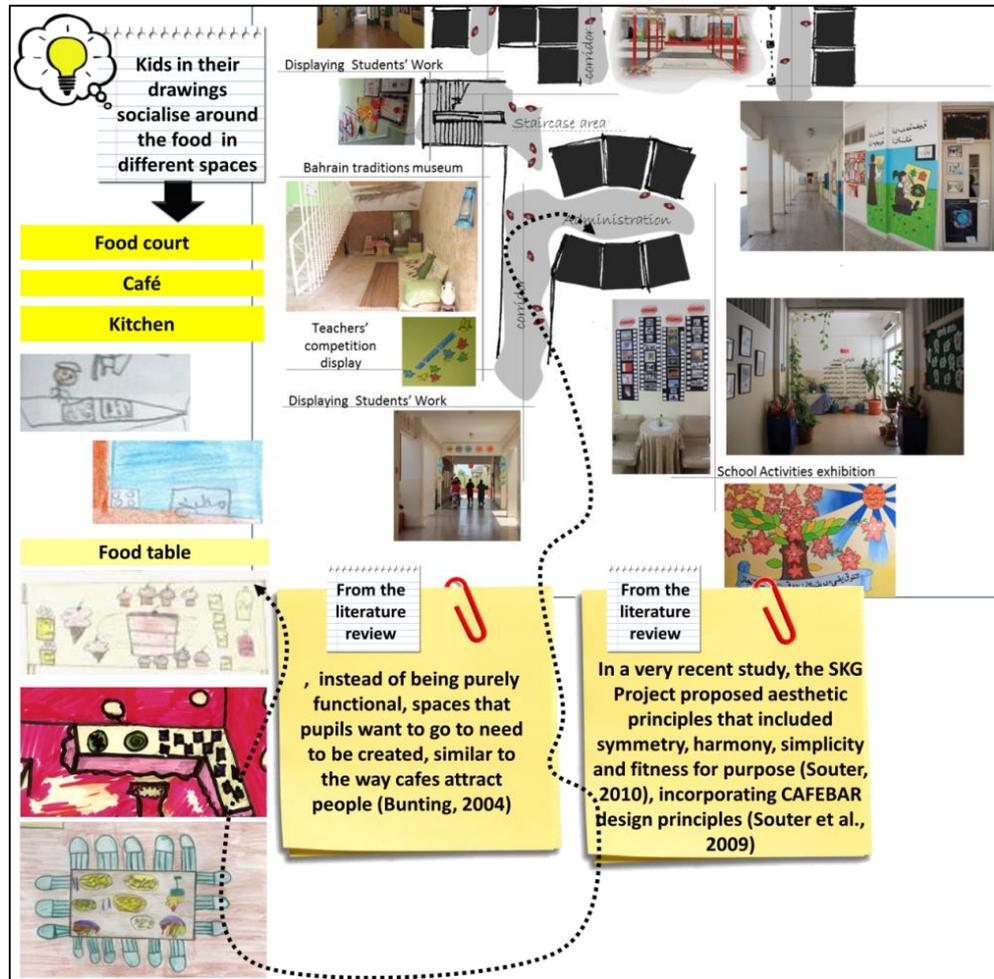


Figure 511: Inspirations from Literature Review and Students Drawings

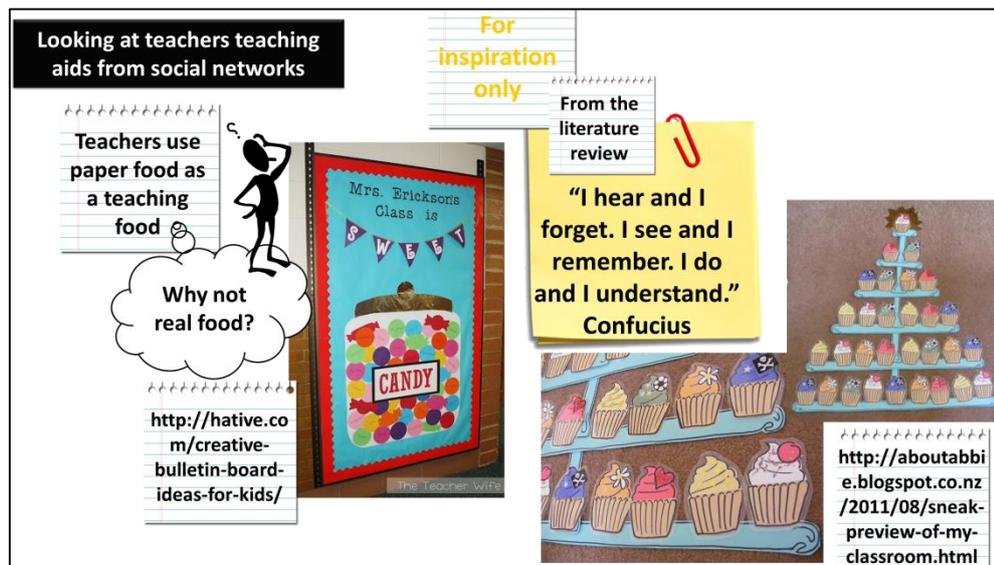


Figure 512: The Use of Food in Teaching Tools

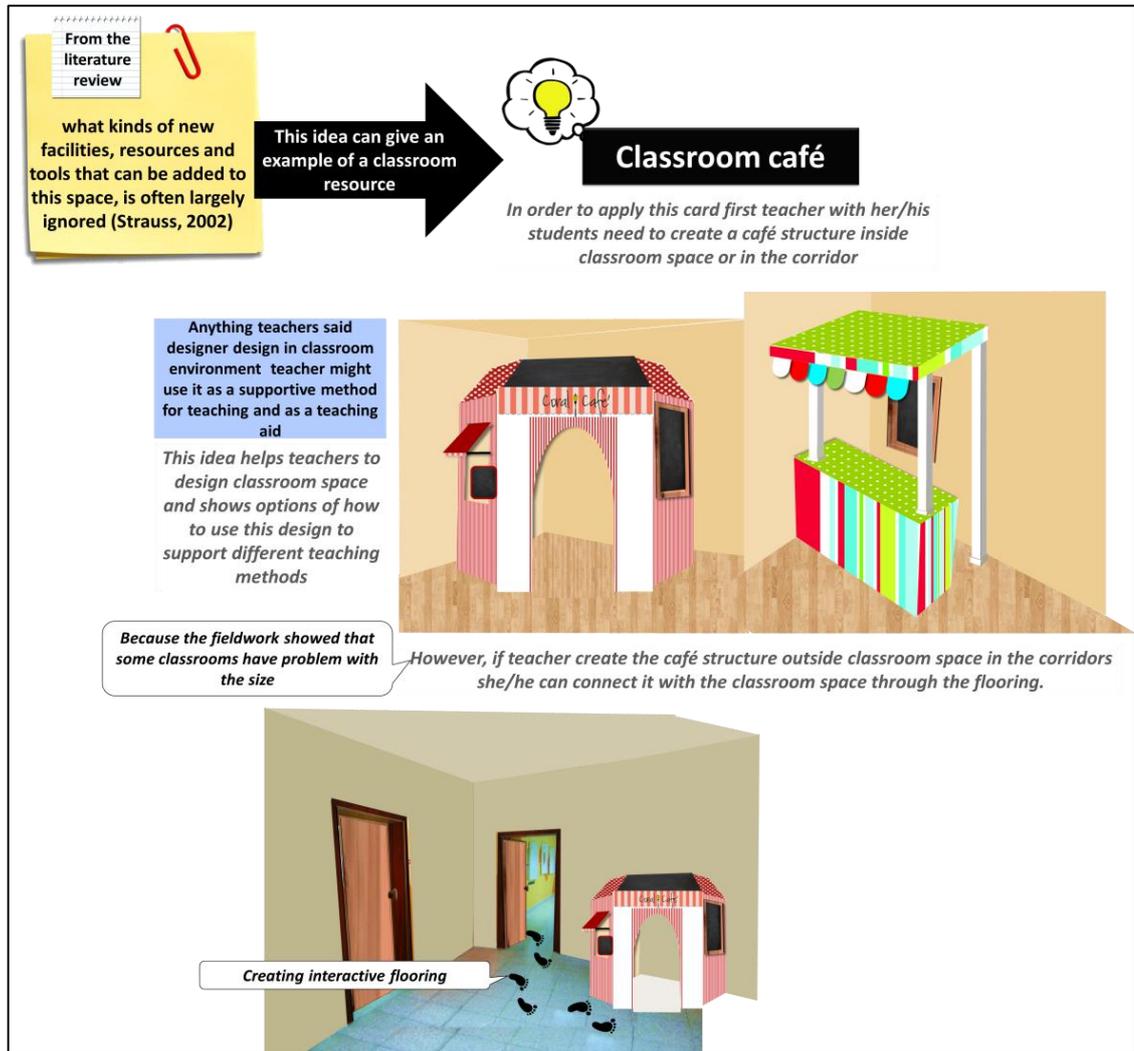


Figure 513: The Development Of "Classroom Café" Idea

The classroom café offers a space to socialise, build relationships between classroom uses, and respond to common problems mentioned by users in the fieldwork and Figure 514 shows connections between fieldwork problems and classroom café idea. For example responding to the limitation in interaction and communication in classroom space by making competition between students asking each group of students to design the café logo and choose its colours then display it on the walls after that students' can vote for their favourite design and apply it on the classroom café. Additionally, this set of cards explains to teachers how to use the café structure as a teaching tool for many teaching methods and by using students' drawings it suggests different ways for designing group of group settings around the café, Figure 515 shows classroom café teaching and learning applications.

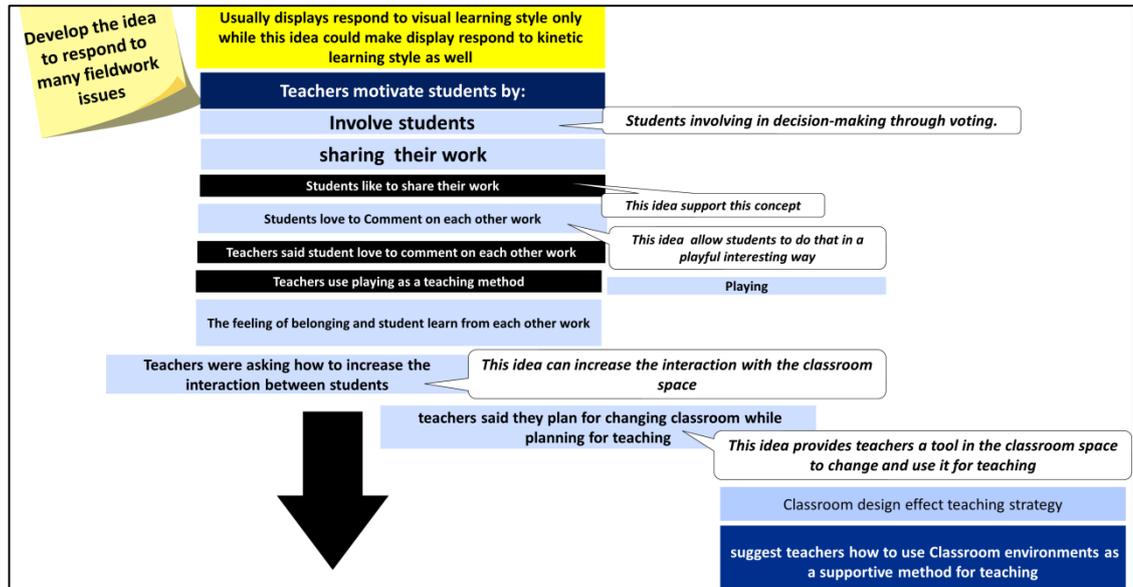


Figure 514: Connections between Fieldwork Problems and Classroom Café Idea



Figure 515: Classroom Café Teaching and Learning Applications

Why

Why use this card? The benefits classroom users' will get when they use this card are:

- Creating a tool that will aid teachers in applying diverse teaching strategies such as brain storming, problem solving and cooperative teaching strategies.
- Involving students in designing the classroom space.
- Motivating and stimulating students to use the classroom space through competitions.
- Creating another place within the classroom space.
- Connecting the learning process and the curriculum with reality.
- Connecting students with the outside classroom space.
- Students participating in decision-making through voting.
- Creating different seating arrangements in the classroom space.
- Using space to support teaching and learning.
- Providing a learning experience that responds to diverse students' learning styles.
- Designing an interactive wall and flooring in the space.

How

In order to apply this card, the teacher with her/his students first needs to create a café structure inside the classroom space or in the corridor. Figure 516 shows different café structure examples which the teacher could create in a classroom space. However, if the teacher creates the café structure outside the classroom space in the corridors she/he can connect it with the classroom space through the flooring. Figure 517 shows example of how to connect a corridor café with a classroom space through flooring.



Figure 516: Different Café Structure to Create in Classroom Space



Figure 517: How to Connect Corridor Café with Classroom Space through Flooring

How to use the café structure? The café structure can be an effective teaching tool and there are numerous ways in which the café structure can be used in order to support diverse teaching strategies.

1. Teachers can create a competition among students on “*Design Your Café*”. Each student or group of students design a logo for the café and choose colours for it. After that, the competitors’ work is displayed on the walls and students vote for the best café. Finally, the teacher and students work together to apply the winning idea. This involves students in designing parts of their own classroom space and gives them the opportunity to make decisions. Figure 518 explains an example for using the café structure.

The café structure can be an effective teaching tool and there are unlimited ways for how to use the café structure in order to support diverse teaching strategy, for example:

1 Teacher can do a competition between students about "Design Your Café" each student or each group of students

design a logo for the café choose it colours

after that competitors' work displayed on the walls

students can vote for the best café, 4

finally teacher and students work together in order to apply the winning idea This idea will involve students in design parts of their classroom space and give students the opportunity to make decision.

Figure 518: an example for using the café structure

2. Ask students to cook at home and bring in what they have cooked to sell in the café. The money raised can be used to support other classroom activities. However, cooking and selling are also useful learning processes where students can learn to solve real problems instead of proposed ones; teachers can also connect this process

with the teaching curriculum by, for example: addition and subtraction while selling what they have cooked; learning how to count money through selling; experiencing the mixing of different cooking ingredients; and learning about weights and measurements.

3. Creating different seating arrangements around the café structure. This can be used to enhance socialisation amongst students. Figure 519 shows example of seating area next to the café structure.



Figure 519: Example of Seating Area Next To the Café Structure

4. The café structure could be used to teach students how to start a business. Each student or group of students could be given a small amount of money and they can choose something to sell in the café.
5. A library can be added to the café structure by putting up bookshelves, and creating a reading or eating area. Figure 520 shows an example of creating a reading eating area.



Figure 520: An Example of Creating a Reading Eating Area

6. The idea of the corridor café can be extended; more shops can be opened to create a corridor mall. Figure 521 shows cafes and shop structures in the corridor.



Figure 521: cafes and shop structures in the corridor

What

What does the teacher expect when she/he is using this card? What would the learning space look like? Figure 522 and Figure 523 show different café structures in the classroom and the corridors.



Figure 522: Different Café Structures in the Classroom and the Corridors



Figure 523: Different Café Structures in the Classroom and the Corridors

Final Set of Cards 9 “Classroom Café”

Card 9

Classroom Café

<http://classroomrecine.blogspot.co.uk>

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Creating a tool that will aid teachers in applying diverse teaching strategies such as brain storming, problem solving and cooperative teaching strategies.
- Involving students in designing the classroom space.
- Motivating and stimulating students to use the classroom space through competitions.
- Creating another space within the classroom space.

Card 9 2

Why

Why use this card? Benefits classroom users' will get when they use this card:

- Connecting the learning process and the curriculum with reality.
- Connecting students with the outside classroom space.
- Students participating in decision-making through voting.
- Creating different seating arrangements in the classroom space.
- Using space to support teaching and learning.
- Providing a learning experience that responds to diverse students' learning styles.
- Designing an interactive wall and flooring in the space.

Card 9 3

How

What do you need to apply this card?
How to apply this card.

In order to apply this card, the teacher with her/his students first needs to:

Create a café structure inside the classroom space or in the corridor.

Card 9 4

How

What do you need to apply this card?
How to apply this card.

The café structure is created outside the classroom space in the corridors, the teacher can connect it with the classroom space through the flooring.

Card 9 5

How

What do you need to apply this card?
How to apply this card.

How to use the café structure.

The café structure can be an effective teaching tool and there are unlimited ways in which the café structure can be used in order to support diverse teaching strategies. For example:

Card 9 6

How

What do you need to apply this card?
How to apply this card.

1. Teachers can create a competition among students on “Design Your Café”. Each student or group of students design a logo for the café and choose colours for it. After that, competitors’ work is displayed on the walls and students vote for the best café. Finally, the teacher and students work together to apply the winning idea. This involves students in designing parts of their own classroom space and gives them the opportunity to make decisions.

1 Teacher can do a competition between students about “Design Your Café” each student or each group of students

design a logo for the café choose its colours

Card 9 7

How

What do you need to apply this card?
How to apply this card.

after that competitors' work displayed on the walls

students can vote for the best café

Card 9 8

How

What do you need to apply this card?
How to apply this card.

2. Ask students to cook at home and bring in what they have cooked to sell in the café. The money raised can be used to support other classroom activities. However, cooking and selling are also useful learning processes where students can learn to solve real problems instead of proposed ones; teachers can also connect this process with the teaching curriculum by, for example: addition and subtraction while selling what they have cooked; learning how to count money through selling; experiencing the mixing of different cooking ingredients; and learning about weights and measurements.

Card 9 9

How

What do you need to apply this card?
How to apply this card.

3. Creating different seating arrangements around the café structure. This can be used to enhance socialisation amongst students.



Card 9 10

How

What do you need to apply this card?
How to apply this card.

4. The café structure could be used to teach students how to start a business. Each student or group of students could be given a small amount of money and they can choose something to sell in the café.

5. A library can be added to the café structure by hanging up bookshelves, and creating a reading or eating area.



Card 9 11

How

What do you need to apply this card?
How to apply this card.

6. The idea of the corridor café can be extended; more shops can be opened to create a corridor mall.



Card 9 12

What

What do teachers expect when using this card?
How might the learning space look?



Card 9 13

What

What do teachers expect when using this card?
How might the learning space look?



Card 9 14

What

What do teachers expect when using this card?
How might the learning space look?



Card 9 15

Apply and Share

#Classroom_Design_Recipes
#Classroom_Café #your_name



To share your work, please send it to this email
Classroom.Recipe@gmail.com
<http://classroomrecipe.blogspot.co.uk>

Card 9 16

Set of Cards 10 “Interior Design Tips”

This set of card was designed after the pilot study of this tool, responding to teachers request to know more about interior design elements in space and how to use it in learning, therefore cards 10 were designed and added. Revisiting table themes from the observation

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analysis (table themes are explained in Analysis chapter in 1.1.2 Second Approach), these tables revealed many interior design opportunities to redesign classroom space that teachers are not aware off, therefore this set of cards will empower teachers with simple interior design tips, yet have great impact on changing space design and using it in learning and teaching. This set of cards is the biggest set of cards in this tool and the size of its thinking map will not fit in this page, therefore it will not be displayed as a whole, but will be divided into separate sections and explained in details.

Table 20: Shows Thinking Elements of Set of Cards 10 “Interior Design Tips”

| | 1.Literature Review | 2.Fieldwork Findings | 3.Social network | 4.Inspiration | 5.Creative practice | 6. Evaluation request |
|---|--|---|---|--|--|--|
| Cards 10 “Interior Design Tips” | <p>the importance of environmental aesthetics (Cash, 1993)</p> <p>the value of interactive classroom space</p> <p>a powerful teaching instrument at the disposal of the teacher (Prashnig, 2004b, Martin, 2002b)</p> <p>a meaningful educational experience (Heiss, 2004)</p> <p>the power of diversity (Prashnig, 2004a)</p> <p>the importance of nature elements as a design element in classroom space and valuable benefits for learning</p> | <p>Revisiting table themes from observation</p> <p>interior design opportunities that teachers are not aware off</p> <p>teachers’ use of interior design elements</p> <p>students’ drawings</p> <p>diversity is a keyword in designing classroom space</p> <p>teachers’ and students explained the importance of nature elements</p> <p>Classroom Space Design Elements</p> <p>help teachers to stimulate students to classroom space</p> | <p>teachers with different space awareness use it differently</p> <p>teachers’ use of classroom doors</p> <p>nature in classroom displays</p> | <p>photo wallpaper ideas</p> <p>home parties</p> <p>students’ drawings</p> <p>Stephen Ritz growing garden inside classroom space</p> <p>students’ decoration in the classroom space</p> <p>Arabic spring street arts</p> <p>Austin Kleon and Liu Bolin artworks</p> <p>the street art of JR</p> <p>Jinsop Lee idea of stimulating sense through design</p> | <p>How can teachers be aware of aesthetic features</p> <p>how to design them to create an interactive meaningful educational experience</p> <p>Bringing real natural elements into classroom and connect them with curriculum in order to support teaching strategy</p> <p>How the classroom affects the practice of teacher?</p> <p>How the classroom is being used during lessons?</p> <p>redesigning the classroom space using party themes concepts</p> <p>using party themes to solve</p> | <p>More interior design elements awareness</p> |

APPENDICES

| | | | | | | |
|--|--|--|--|--|---|--|
| | | <p>the relationship between classroom design, curriculum and teaching strategy</p> <p>wall drawings in current learning space</p> <p>designing a classroom space that communicates with student' diverse learning styles</p> | | | <p>common problems</p> <p>walls to express voices and create interaction</p> <p>walls express students' voices</p> <p>drawing and writing on walls legal by covering the wall</p> <p>covering the wall with newspaper, students' work and students' photos</p> <p>giving students tools to interact with wallpaper and express their voices</p> | |
|--|--|--|--|--|---|--|

As illustrated in Figure 524, the thinking map of this set started revisiting the observation analysis, especially the table themes, relooking at teachers' use of interior design elements in classroom but this time looking solution inspirations.

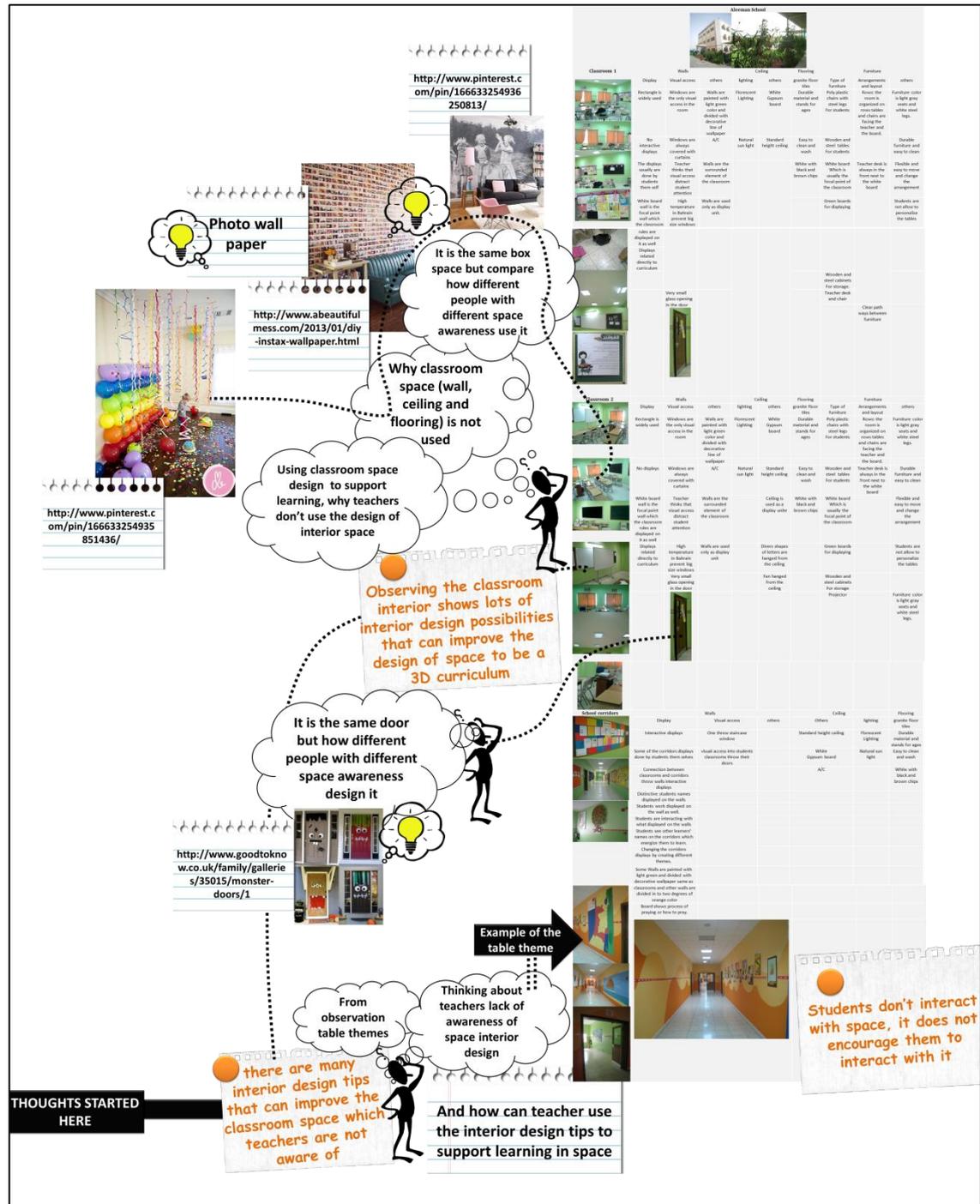


Figure 524: Revisiting the Observation Analysis and Table Themes

Comparing different interior design changes done by teachers in different classrooms showed that many teachers are not aware off the design potential of their space while some teachers had better awareness of space design elements specially art teachers and teachers who spent long years in teaching, It is the same box space but teachers with different space awareness use it differently. For example an element such as door is usually an over looked design element which is available in all classroom spaces but some

teachers use it differently; Figure 525 shows examples of teachers' use of classroom doors.



Figure 525: Teachers' Use of Classroom Doors

Source: <http://www.buzzfeed.com/weareteachers/29-awesome-classroom-doors-for-back-to-school-h0xt>

Additionally, another inspirations where founded in photo wallpaper ideas, which shows creating wallpaper using photos. This idea explains using simple and available materials such as photos to create a change in the walls of interior space. Figure 526 shows examples of photo wallpaper idea.



Figure 526: Photo Wallpaper Idea

Source of left image: <http://www.pinterest.com/pin/166633254936250813/>

Source of right image: <http://www.abeautifulmess.com/2013/01/diy-instax-wallpaper.html>

Another inspiration was home parties, looking at how people create great changes in their interior spaces using simple ideas and available materials in party decoration at homes. For example, in Figure 527 users have used balloons to create a monster on the wall.



Figure 527: Using Balloons to Create a Monster Wall

Source: <http://www.karapartyideas.com/2013/04/monster-themed-4th-birthday-party.html>

Furthermore, literature review have highlighted the importance of environmental aesthetics (Cash, 1993) which can be defined broadly as the interaction between the user and the environment in relation to beauty (H.Perkins and Brown, 1999), however current literature does not explain to teachers how to change space using environmental aesthetics, while students' drawings illustrated in Figure 528 shows classroom design using environmental aesthetics, which clarifies that aesthetics in space can be achieved through interior design elements of space. Additionally, revisiting students' drawings which show how they want their classroom to be designed and comparing it with current classroom space in table themes showed the differences between current space and how it should be. Moreover, literature review has explained theoretically the value of interactive classroom space, which mentioned in chapter one, in section 1.3.1.4 Constructivism, Interactive learning, additionally researchers claimed that learning space is a powerful teaching instrument at the disposal of the teacher (Prashnig, 2004b, Martin, 2002b) and space can create a meaningful educational experience (Heiss, 2004). Nevertheless, literature explains theoretical values and benefits, while students' drawings illustrate practical design solutions to get these values. Figure 528 is reflecting on classroom space in students' drawings. After that the question which was raised is: How can teachers be aware of aesthetic features and how to design them to create an interactive meaningful educational experience and use space as a teaching instrument.

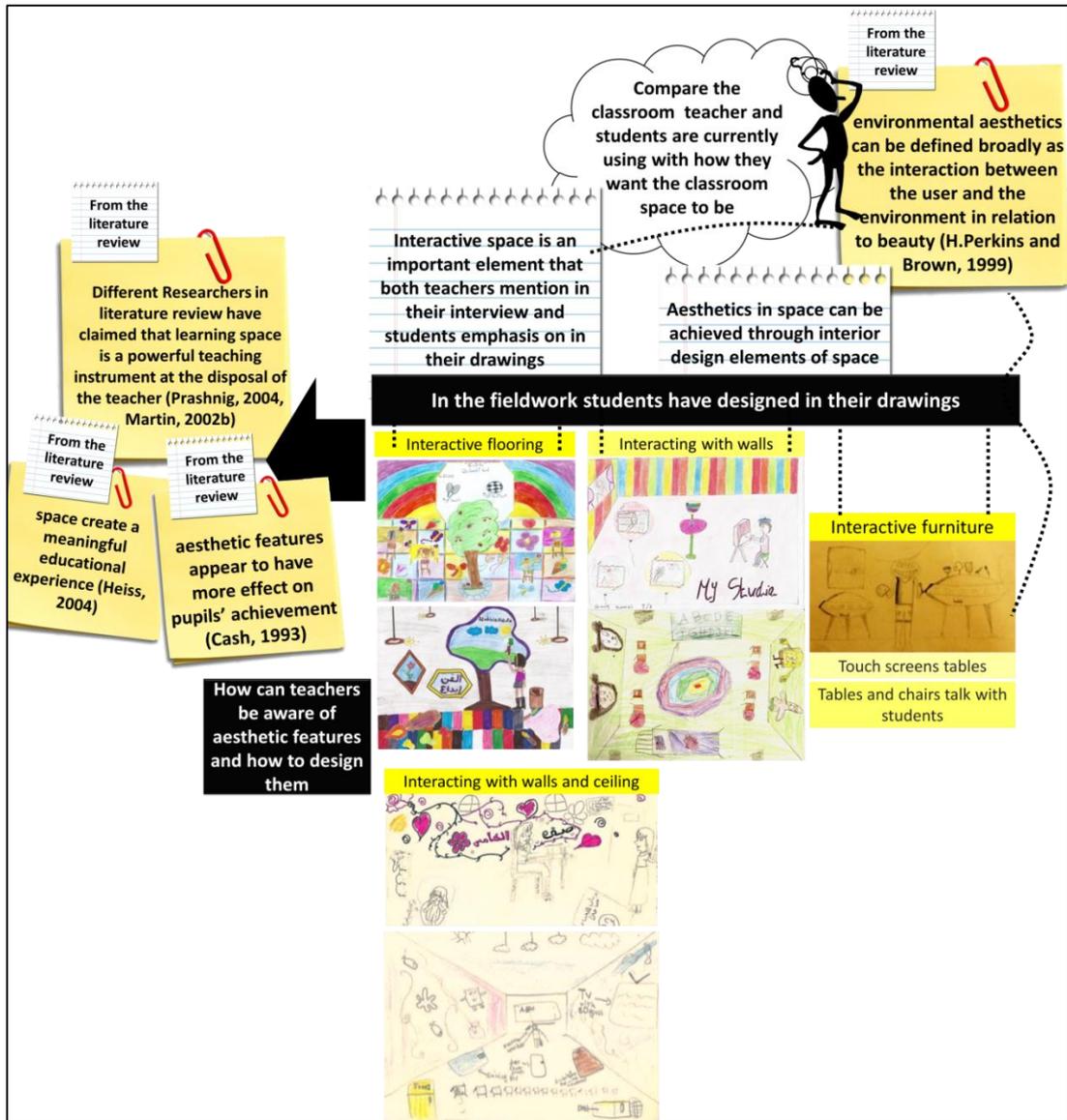


Figure 528: Reflecting On Classroom Space in Students' Drawings

Looking to answer previous question, and how to inspire teachers with diverse possibilities to use space interiors supporting different teaching methods researcher revisits teachers' claims about classroom space in the finding chapter, teachers mentioned diversity as a keyword in designing classroom space, for example: diversity in materials, displays, colours, activities and teaching strategies. Supporting teachers' claims about diversity is Barbara Prashnig book about the power of diversity where she explained how to plan diverse teaching and learning methods responding to students' diverse learning styles (Prashnig, 2004a). Therefore, teachers need to know how to achieve these claims using design elements of space, part of the answer is found in students' drawings. As demonstrated in Figure 529, students' drawings have explained how to achieve diversity in classroom space by illustrating diverse furniture shapes and colours, seating

APPENDICES

arrangements, displays, photos, textured materials, colours, patterns and diverse activities (more details about these drawings in Finding Chapter). More inspirations for designing this set were founded in the details of students drawings, illustrated in Figure 530.

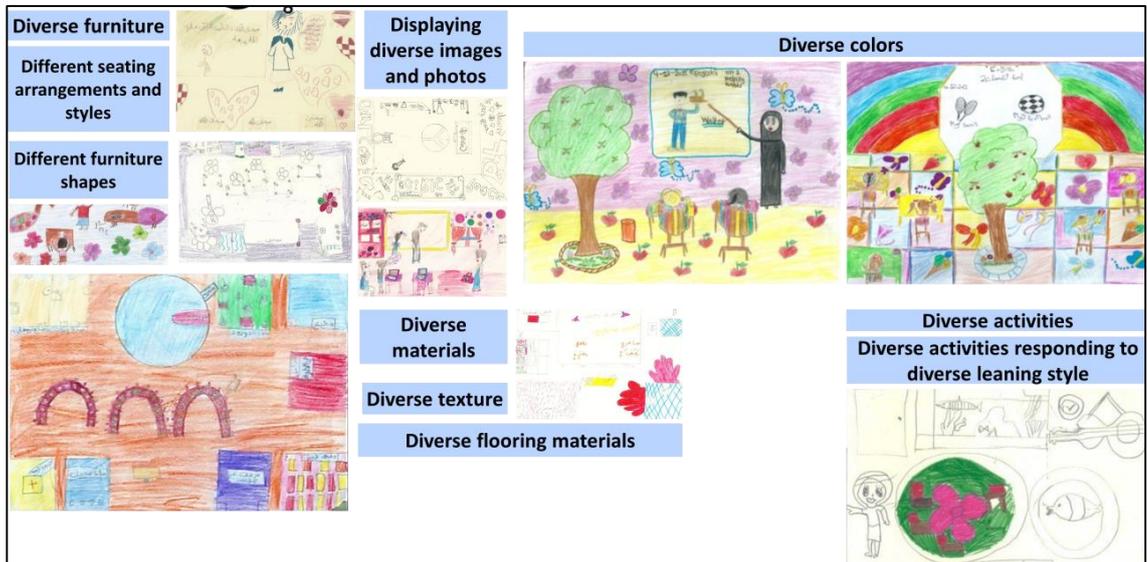


Figure 529: Diversity in Students' Drawings

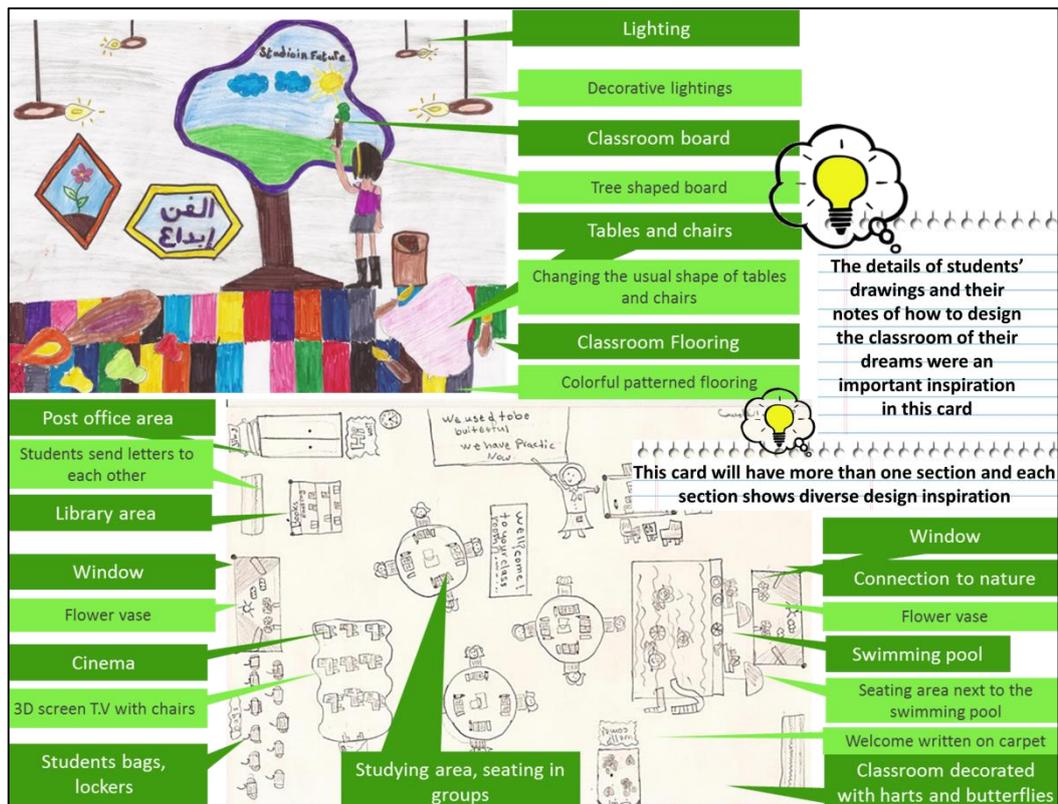


Figure 530: Design Inspirations from Students' Drawings

Building on what have been explained so far and thinking of common problems mentioned by teachers this set of card will be divided into four sections, each section aims

to respond in addition to the main aim, it solves a group of teachers’ common problems and inspire them with diverse, simple interior design tips. Nevertheless each section was built upon literature review, fieldwork findings, users’ social network, and inspirations from different disciplines and connected together to design a solution. The four sections are: Section 1: Nature inside classroom space, Section 2: Classroom party, Section 3: Collage wallpaper and Section 4: Stimulating the Senses.

Section 1: Nature inside classroom space

Both classroom users in the fieldwork and literature review emphasised on the importance of nature elements as a design element in classroom space and valuable benefits for learning. Nature as a design element is explained in literature review chapter in section 1.5.3.4Nature. Additionally, as explained in Figure 531 natural elements have a valuable impact on students learning.

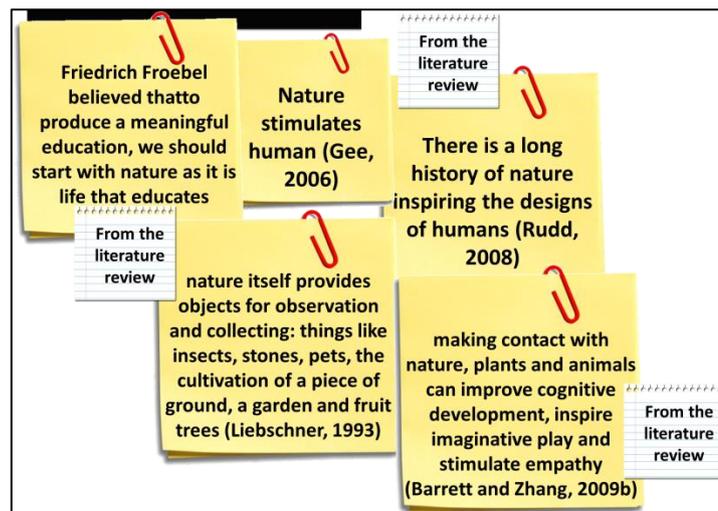


Figure 531: Natural Elements Impacts’ on Students Learning

In the fieldwork teachers’ explained the importance of nature elements for students’ learning therefore teachers’ use images from nature to motivate and stimulate students in classroom space, teachers have demonstrate this in their blogs by sharing images of their classroom displays. Figure 532 shows examples of nature in teachers’ displays.



Figure 532: Nature in Teachers' Displays

Source of left figure: <http://www.aroundthekampfire.blogspot.co.uk/2012/09/apple-love.html>

Source for right figure: <http://www.sparklebox.co.uk/gallery/gal656-660/gal656.html#.VA3QHfdVIG>

In addition to teachers' use of nature, students' drawings illustrated strong relation between nature and their dream classroom, as they used real natural elements such as: birds, fish, ponds with duck and flowers. Moreover, students draw themselves interacting and talking to these elements. However, while teachers usually use images from nature students bring real natural elements to space, Figure 533 illustrates teachers and students view on nature in classroom space.

| | | | |
|---|------------------------|---|-------------------------|
| Nature is a strong inspiration element for teaches and students decoration in classroom | | | |
| Elements from nature, images and paintings of | | | |
| Classroom needs a lot of greeneries | Sun, rain, sky, leaves | Animals, shells Flowers, tree, grass | |
| Bring nature inside classroom environment instead of just images | | | |
| Garden shaped classroom, tables and chairs are the flowers | Organism | Greeneries Water element | |
| Indoor Fountain | Animals | Indoor garden Ponds | |
| <p>From teachers' blog</p> <p>http://www.aroundthekampfire.blogspot.co.uk/2012/09/apple-love.html</p> <p>From teachers' blog</p> <p>http://www.sparklebox.co.uk/gallery/gal656-660/gal656.html#.VA3QHfdVIG</p> | <p>Birds</p> | <p>Indoor garden</p> | |
| | <p>Fish</p> | <p>Indoor garden</p> | <p>Ponds</p> |
| | <p>Flowers</p> | <p>Indoor garden</p> | <p>Aquarium</p> |
| | <p>Butterflies</p> | <p>Indoor garden</p> | <p>Indoor Fish bowl</p> |
| | <p>Butterflies</p> | <p>Indoor garden</p> | <p>Indoor Fish bowl</p> |

Teachers usually use images of natural elements while students wanted real natural elements in

Figure 533: Teachers and Students View on Nature in Classroom Space

Building on previous argument this section “Nature inside Classroom Space” suggest to teachers ways of Bringing real natural elements into classroom and explains to them how to connect them with curriculum in order to support your teaching strategy, which can make space work as a 3D curriculum. Additionally, this set of cards suggests teachers to ask pupils to contemplate natural elements around them in order benefit of nature learning value mentioned in the literature review, Figure 534 explains how “Nature inside Classroom Space” can be applied and the value of its application in relation to literature and fieldwork findings.

The figure consists of several interconnected cards and diagrams:

- Fish bowl or fish aquarium:** Includes a photograph of a fishbowl, a color palette (orange, green, blue), and the text "way of living". A black box asks "What teachers need is HOW?".
- Indoor gardening:** Shows potted plants, a color palette (purple, green, blue), and a seedling. A black box notes "Teacher can stick students photos on the pots".
- Indoor fountain:** Features a stone fountain, a bowl of water, and a color palette (blue, grey). A black box states "Teacher can stick students photos on the pots".
- Birds in cages and chicks:** Displays colorful birds, a color palette (yellow, red, green), and chicks. A black box says "Teacher can stick students photos on the pots".
- Classroom Sketch:** A line drawing of a classroom with a birdcage hanging from the ceiling and a box on a desk.
- Learning Style Legend:** A blue box titled "Diversity responding to students' diverse learning style" lists: Visual, Auditory, Kinetic, and Smell, each with a grey arrow pointing left.
- Text Boxes:**
 - Yellow boxes with red paperclip icons: "From the literature review. Researchers talk about the importance of contemplating fishes movements and colours for kids' learning process and how it can be used to support different teaching methods." and "From the literature review. Researchers talk about the importance of planting for kids' learning process and how it can be used as a teaching method for different subjects".
 - Black box: "These elements also can increase the students' interaction with the classroom space".
 - Red box: "Interactive space was a keyword that users highlighted its importance during the fieldwork".
 - Black box: "Responding to students' diverse learning style through the use of nature diverse elements".
 - Black box: "In the fieldwork teachers have mention that one of the ways of improving the design of learning space is to respond to students diverse learning style".

Figure 534: Applying “Nature inside Classroom Space” Cards

Nevertheless, the idea for indoor gardening was explained in this set of card shown in Figure 534 was inspired by a successful teacher experience shared in TED, Stephen Ritz a teacher who shares his experience of using growing gardens in learning space as a tool to solve many of his students’ problems and its value to learning. figure shows Stephen Ritz growing garden inside classroom space.



Figure 535: Stephen Ritz Growing Garden inside Classroom Space

Source: http://www.ted.com/talks/stephen_ritz_a_teacher_growing_green_in_the_south_bronx#t-147070

Section 2: Classroom party

Revisiting student drawing analysis and reflecting on space design elements from users point of view (this was explained in finding chapter in section 1.3.3 Classroom Space Design Elements) supported this section idea. As shown in Figure 536, many students' drawings illustrated decorative classroom showing interior design details such as wall materials, decorative lighting, furniture texture which usually teachers and designers are not aware off. However, students' decoration in the classroom space looked like they are having a party.



Figure 536: Classroom Decoration in Students' Drawings

These drawings were reflected on questions raised during the observation which are: How the classroom affects the practice of teacher? How the classroom is being used during lessons? And to what extent teachers are in control of their physical classroom space, do they use it deliberately? Additionally, a comparison between students' dream classroom and current classroom, interior design elements in current classroom are usually overlooked, because teachers' are not aware off the design potential of this empty box. As shown in Figure 537 comparing the classroom box with other room boxes inspired researcher to propose to teachers different ideas for redesigning the classroom space using party themes concepts, in order to inspire teachers' with ways of using interior design elements in space to change it. Moreover this set will suggest to teachers how to relate these party themes to their curriculum and benefit from each theme elements to offer students diverse teaching strategies and responding to common teaching problems.

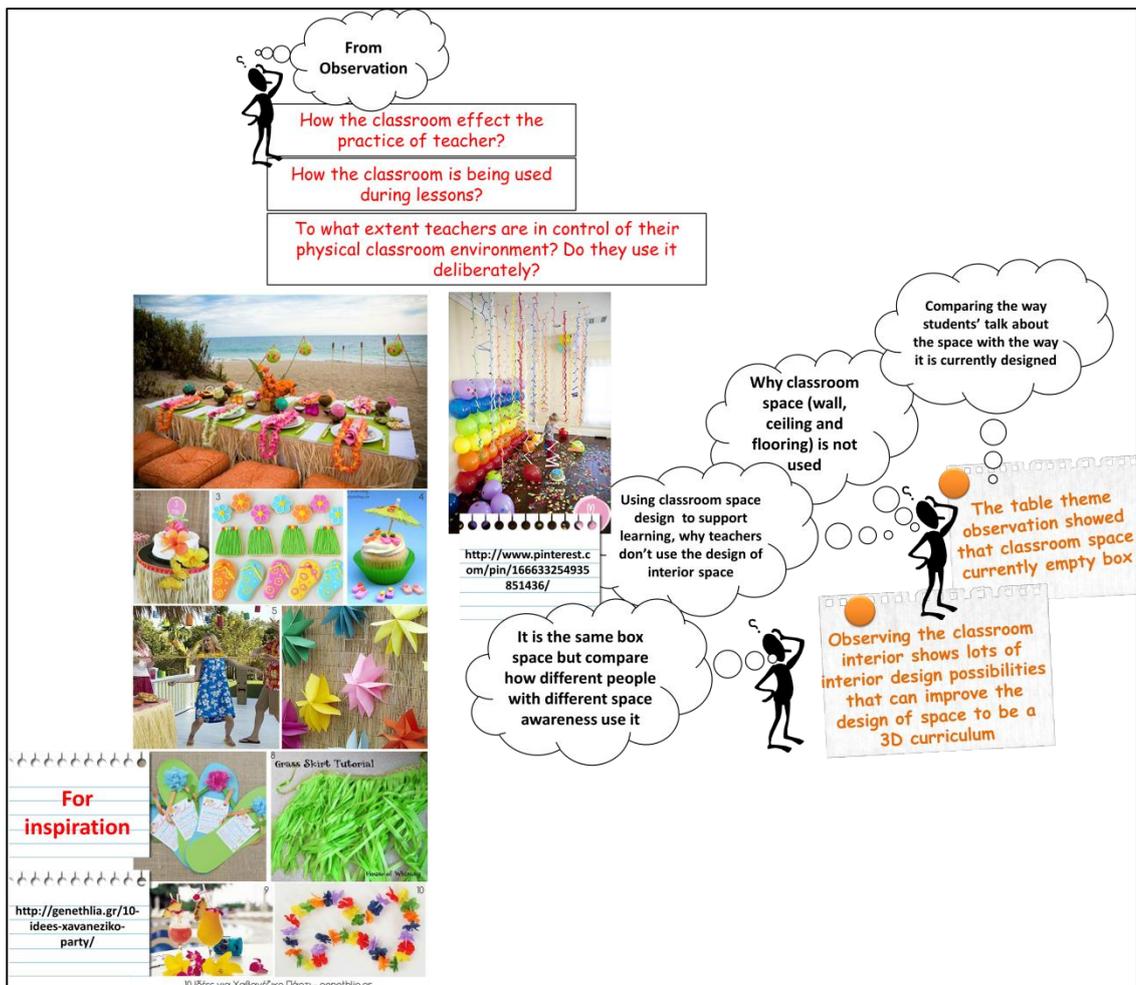


Figure 537: Thinking Process of section 2: Classroom Party

Furthermore, the idea of classroom party developed to help teachers to stimulate students to classroom space. The classroom party idea built upon understanding

relationship between classroom design, curriculum and teaching strategy which was explained in details in the finding chapter. Each suggested theme explains how to redesign classroom space using party theme elements and relating these elements to the curriculum to offer students diverse teaching strategies to benefit from space design values mentioned in the literature review. Figure 538 shows thinking process of classroom party connected to literature and fieldwork findings.

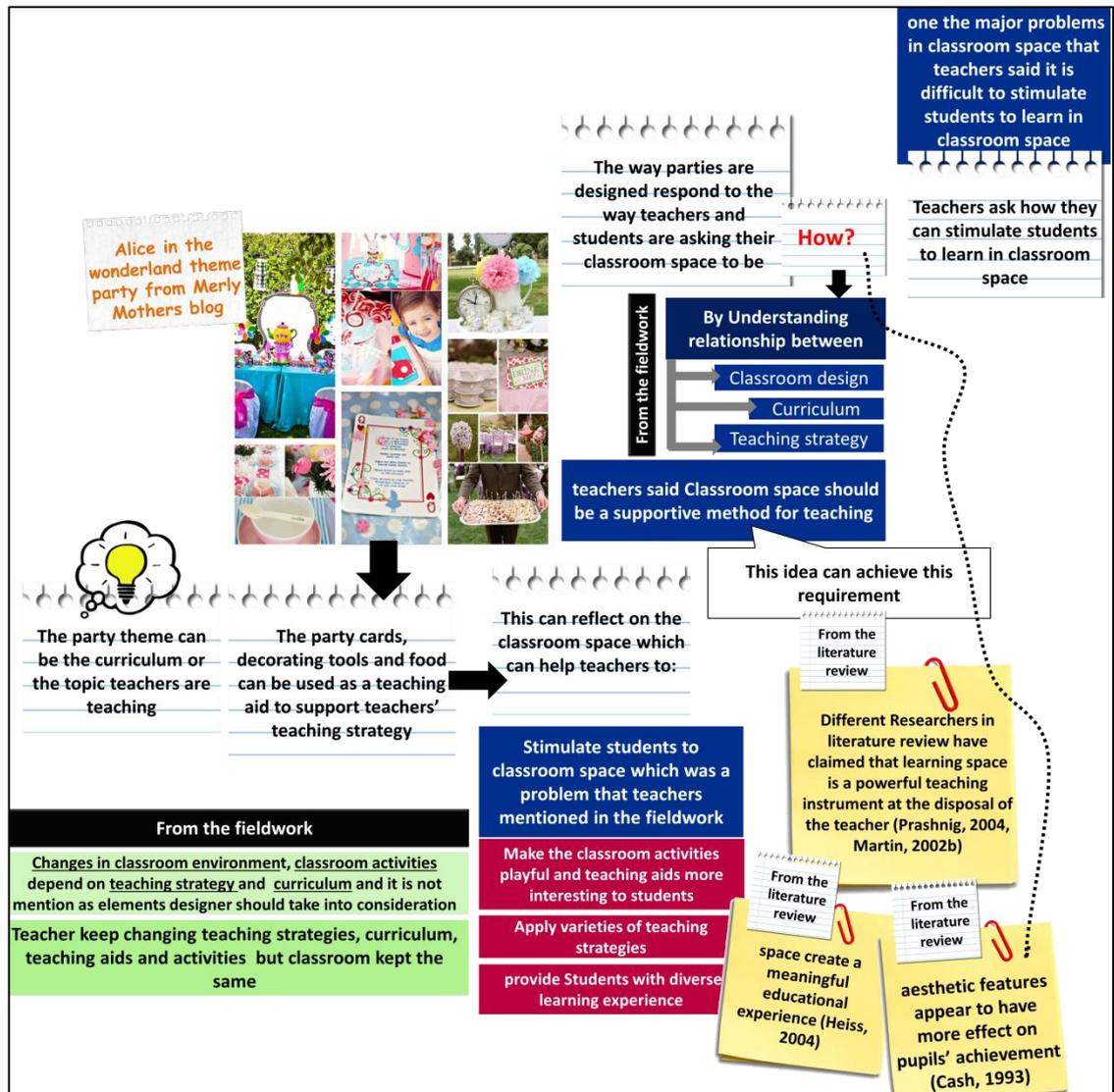


Figure 538: Thinking Process of Classroom Party Connected to Literature and Fieldwork Findings

After a further development made to each party theme solving more common problems, for example solving the problem of unmotivated students by offering divers teaching strategies such as storytelling, playing cards and acting using Alice in the Wonderland party theme through its tea party and Alice playing card. Figure 539 explains using Alice party theme to solve common problems.



Figure 539: Using Alice Party Theme to Solve Common Problems

Finally as illustrated in figure, more party themes were suggested to teachers showing them design solutions in relation to their teaching tools and empowering them to change classroom space using its design elements to benefit from its values that was mentioned in the literature chapter, for example using LEGO party theme to benefit from the use of colours.

How teacher can create an interactive classroom space

From the literature review

Learning should be interactive to allow the development of higher-level learning and social skills, and to help develop personalised meanings (Ally, 2003).

interaction creates a sense of presence and a sense of community for learners (Murphy and Cifuentes, 2001)

From the literature review

colours can be used to define a space's form and manipulate its users (Smith, 2008)

This card show teachers different ways of using colour in classroom space to support their teaching strategy

Circus Party Theme

Picture Reference:
<http://www.merelymothers.com/2012/07/09/top-ten-tuesday-timeless-birthday-party-themes/>

LEGO Party Theme

Picture Reference:
<http://www.mamapicks.com/category/ideas/>

Picture Reference:
<http://www.andersnuff.com/custom-printable-parties/wp-content/uploads/2011/08/lego2-06-640x914.jpg>

Picture Reference:
<http://www.karaspartyideas.com/>

Circus dresses

Circus games

LEGO Blocks

LEGO colours

LEGO characters

From the literature review

Cognitivist theory is concerned with the internal processes of the brain which are involved in making sense of the space; these processes include attention, perception, learning, problem solving, and thinking (Eysenck and Keane, 2005).

Understanding the internal processes of brain make me design classroom party tool using objects from different theme such as (kids stories, kids toys, kids favourite places) because it enhance students perception of the curriculum and increase their attention

LEGO Party theme in the classroom

Tissue paper

Colourful balloons

Colourful plates

Colourful cardboard

What students want to be when they grow up?

WHEN I GROW UP

Stick their photos on a colourful plats

Figure 540: Examples of Party Themes Related to Literature and Fieldwork Findings

584

Section 3: Collage wallpaper

This section inspired from Arabic spring in 2011, specifically Syrian revolution which started because of group of primary school students who used school walls to express their feelings and protest against the Assad Regime through written words on school wall. Additionally, people used street walls during Arab Spring to make their voice heard and these wall voices encouraged other people to interact with their artwork, Figure 541 shows examples of street arts in Arabic world during Arab Spring, the use of walls to express voices and create interaction between people inspired research to rethink walls in learning space, what will happen to these walls if students had the freedom to draw and write on them, and how can these walls express students' voices. Figure 542 express thoughts of street art in comparison to classroom space walls.



Figure 541: Street Art during Arabic Spring

Source of left figure: <http://www.wsj.com/articles/SB10001424052970204425904578072630892858670>

Source of right figure: <http://scribblejunkies.blogspot.co.uk/2011/08/libya-street-art.html>

Classroom walls as an art street, art street reflect on what happens in society

What happen in the Syrian revolution? How did the Syrian revolution start?

classroom walls as a white canvas

If we give students the space that he/she could express his/her self without somebody interfering or instructions we might discover a new world of creativity

classroom walls as street walls

Draw on the walls don't be scared, student should have a space to personalize, express and reflect on what they think without teachers supervision or school instructions

Create your own world, design it , personalize it. Give the students a space to Rebellion

Figure 542: Thoughts of Street Art in Comparison to Classroom Space Walls

However, revisiting the fieldwork findings and reflecting previous inspiration on it, shows most of the wall drawings in current learning space are done under teacher supervision which expresses teachers' voice not students, because students are not allowed to draw or write whatever they want on the walls it is not legal, therefore these drawings represent teachers one personality and not the diversity of students, Figure shows these reflections on fieldwork findings. This reflection led the research to think of making drawing and writing on walls legal by covering the wall.

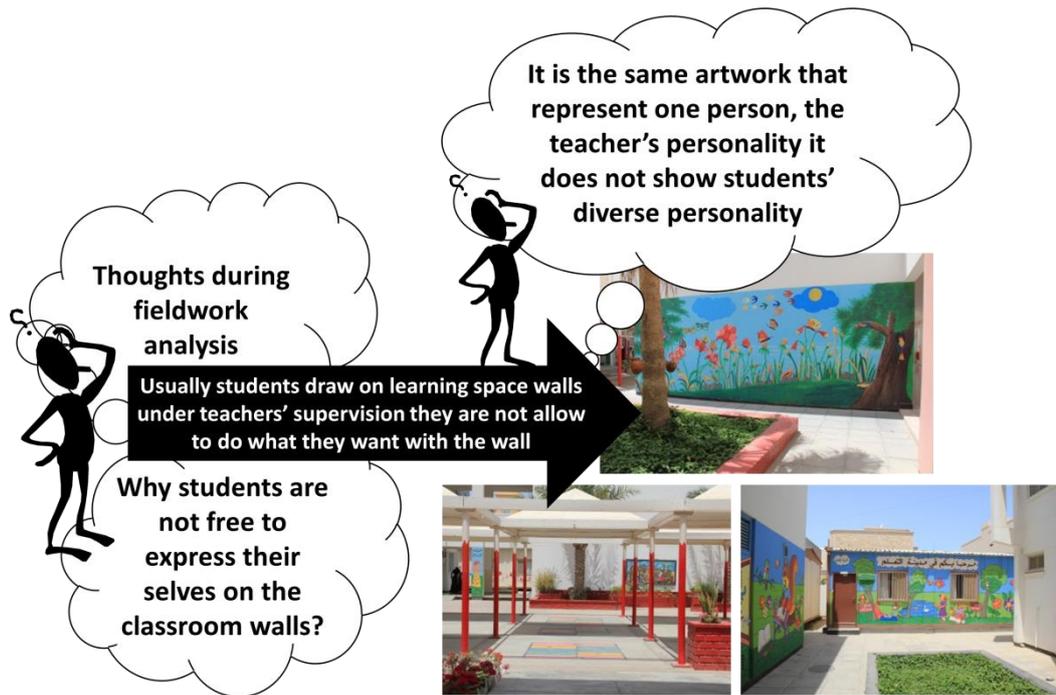


Figure 543: Reflections on Fieldwork Findings

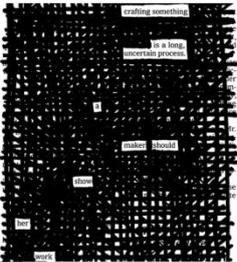
Different artworks have inspired the concept of covering the walls; the first inspiration came from Austin Kleon artwork, Austin in his book "Steal like an Artist" (Kleon, 2012) and in his TEDx presentation presents an interesting artwork that uses old newspapers to create artwork from its written words. Another inspiration came from the invisible man artwork; the invisible man is Liu Bolin who made an art of becoming the invisible man, he inspired this researcher with his way of blending space around him, and his ability to see his self-part of the physical elements in space. Examples of Austin Kleon and Liu Bolin artworks illustrated in Figure 544.



Austin Kleon artwork

**AUSTIN KLEON is a
writer who draws**









**Liu Bolin has made an
art of becoming the
invisible man**

<http://www.dailymail.co.uk/news/article-1201398/Liu-Bolin-The-Chinese-artist-turns-Invisible-Man.html>



inspiration



**How this artist
have blend
human with the
space around
him**

Figure 544: Austin Kleon and Liu Bolin Artworks

Building on previous reflections and inspirations, this section suggests creating collage wallpaper by covering the wall with newspaper, students' work and students' photos. In addition to achieve the main tool aim, the idea each one of these three wallpaper covers was developed to consider common problems and answers requests mentioned by

users in the fieldwork such as teachers request for ideas to motivate students to engage and interact in space. Additionally this section connected with theoretical concepts from literature review to express it design translation in practice. Figure 545 explains “the newspaper wallpaper” and its respond to fieldwork findings.

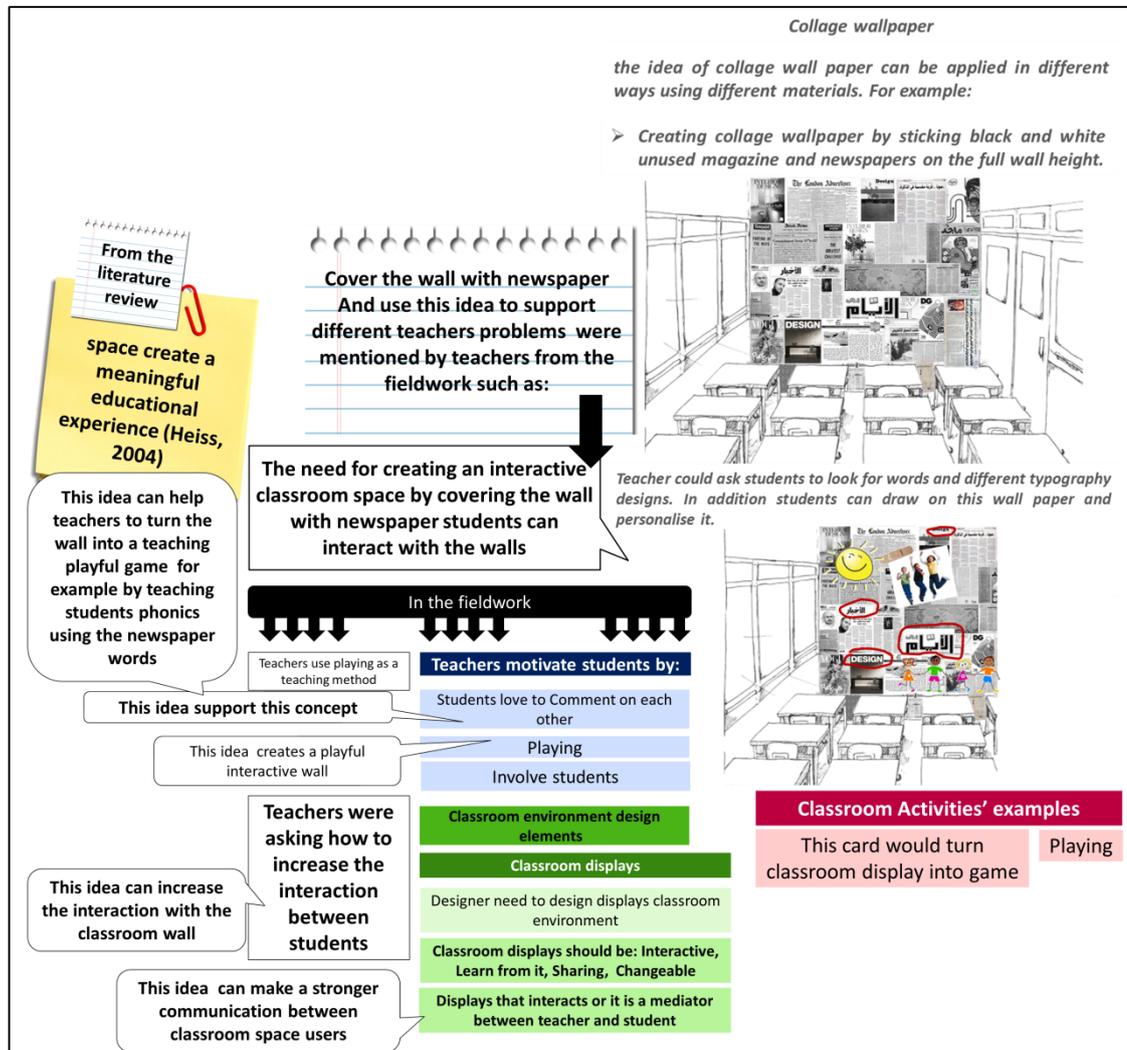


Figure 545: “Newspaper Wallpaper” Responds to Fieldwork Findings

Figure 546 shows students’ work wallpaper responds to fieldwork findings, which explains the values and benefits that this section can have on classroom space. The third collage wallpaper is students’ photos wallpaper was inspired from the street art of JR; Figure 547 shows examples of the street art of JR. Like in previous wallpapers’ ideas, the idea of students’ photos wallpaper was reconnected to fieldwork findings in order to answer teachers’ requests and solve common problems which can add more learning and teaching value to the collage wallpaper concept. Figure 548 shows the idea of students’ photos wallpaper related to fieldwork findings.

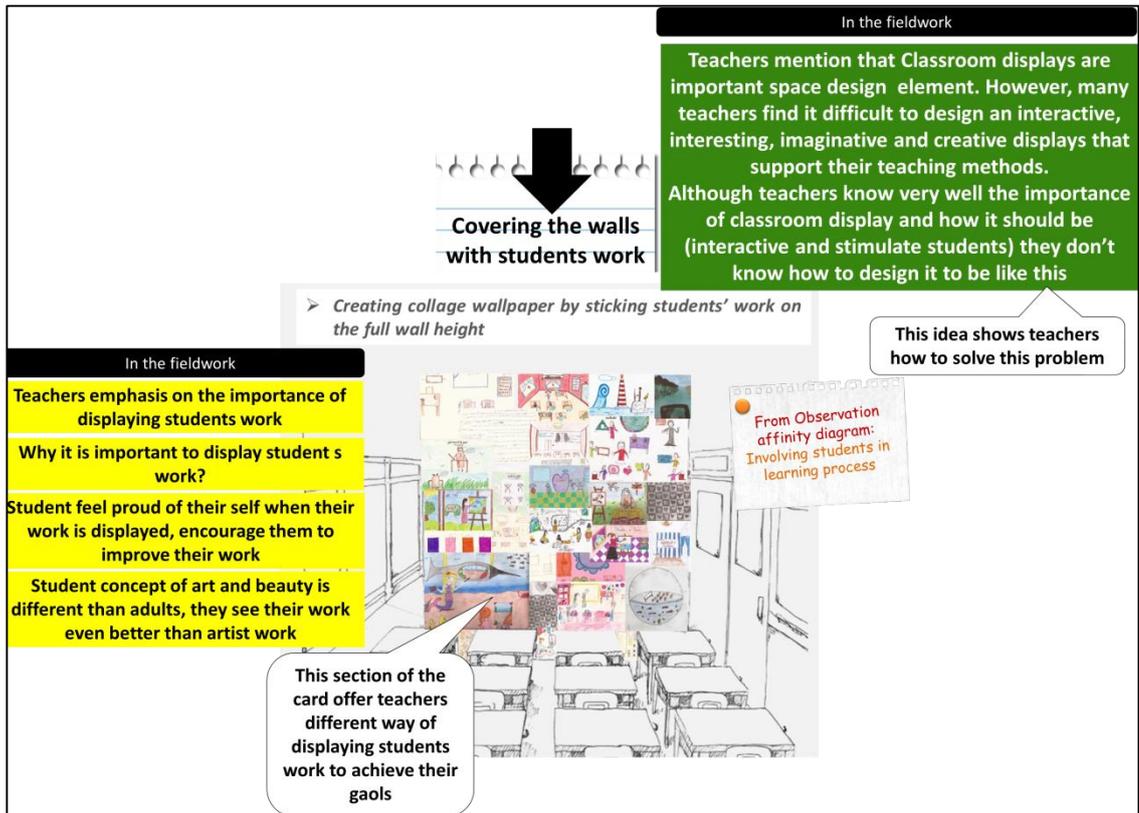


Figure 546: Students' Work Wallpaper Responds to Fieldwork Findings

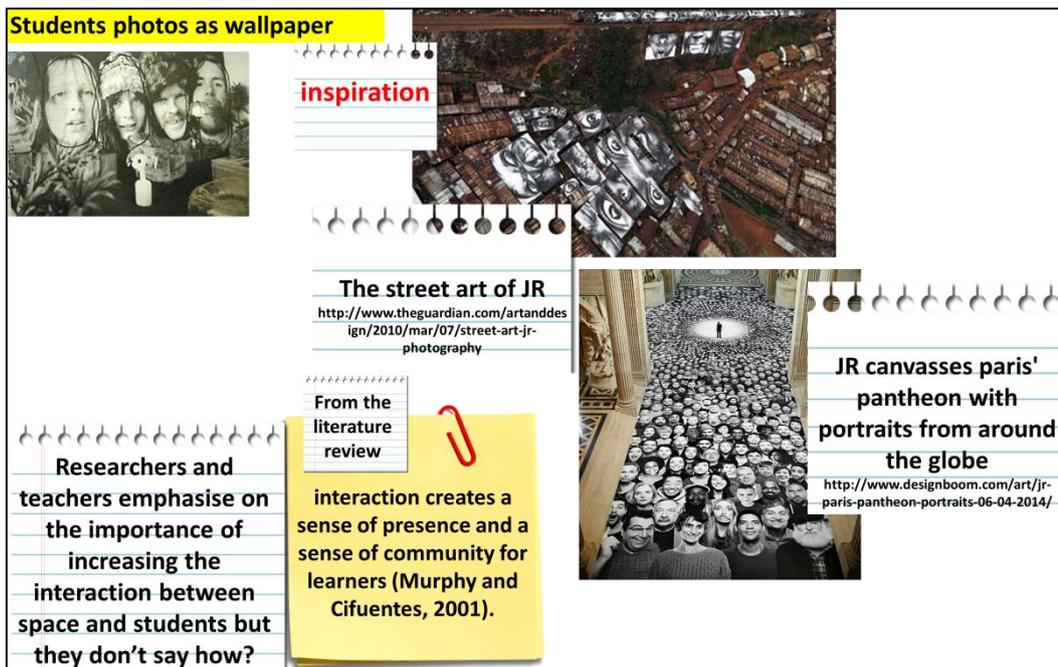


Figure 547: Examples of the Street Art of JR



Figure 548: Students' Photos Wallpaper Related to Fieldwork Findings

Section 4: Stimulating the Senses

This section was designed in respond to teachers' request of designing a classroom space that communicates with student' diverse learning styles, understanding learning styles and ways of learning and teaching through using students' learning style mentioned in Barbara Prashnig book (Prashnig, 2004a) showed the link between stimulating senses and students' learning styles. Designing this section was inspired from the designer Jinsop Lee who shared his idea of stimulating sense through design in TED presentation. However, linking the design inspiration with teachers' request this section suggests teachers ways of stimulating students' senses through the design of the space responding to students' diverse learning styles. This section explains to teachers that they can apply this concept in the classroom space by thinking of the five senses while planning the space, and showing teachers different elements that stimulate these senses.

Why

Why to use this card? The benefits classroom users' are going to get when they use this card:

- Inspiring teachers with different interior design tips in order to create an interesting classroom space
- Responding to students' learning styles
- Creating a change in classroom space
- Improving teachers' awareness of interior design elements in space
- Designing an interactive learning space
- Offering diverse ways of displaying in classroom spaces
- Stimulating students' senses through space design
- Attracting and motivating students' to engage within space
- Designing classroom space as a 3D curriculum
- Connecting classroom space with real nature elements

How

This card is divided into sections; each section can be applied differently, these sections are:

Section 1: **Nature inside classroom space**

Section 2: **Classroom party**

Section 3: **Collage wallpaper**

Section 4: **Stimulating the Senses**

1. **Nature inside classroom space:** Bring natural elements into the classroom space and connect them with the curriculum in order to support your teaching strategy. This can make the classroom space work as a 3D curriculum. Additionally, teachers can ask pupils to contemplate natural elements around them. For instance, teachers can ask pupils to think of colours, sounds and ways of living. Also, different elements from nature can be brought into the classroom space such as:

- Birds in cages and chicks
- Fish bowls or fish aquaria
- Indoor gardening
- Indoor fountain, Figure 549 and Figure 550 explain how to bring different natural elements to classroom space.

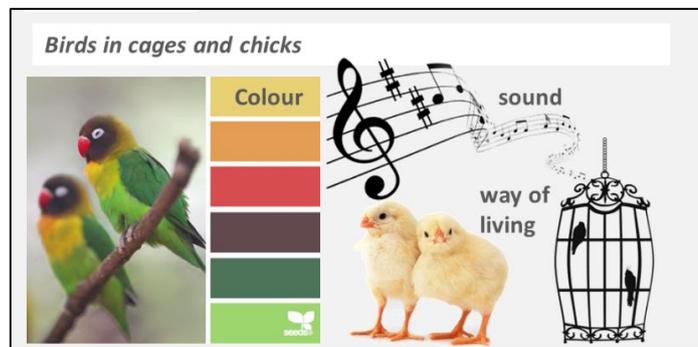


Figure 549: Bringing Different Natural Elements to Classroom Space



Figure 550: Bringing Different Natural Elements to Classroom Space

2. **Classroom party:** Create simple party decorations using simple decorating elements such as: balloons, decorative lighting and colourful decoration papers. These simple ideas help the teachers to create a change in the space. In addition, parties usually have themes so everything in the party, such as food, cards, clothes and decorations can support this theme. Figure 551-134 show different party themes that can be applied in the classroom space. Compare this concept with what happens in the classroom space. In the classroom space, teachers' curricula may also have different themes and so everything in the classroom space, such as activities, displays and teaching tools, can support the curriculum theme. Thus, teachers can think of the curriculum theme as a party theme and design everything in the classroom space to support this theme. Figure 554 explains an example of applying the LEGO theme in the classroom space.

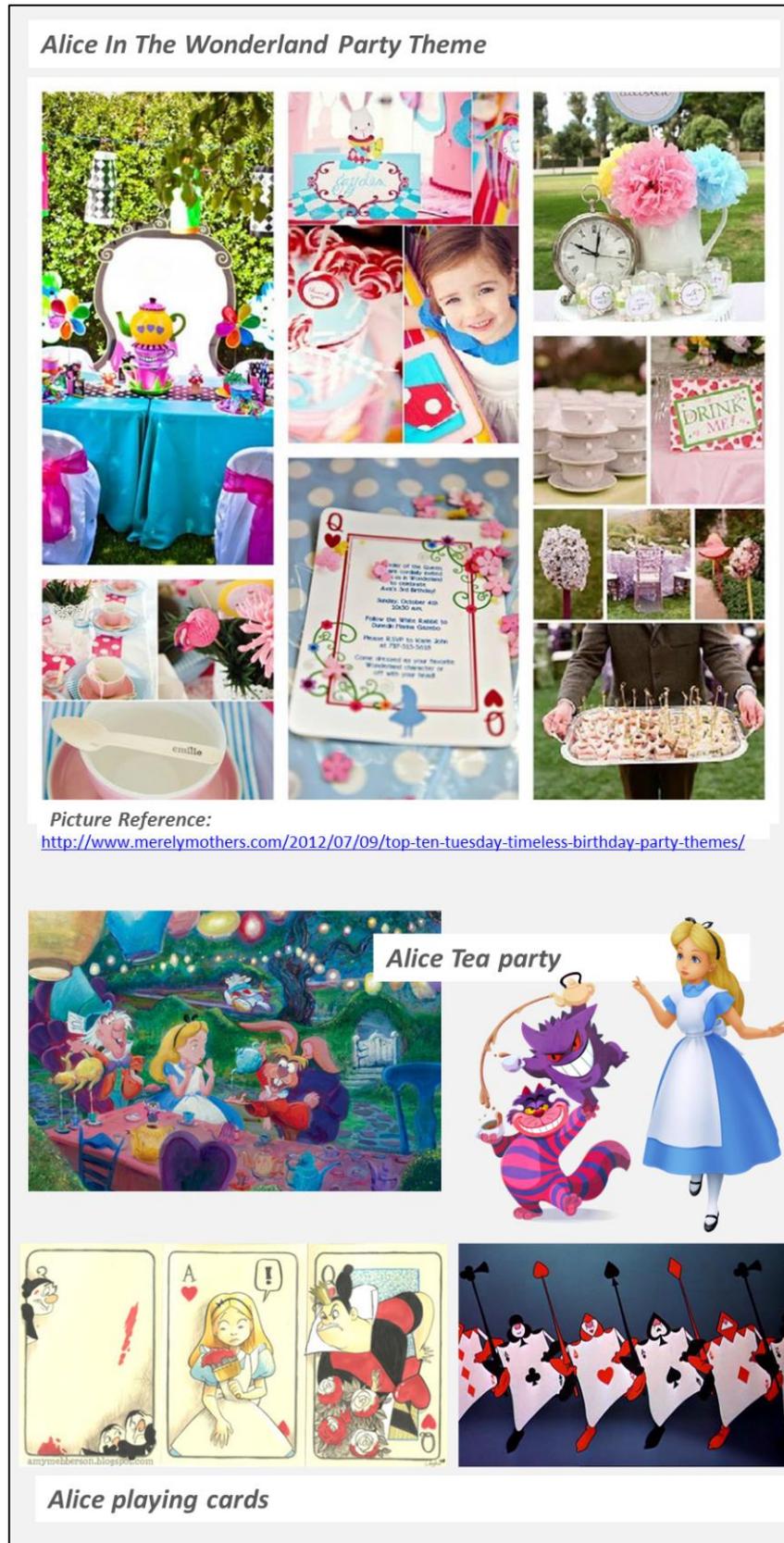


Figure 551: Different Party Themes (Alice in Wonderland Theme)

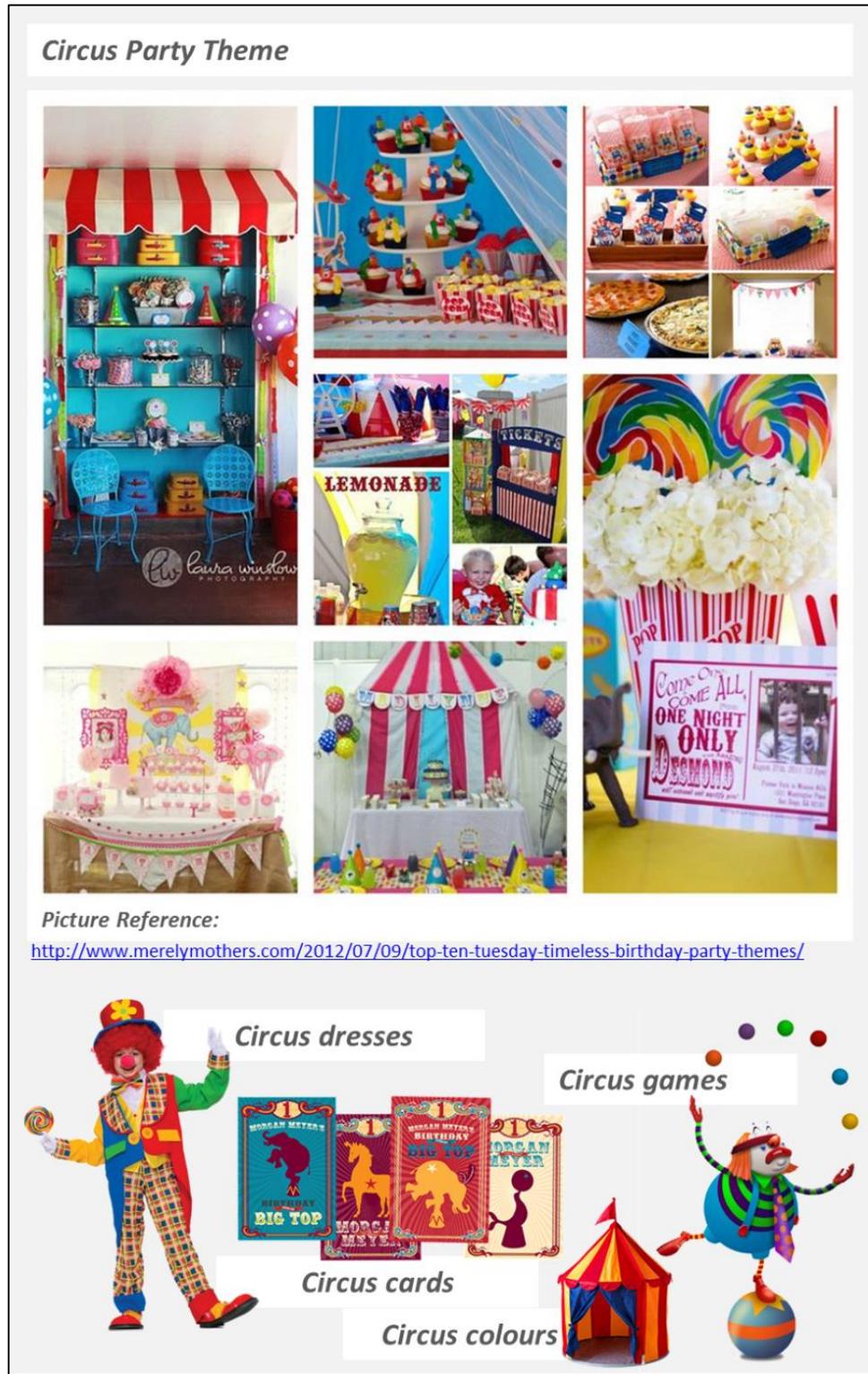


Figure 552: Different Party Themes (Circus Theme)

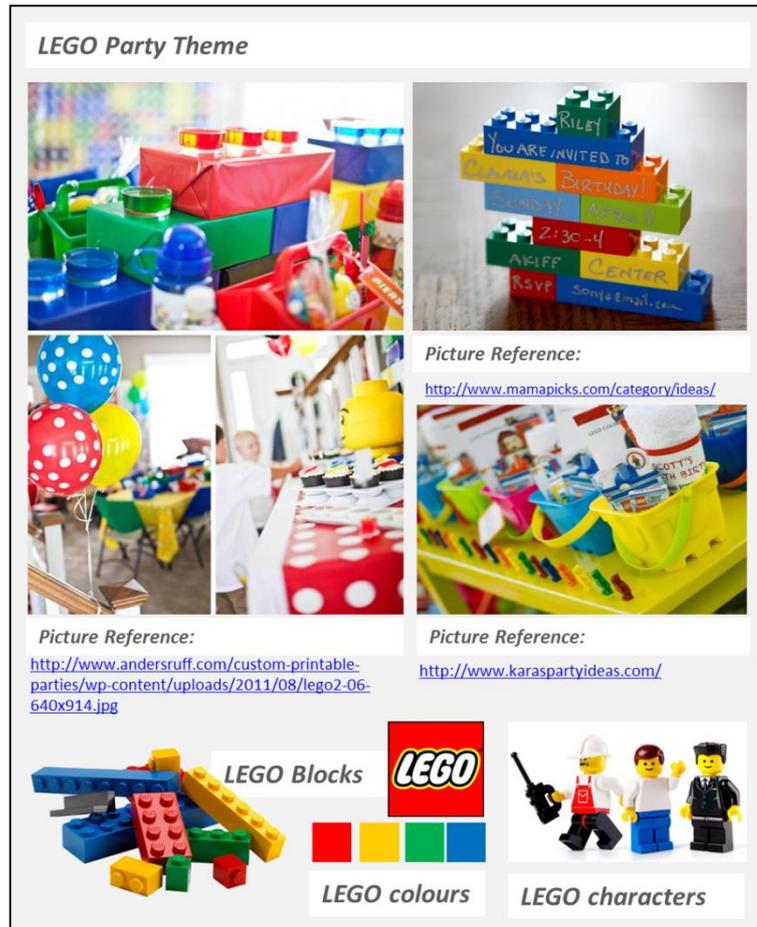


Figure 553: Different Party Themes (LEGO Theme)



Figure 554: Applying the LEGO Theme in the Classroom Space

3. **Collage wallpaper:** The idea of collage wallpaper can be applied in different ways using different materials. For example:

- Create collage wallpaper by sticking discarded black and white magazines and newspapers on the full wall height. Then teachers could ask students to look for words and different designs of typography. In addition, students can draw on this wallpaper and personalise it. Figure 555 shows collage wallpaper using black and white unused magazine and newspapers.

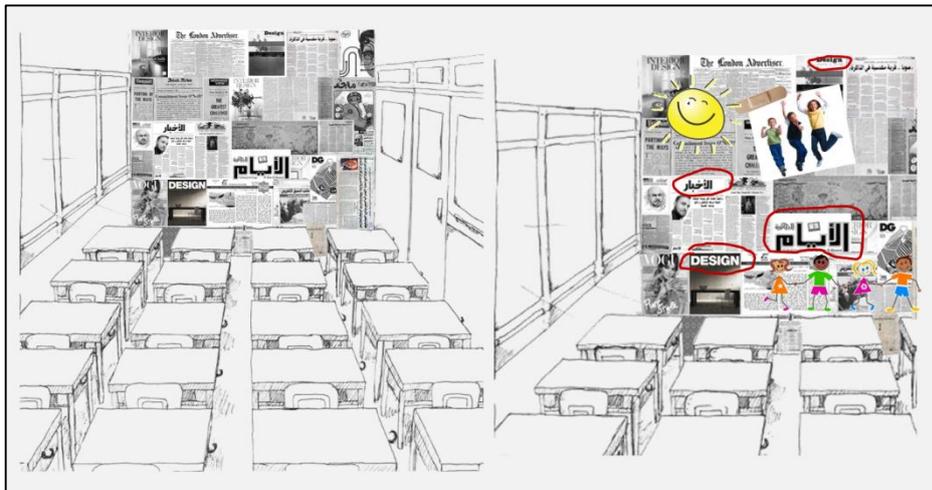


Figure 555: Collage Wallpaper Using Black And White Unused Magazine and Newspapers

- Create collage wallpaper by sticking students' work on the full wall height. Figure 556 shows collage wallpaper using students' work.



Figure 556: collage wallpaper using students' work

- Create collage wallpaper by sticking students' photos on the full wall height to create a memory wall. In addition, students could talk about their memories and best classroom moments using sticky notes and speech bubbles. Figure 557 shows collage wallpaper using students photos



Figure 557: shows collage wallpaper using students' photos

Stimulating the Senses: is about stimulating students' senses through the design of the space, teachers can apply this concept in the classroom space by thinking of the five senses while planning the space, bringing in different elements that stimulate these senses. Figure 558 - Figure 564 explains human five senses.

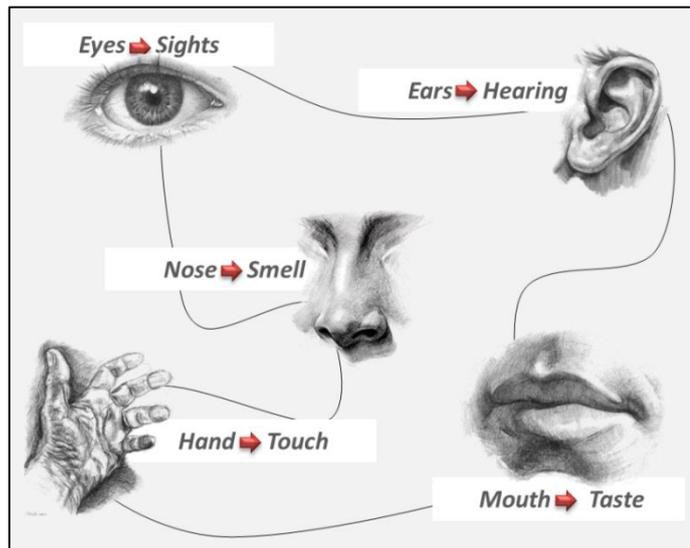


Figure 558: Human five senses



Figure 559: Examples of Different Elements That Teacher Can Bring To Her/his Classroom Space

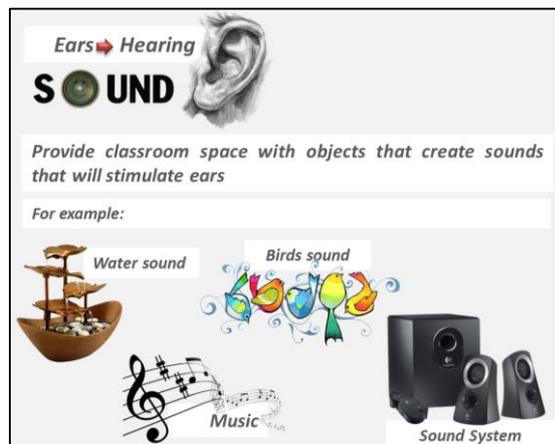


Figure 560: Examples of Different Elements That Stimulate Hearing Sense

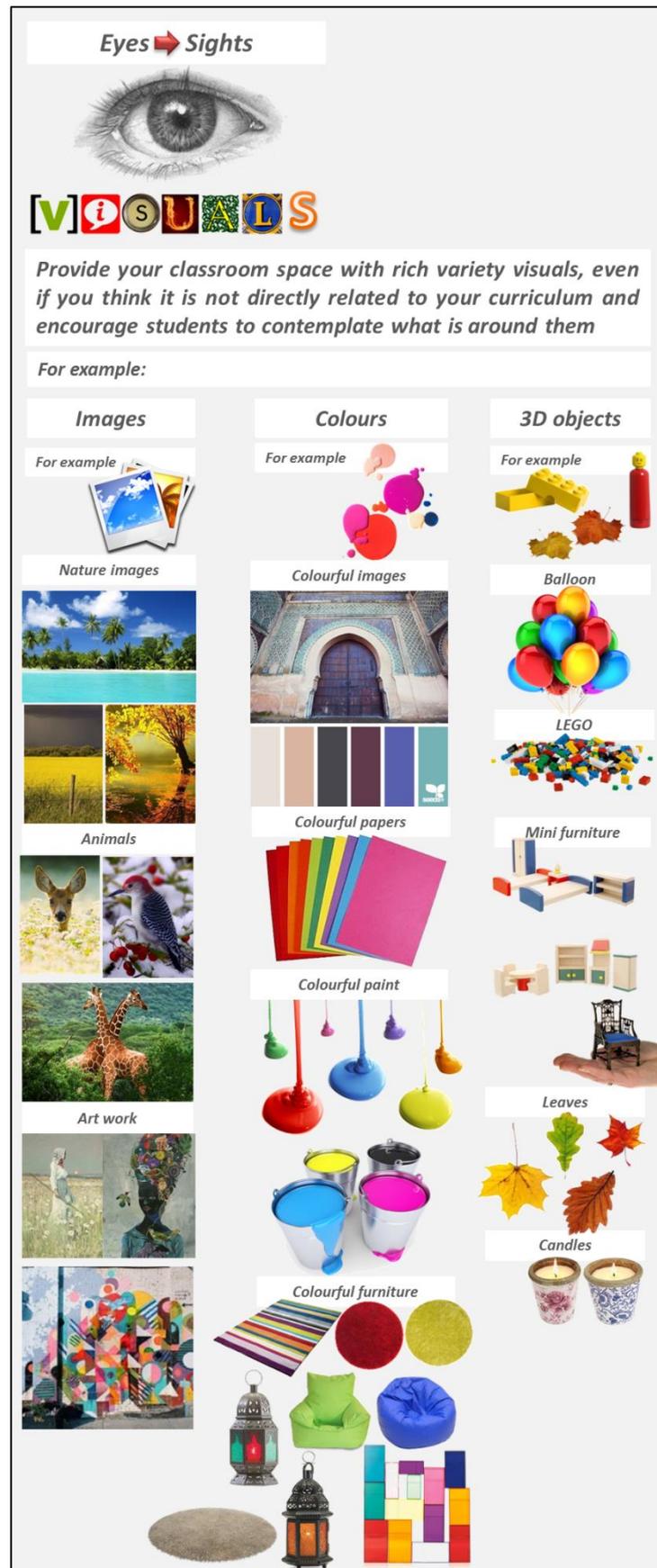


Figure 561: Examples of Different Elements That Stimulate Sights Sense



Figure 562: Examples of Different Elements That Stimulate Smell Sense



Hand Touch
TEXTURE

Provide your classroom space with rich variety of materials and objects with different textures. Even if you think it is not directly related to your curriculum and encourage students to touch and feel the different texture of materials and objects around them.

For example:

Objects with different textures



For example:

Leaves



Furniture

For example:

Wooden desk and chair



Textured rugs




Shells



Stones



beads



Materials with different textures



For example:

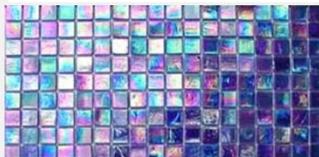
Leather



Wood



Tiles



Different fabric textures



Figure 563: Examples of Different Elements That Stimulate Touch Sense

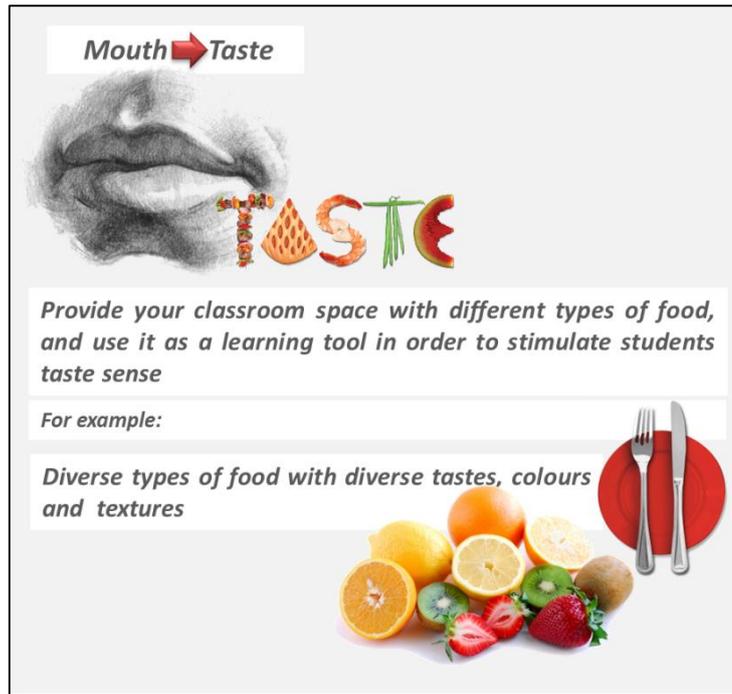


Figure 564: Examples of different elements that stimulate taste sense

What

What does the teacher expect when she/he is using this card? What would the learning space look like? Figure 565 - Figure 568 show examples of applying different sections of card 10.

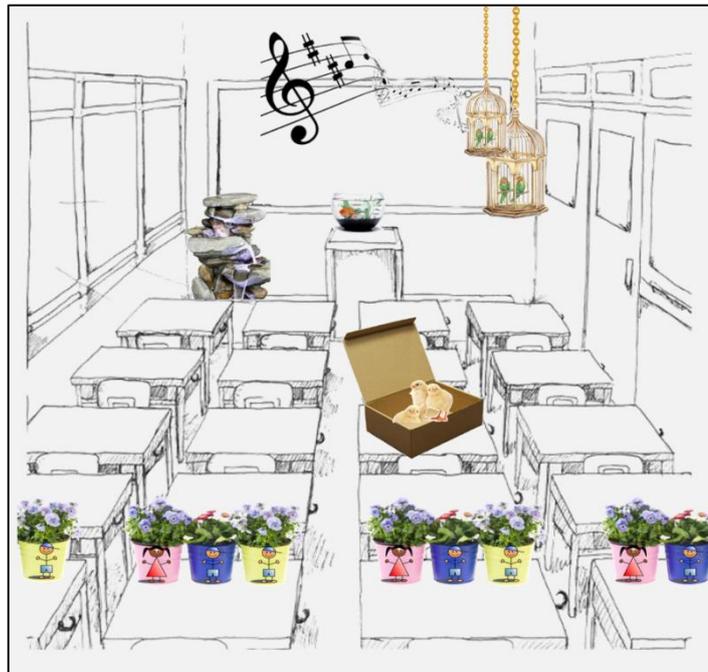


Figure 565: Using section 1 “Nature inside classroom space” in classroom space

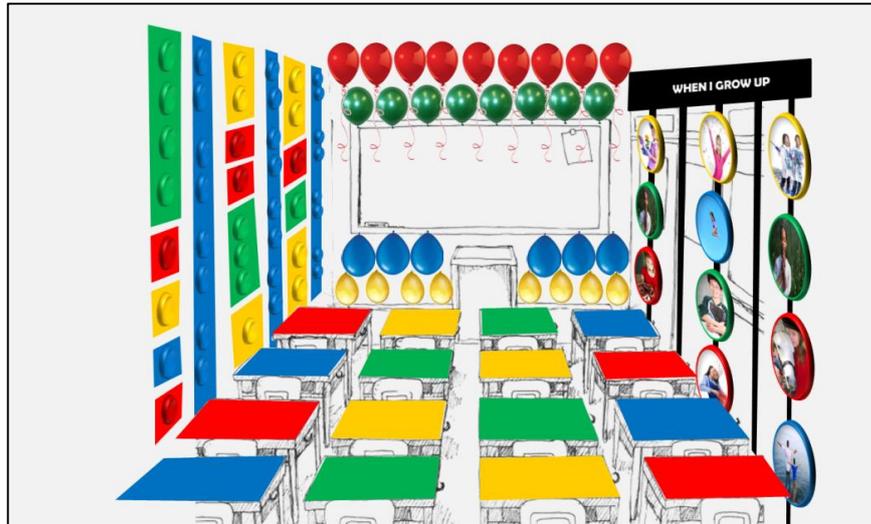


Figure 566: Using section 2 “Classroom party” in classroom space

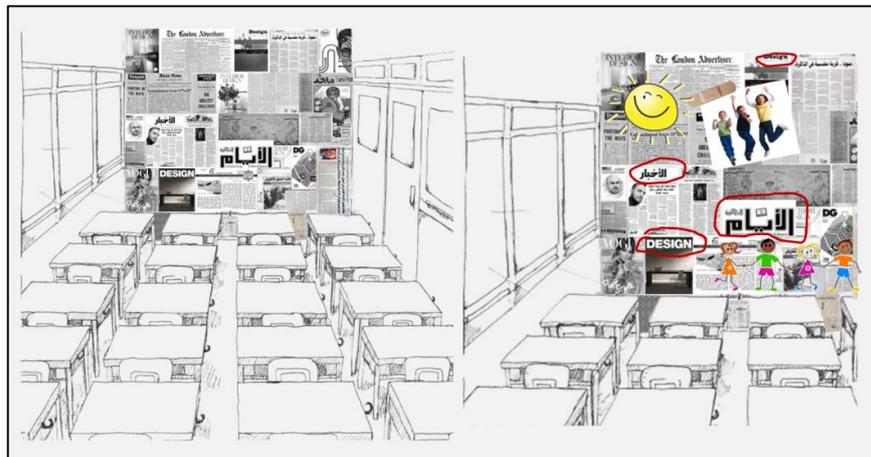


Figure 567: Using section 3 “Collage wallpaper” in classroom space

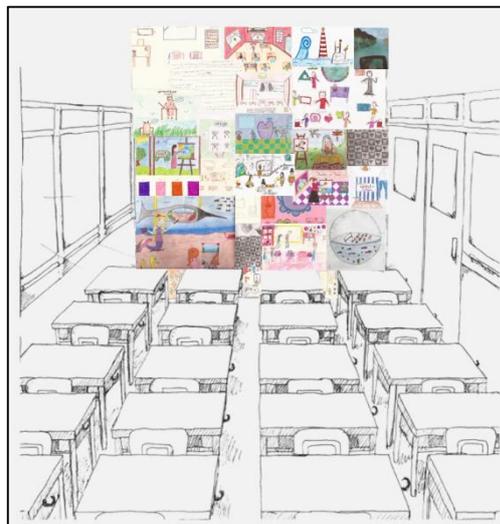


Figure 568: Using section 3 “Collage wallpaper” in classroom space



Figure 569: Using section 3 “Collage wallpaper” in classroom space

Final Set of Cards 10 “Interior Design Tips”

Card 10

Interior Design Tips

<http://classroomecine.blogspot.co.uk>

Why

Why use this card? Benefits classroom users will get when they use this card:

- Inspiring teachers with different interior design tips in order to create an interesting classroom space
- Responding to students’ different learning styles
- Creating a change in classroom space
- Improving teachers’ awareness of interior design elements in a space
- Designing an interactive learning space

Card 10 2

Why

Why use this card? Benefits classroom users will get when they use this card:

- Offering diverse ways for display in the classroom space
- Stimulating students’ senses through space design
- Attracting and motivating students in the space
- Designing the classroom space as a 3D curriculum
- Connecting classroom space with real natural elements

Card 10 3

How

What do you need to apply this card?
How to apply this card.

This card is divided into four sections and each section can be applied differently. These sections are:

Section 1: Nature inside the classroom space
Section 2: Classroom party
Section 3: Collage wallpaper
Section 4: Stimulating the senses

Section 1:
Nature inside the classroom space
 Bring real natural elements into the classroom space and connect them with the teaching curriculum in order to support your teaching strategy. This can make the classroom space work as a 3D curriculum.

Additionally, teachers can ask pupils to contemplate natural elements around them.

Card 10 4

How

What do you need to apply this card?
How to apply this card.

For instance, teachers can ask pupils to think of colours, sounds and ways of living. Also, different elements from nature can be brought into the classroom space such as:

- Birds in cages and chicks
- Fish bowls or fish aquaria
- Indoor gardening
- Indoor fountain

Birds in cages and chicks

Card 10 5

How

What do you need to apply this card?
How to apply this card.

Fish bowl or fish aquarium

Indoor gardening

Teacher can stick students photos on the pots

Card 10 6

How

What do you need to apply this card?
How to apply this card?

Indoor fountain



Sound

Colour

Card 10 7

How

What do you need to apply this card?
How to apply this card.

Section 2:
Classroom Party

Create simple party decorations using simple decorating elements such as:

balloons, decorative lighting and colourful decoration papers. These simple ideas help teachers to create a change in the space.



In addition, parties usually have themes so everything in the party, such as food, cards, dresses and decorations, can support this theme.

Card 10 8

How

What do you need to apply this card?
How to apply this card.

Compare this concept with what happens in the classroom space. In the classroom space, teachers' curricula also have different themes and so everything in the classroom space, such as activities, displays and teaching tools, can support the curriculum theme. Thus, teachers can think of the curriculum theme as a party theme and design everything in the classroom space to support this theme.

Here are some different examples of party themes:

Card 10 9

How

What do you need to apply this card?
How to apply this card.

Alice in Wonderland Party Theme



Picture Reference:
<http://www.teenymothers.com/2013/12/09/Shop-Item-Supplies-Examples-For-Party-Theme/>

Card 10 10

How

What do you need to apply this card?
How to apply this card.

Alice tea party



Alice playing cards

Card 10 11

How

What do you need to apply this card?
How to apply this card.

Circus Party Theme



Picture Reference:
<http://www.teenymothers.com/2013/12/09/Shop-Item-Supplies-Examples-For-Party-Theme/>

Card 10 12

How

What do you need to apply this card?
How to apply this card.

Circus dresses

Circus games

Circus cards

Circus colours

Parties usually have themes, and everything in the party, such as food, cards, dresses and decorations, can support this theme.

In the classroom space, teachers' curricula also have different themes and everything in the classroom space, such as activities, displays and teaching tools, can support the curriculum theme. Thus, teachers can think of the curriculum theme as a party theme and design everything in the classroom space to support this theme

Card 10 13

How

What do you need to apply this card?
How to apply this card.

LEGO Party Theme



Picture Reference:
<http://www.undercuff.com/custom-printable-4x6-photos-4x6-photos-2013-10-08-page-136-849021-146>

Picture Reference:
<http://www.karenandbruce.com/>

LEGO blocks

LEGO colours

LEGO characters

Card 10 14

How

What do you need to apply this card?
How to apply this card?

Example of applying the LEGO theme in the classroom space



Tissue paper

Colourful balloons

Colourful plates

Colourful cardboard

What students want to be when they grow up?

GROUP UP

Card 10 15

How

What do you need to apply this card?
How to apply this card.

**Section 3:
Collage wallpaper**

The idea of collage wallpaper can be applied in different ways using different materials. For example:

Create collage wallpaper by sticking unused black and white magazines and newspapers on the full wall height.



Card 10 16

How

What do you need to apply this card?
How to apply this card.

Teachers could ask students to look for words and different designs of typography. In addition, students can draw on this wallpaper and personalise it.



Card 10 17

How

What do you need to apply this card?
How to apply this card.

Create collage wallpaper by sticking students' work on the full wall height.



Card 10 18

How

What do you need to apply this card?
How to apply this card.

Create collage wallpaper by sticking students' photos on the full wall height to create a memory wall.



Card 10 19

How

What do you need to apply this card?
How to apply this card.

In addition, students could talk about their memories and best classroom moments using sticky notes and speech bubbles.



Card 10 20

How

What do you need to apply this card?
How to apply this card.

In addition, students could talk about their memories and best classroom moments using sticky notes and speech bubbles.



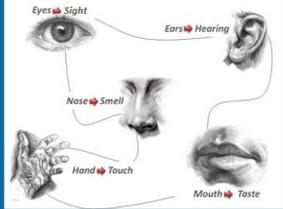
Card 10 21

How

What do you need to apply this card?
How to apply this card.

**Section 4:
Stimulate the Senses**

Stimulate students' senses through the design of the space. Teachers can apply this concept in the classroom space by thinking of the five senses while planning the space, bringing in different elements that stimulate these senses.

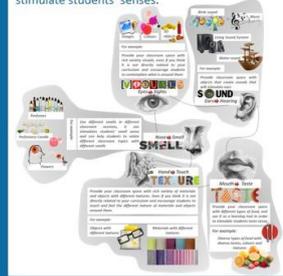


Card 10 22

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that teachers can bring to their classroom space in order to stimulate students' senses.



Card 10 23

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of hearing.

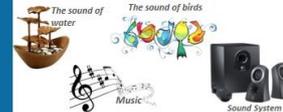
Ears Hearing

SOUND

Provide classroom space with objects that create sounds that will stimulate ears

For example:

- The sound of water
- The sound of birds
- Music
- Sound System



Card 10 24

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of sight.

Eyes → Sight



VISUALS

Provide your classroom space with a rich variety of visuals, even if you think they are not directly related to your curriculum. Encourage students to contemplate what is around them.

For example:

Images Colours 3D objects

For example: 

Card 10 25

How

What do you need to apply this card?
How to apply this card.



Card 10 26

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of smell.

Nose → Smell

SMELL

Use different smells in different classroom sessions. This can stimulate students' sense of smell and can help students to relate different classroom topics with different smells.

For example:



Perfumes Flowers Perfumed Candles

Card 10 27

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of touch.

Hand → Touch

TEXTURE

Provide your classroom space with a rich variety of materials and objects with different textures, even if you think it is not related to your curriculum. Encourage students to touch and feel the different texture of materials and objects around them.

For example:

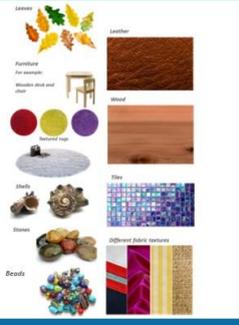
Objects with different textures Materials with different textures



Card 10 28

How

What do you need to apply this card?
How to apply this card.



Card 10 29

How

What do you need to apply this card?
How to apply this card.

Examples of different elements that stimulate the sense of taste.

Mouth → Taste

TASTE

Provide your classroom space with different types of food and use them as a learning tool in order to stimulate students' sense of taste.

For example:

Diverse types of food with diverse tastes, colours and textures



Card 10 30

What

What do teachers expect when using this card?
How might the learning space look?

Section 1: Nature inside the classroom space

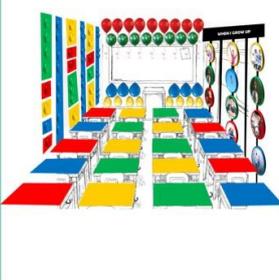


Card 10 31

What

What do teachers expect when using this card?
How might the learning space look?

Section 2: Classroom party

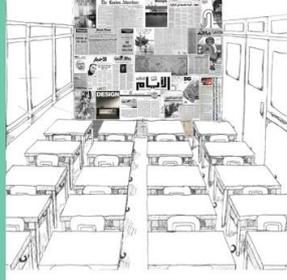


Card 10 32

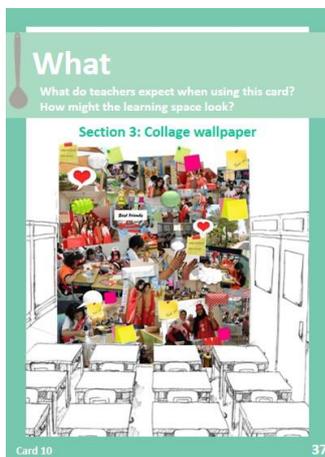
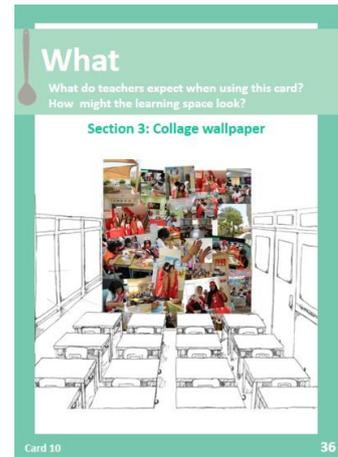
What

What do teachers expect when using this card?
How might the learning space look?

Section 3: Collage wallpaper



Card 10 33



Set of Cards 11 Template

Card set 11 are empty templates for teachers to fill in their own ideas of classroom space. Teachers can download also this template from the website. The aim of this set of cards is to empower further tool development through allowing users to publish their own ideas of using space to support learning. Furthermore, this set provides an opportunity for users to network with others sharing an interest in their ideas.

Final Set of Cards 11 Templates

