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# A Critical Analysis of Building Services Engineering as a Learning Environment

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## **ABSTRACT**

This paper addresses the issues of study support, programme alignment and feedback for directed learning within the Building Services Engineering Programmes delivered at Northumbria University. The author draws on experience both as a past student on the course and subsequent recent teaching experience in order to reflect critically upon the teaching methods used and also the student experience. Project work is a focal aspect of the programme and can, the author believes, be supported more effectively by the active encouragement of study support. Issues of programme alignment and the consequences of programme miss-alignment are discussed. The work of Biggs [2003] supports the author's observations and belief that students must both expect to succeed and also see clear value in succeeding if they are to be well motivated. The issue of the correct sequencing of the delivery of the learning activities within different modules is discussed. The importance of providing effective feedback for directed learning material is also discussed as a key issue since without effective feedback students engagement with directed learning diminishes.

Keywords: Learning Environments

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## 1.0 INTRODUCTION

The Foundation Degree [previously HND] and BEng [Hons] Building Services Engineering within the School of the Built Environment have been established for over forty years and have been successfully providing highly sought after graduates for the Building Services Engineering industry.

The Building Services Engineering arena contains many rich and varied teaching and learning activities which range from the traditional lecture supported by seminars, to design projects, analysis workshops, laboratory studies and site visits.

The aim of the BEng Honours programme is to produce graduates who are;

Highly competent within our field of engineering both in terms of system design and specification but also able to be independent thinkers and effective problem solvers.

Able to effectively communicate their ideas and understanding via presentations, reports, sketches and technical drawings.

Aware of the wider issues within their industry and their role within the design team.

At the appropriate academic standard in order to gain admission to membership of the Chartered Institute of Building Services Engineers [CIBSE].

The abridged list above has been derived from the list of programme aims stated on page 3 in the CIBSE accreditation document [2005].

The aim of this report is to examine this educational arena critically analysing the currently utilised learning activities with a view to improving the learning experience for students within the BEng [Hons] Building Services Engineering programme.

The three areas selected for reflection and examination within this report are study support, programme alignment and feedback for directed learning.

## 2.0 CRITICAL ANALYSIS: STUDY SUPPORT

The design projects are focal in each year of study and are an example of 'authentic assessment' as described by Dunn et al [2004]. The BEng [Hons] Programme Specification [2005] p6 states that "The method of working [in design projects] is designed to help simulate a design office [authentic] environment".

"Projects form a basis for engineering awareness study in level 4 and are a focal point in levels five and six of the programme; providing relevance and integration of the more theoretical academic studies. There is an inherent philosophy throughout the programme that supports 'learning by doing'." – CIBSE accreditation document p12 [2005]. The well established philosophy of 'learning by doing' is strongly established in many teaching and learning activities within the programme and is supported by Biggs [2003] who reports how since writing the first edition of his book he came across the following quote from Tyler [1949] "Learning takes place through the active behaviour of the student: it is what he does that he learns, not what the teacher does."

The design projects present many new problems for the students to solve using their prior knowledge and understanding gained through study on the supporting modules. Students with well developed meta- cognitive skills thrive on the challenge presented and look for confirmation from staff that they are heading in the correct direction whilst those with a less well developed ability to reflect upon and analyse their problem solving strategies often need support and advice which is provided by staff during the limited workshop sessions or a newly established discussion forum hosted on the e-learning portal. Students engaged well with the discussion forum this year and pleasingly moved away from addressing the questions to the tutor, instead phrasing the questions in an open manner leaving anyone free to answer. The

discussion forum in the level 5 project has been a conscious development in order to encourage discussion and the sharing of ideas between the full and part time student groups who often have very different levels of experience and understanding. Biggs [2003] states that “education is about conceptual change” and one of the four conditions he states as being necessary to enable this conceptual change is; “when students can work collaboratively and in dialogue with others, both teachers and peers, good dialogue elicits those activities that shape, elaborate and deepen understanding.”

Students supporting each others ‘learning through doing’ is important for the development and maintenance of student self confidence since without peer support the projects can be very daunting for those students without industry experience. Sharp [1999] states that “Underachieving pupils can get ‘stuck’ in their learning because they have failed to grasp a particular skill or concept” and goes on to say that “Study support can offer them a chance to ‘get’ something that they had previously struggled to understand”. Biggs [2003] referring to the work of Goodlad [1990] and Topping [1996] notes how “the peer teacher reflects on how they learned the topic, which means that peers, being closer to that process and more aware of the traps and difficulties than the expert, and can teach more empathetically”. Biggs [2003] also states that the peer teacher is careful not to loose face by explaining the issue incorrectly and so is careful not to get the explanation wrong.

Figure 1.0, Theory of Study Support

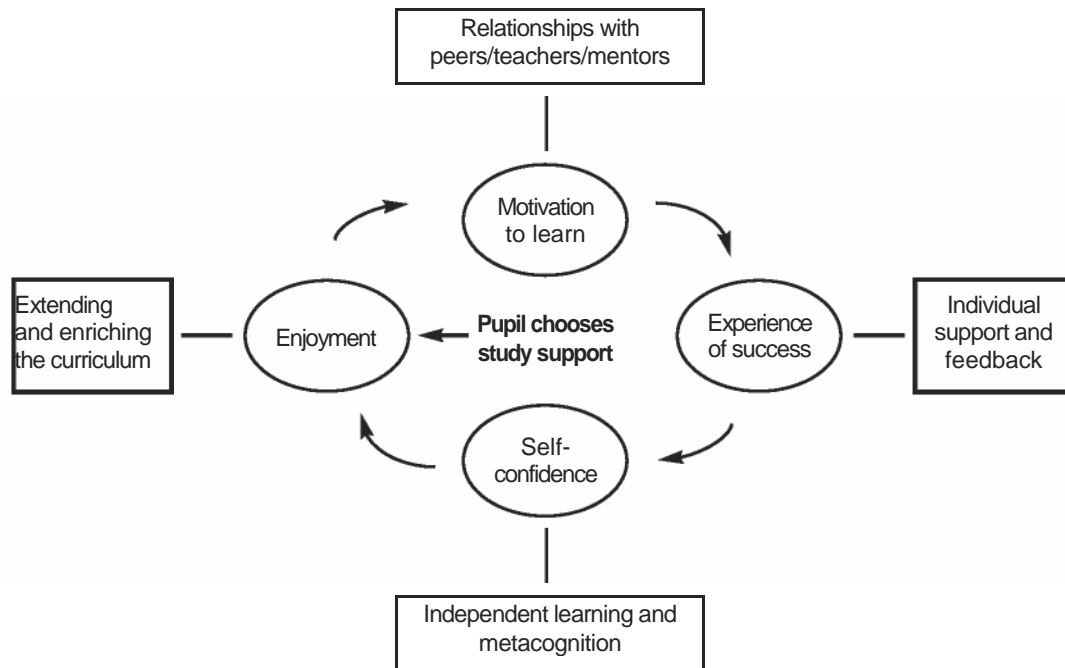


Figure 1 above, taken from Sharp [1999], illustrates her theory of how study support, when embraced by the student, increases enjoyment as the boundary of understanding is pushed back which combined with the improved relationships formed with peers and tutors improves student motivation. Motivation then leads to the production of some work and the receipt of feedback which ultimately leads to the student experiencing success which builds self confidence which in turn improves enjoyment etc.

Given the importance placed upon project work within the Building Services Engineering programmes it is important that this mechanism works effectively and is properly approached and supported by staff.

Historically the programme used to employ 'systems workshop days' within the timetable where there were many opportunities to discuss various aspects of system design. This has been lost within the current project modules largely due to economic and timetabling constraints but should be considered for re- inclusion in some form as an improvement to the current provision.

Ultimately the author would like to make the level 5 design project a group project since he believes this would further strengthen the principle of student support by further breaking down the barriers, at least within each group, which are often erected by students against other students in order to prevent them understanding everything which they do and therefore losing their perceived 'competitive edge'.

### **3.0 CRITICAL ANALYSIS: PROGRAMME ALIGNMENT**

Prior to modularisation of the programme there were regular efforts to ensure that the students were exposed to topics in a sequence that ensured that new material built upon that previous delivered, a cognitivist approach, which makes good sense given the complex and interconnected nature of this subject area. In order to help achieve this goal a chart was developed which showed the topic areas to be covered at each stage within the programme.

Since modularisation this discipline has been lost and we are therefore at risk that what we teach in our individual modules may not be ordered in the most logical or advantageous sequence when considered with the further building blocks of learning which teaching and learning activities in other modules are seeking to establish. Biggs [2003] states that according to constructivism theory "what people construct from a learning encounter depends upon their motives and intentions, on what they know already, and on how they use their prior knowledge."

This presents a challenge for the team of Building Services Engineering academic staff if they are to avoid demoralising and disillusioning our students and therefore ultimately damaging the reputation of the course both in terms of the quality of our graduates but also in relation to the reduced enjoyment of our students since many of our applicants apply as a direct result of the recommendation by current or past students. If the group gets [or already have got] the sequence of topics wrong [in a programme context] then this will make the learning process unnecessarily difficult for students which will inevitably have a knock on effect upon student motivation and achievement.

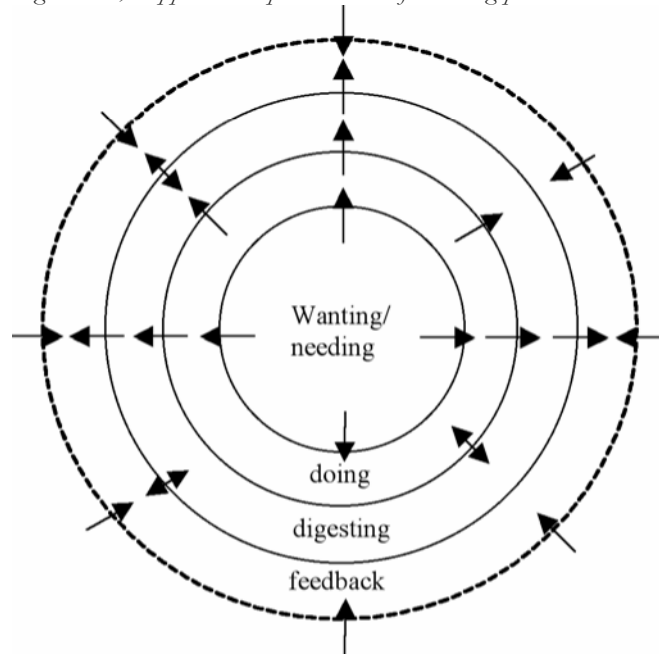
Biggs [2003] outlines the 'Expectancy – Value' theory of motivation where students must both expect to succeed in the learning activity and see the value of the activity in order to be motivated. Importantly he notes that the two factors are related in a multiplication relationship where if either is zero there will be no motivation. If the team can be shown to be failing to build on prior knowledge in a purposeful way then the team risks undermining both the expectancy of students to succeed [because they may not have received the required prior learning] and the perceived value of the task [since it may not be possible for students to conceptually make the link between the associated topics].

### **4.0 CRITICAL ANALYSIS: FEEDBACK FROM DIRECTED LEARNING**

Gibbs [1999] states that; "the best way to learn how to tackle problems is to tackle lots of problems", a philosophy which our programme has embraced both through lectures and seminars but also in some cases through directed learning.

Directed learning activities, however, have tended not to receive effective feedback due to high workloads and as a result the learning process has been compromised in many cases by students losing the desire to engage with the activities. Race [2001] discusses several models which describe the learning process. Figure 2.0 [below, taken from Race, 2001], demonstrates the 'ripples on a pond' model.

Figure 2.0, Ripples on a pond model of learning processes



The vital role that feedback plays in keeping the learning process active is clear from this model and the associated explanation: “Feedback can be regarded as the process that prevents the whole ‘ripple’ simply dying away, as feedback interacts with the digesting and doing stages, and keeps the learning moving”. It is therefore not sufficient simply to issue good quality directed learning material without some form of appropriate feedback.

When initially considering this need for feedback and discussing it with other members of my team it appeared that significant additional time would be required to generating feedback for each learner or to develop multiple choice or similar types of question which could be delivered via blackboard along with appropriate built in feedback for each incorrect answer. However, Biggs [2003] retells a case originally reported by Gibbs [1999] where a form of peer assessment was introduced into a similar situation in order to address declining academic standards. Biggs [2003] states a number of anticipated benefits of this approach such as the reduction in time which students had to wait in order to receive the feedback and that students time was now spent on activities required by the course rather than on instrumental activities such as reading lecture notes. Interestingly Gibbs reported that the feedback received was ‘socially amplified’, that is to say that negative feedback from peers hits home more effectively than if received from the tutor. Another important benefit of the strategy is that the students “learned to judge when a performance was good or not” aided by the exemplar solutions provided with the marking scheme thereby improving their ability to provide quality solutions on subsequent occasions.

## 5.0 CONCLUSIONS

The aim of this report was to examine the areas of study support, programme alignment and feedback for directed learning with a view to improving the learning experience for students within the BEng [Hons] Building Services Engineering programme.

Recent developments such as the introduction of a discussion forum have helped to create an environment where active dialogue is encouraged as being positive and valuable which Biggs [2003] states is important if 'conceptual change' or education is to be achieved. Opportunities to create additional environments for dialogue and the exchange of ideas should be considered such as the 'systems design workshops' which have run in the past.

The issue of programme alignment should be addressed in order to ensure the effective constructing of new knowledge as students use their planned and programmed prior knowledge to make sense of that newly delivered. If the group fails to do this students will not construct the knowledge expected from given learning activities.

Directed learning materials have the potential to engage students in activities that are directly related to the learning outcomes but need to be supported by feedback in order to effectively engage students. Peer assessment as reported by Biggs [2003] opens up opportunities for providing feedback on directed learning tasks which is difficult to achieve in the traditional tutor assessed model due to time restraints.

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