Northumbria Research Link

Identifying key Effective Lifelong Learning Inventory (ELLI) dimensions associated with academic success amongst postgraduate medical students

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Abstract

Many elements have been identified as contributors of academic success amongst medical students but to group these components in order to develop guidelines for intervention strategies is atypical. One such tool which could allow this possibility is the Effective Lifelong Learning Inventory (ELLI) developed by the University of Bristol. ELLI is an online self-assessment instrument which identifies and measures the dimensions of learner development. It comprises of 90 key questions used to measure the seven dimensions of learning power: changing and learning; meaning making; critical curiosity; creativity; learning relationships; strategic awareness and resilience.

This study used ELLI to explore learning dimensions as potential drivers for academic success. A small cohort of thirty-three first year postgraduate medical students consented and completed the first ELLI before starting formal classes. Only eighteen of these completed it a second time, 45 days later. The data from the ELLI questionnaires were analysed both for the whole cohort and separately for each academic performance group (defined using grade point averages).

The results showed that the students obtained the highest scores for the meaning making or changing and learning dimensions, and the lowest scores for creativity or resilience. After a period of postgraduate study, only the successful students displayed significant improvements in the mean ELLI scores, with increases for all ELLI dimensions apart from resilience. Those who were less successful made declines in more than one dimension.

It was concluded that ELLI is an effective instrument for identifying key learning dispositions and it is proposed that an intervention could be developed in the future to improve academic achievement.

Introduction

Clark (1997) argues that learning is a single, dynamic multifaceted process that is inherent in human consciousness but is composed of affective, intuitive, rational, sensory and preferential ways of knowing. The measurement of learner characteristics is a complex matter with much debate, resulting in the production of a wide assortment of educational assessments offering opportunities for students to assess their capacity and desire to learn (Rossman and Rossman, 1990, Sobral, 1995; Grimsell, 2001; Deakin Crick, Broadfoot and Claxton, 2004). This type of inventory attempts to dissect overarching and complex elements of learning reducing them to singular dimensions. One such assessment offering this opportunity is the effective lifelong learning inventory (ELLI) developed by Deakin Crick and colleagues circa 2004.

ELLI was initially developed to identify behaviours and factors of an individual's capacity for lifelong learning within a school environment (Deakin Crick *et al.*, 2004). Later it evolved as a self-assessment tool used by students in Higher Education to monitor and improve qualities which make up their capacity for learning, in essence promoting personal change through critical self-reflection (Deakin Crick and Yu, 2008). It invites the learner to become aware of and take responsibility for their own learning process over time. The authors highlight the importance of learners describing their learning and fixing their learner identity (Deakin Crick and Yu, 2008). The inventory has four assessment purposes: first it enables the student to critically reflect on their own learning, second it enables staff to develop a profile on the learning characteristics of the class thus allowing them to use this to design effective pedagogy, third it is useful in institutional self-evaluation and finally it facilitates research by working across organisations. ELLI was conceptualised as a tool capable of measuring a set of dispositions, values and attitudes which were part of a complex learning journey (Deakin Crick and Yu, 2008). It breaks down learning power of an individual into seven key dimensions by building upon the traditional cognitive learning styles type inventory by incorporating a set of malleable elements to learning. It also offered reliability and validity based on empirical findings avoiding discipline-specific terms thus making comparisons easier (Deakin Crick and Yu, 2008).

Many studies have been conducted to identify factors affiliated with academic success: cognitive, social, demographic and environmental (Jacobs, Selby and Madsen, 1996; Dearnley and Matthew, 2007; Mills *et al.*, 2009). While most of these characteristics are endogenous, such as age, sex, religion,

what ELLI offers is to assign learning power into seven dimensions which can benefit practitioners who can use the key components of a good learner to improve and evaluate others (Thompson, 2010).

This study aimed to use ELLI as a learning assessment tool from a practitioner's perspective, to explore ELLI's ability to quantify learning orientations and seek differences between learners with different levels of academic achievement. The motivation behind the study arose after making observations of differences in learning approaches between academically successful and unsuccessful postgraduate medical students during their first term. The ELLI questionnaire was used amongst a small cohort of first year postgraduate medical students, to look for any differences in learning power across the seven learning dimensions (changing and learning; critical curiosity; meaning making; resilience; creativity; strategic awareness; learning relationships). ELLI provided an ideal tool to explore whether there were any actual measureable differences in the learning traits over the achievement spectrum.

It was hoped that ELLI could provide a framework for understanding a range of learning dispositions, which could be used in practice as a basis for intervention aimed at improving the performance of those individuals who were less successful.

Methodology

The Effective Lifelong Learning Inventory (ELLI)

The ELLI is an established online questionnaire, developed and validated by researchers from the University of Bristol (Deakin Crick *et al.*, 2004) and subsequently tested in several UK universities, including Northumbria University (Small and Deakin Crick, 2008; Harding, Thompson and Williamson, 2009 and 2010). In its current online format it includes 90 Likert-type questions about learning styles and preferences. An individual's answers are processed automatically to return measures of 'learning power' (on a 0-100 scale) for each of the seven learning dimensions: changing and learning; meaning making; critical curiosity; creativity; learning relationships; strategic awareness and resilience, presented as a 7-axes diagram profile.

Design of the Study

This was an exploratory longitudinal study conducted during the 2010-11 academic year. The students who were invited to participate were medical students on the Keith B. Taylor Global Scholars Program that offers the opportunity to complete the first year of a Doctor of Medicine degree at

Northumbria University, followed by three more years of study at St George's University, Grenada. To gain an insight into their current and acquired learning power, they were asked by the postgraduate academic tutor in charge with providing overall academic support to their cohort to complete the ELLI questionnaire at two distinct time points, once before they had started their formal teaching and then again 45 days later after their first major assessment. Their testing within this time frame was essential as it allowed a threshold measurement of their undergraduate learning characteristics before participation in postgraduate studies against new ones developed on the programme. In order to maximise participation, all students on the programme were alerted to the ELLI tool during a mandatory briefing during Orientation week. They were invited to participate, consented and offered instructions on ELLI registration later on that same week during formal one-to-one sessions.

The Learning Experiences of the Cohort

The medical students experienced a week of orientation presentations during which they were advised on appropriate study skills, time management, test-taking and group learning followed by 16 weeks of teaching. They studied 4 subjects, mainly taught using lectures but enhanced with weekly case-based discussions and laboratory sessions. The formal subject-centred teaching was supplemented by a strong academic and pastoral support system that consisted of one-to-one discussions and workshops on effective test-taking strategies where concerns were aired and recommendations were reinforced. The aims were to develop their subject knowledge, practical and transferrable skills (patient history taking, team management, etc) and lifelong learning abilities (e.g. balancing working on their own and with groups to expedite their learning; making association between subjects delivered rather than keeping them compartmentalised, etc.). ELLI was used as a measure of the skills and experience they had attained within the first 8 weeks including their first substantive summative assessment preparation and scores.

Ethical Issues

Due to working with human subjects, ethical approval for this project had to be obtained according to the policy and guidelines set out by Northumbria University. Anonymity, confidentiality and privacy were assured to the participants and written consent was obtained prior to the data collection.

Data Collection

Thirty-eight students consented to participate in this pilot study, 33 went on to complete the first questionnaire and only 18 of these went on to complete the questionnaire a second time, 45 days later. This cohort was composed of 13 females and 5 males, all students who had completed their first degree in a country other than the UK. Data collection took place at two time points, both in the form of a summary of the individuals learning power (the spider diagrams produced automatically by ELLI) and as raw data for analysis. The individual ELLI outputs were used in one-to-one tutorials with the students. The raw data was matched with academic achievement for each student and exported into statistical software for further analysis. The assignation of individual students to academic performance groups was carried out using terminal grade point averages (GPAs) at the end of term 1, as follows: those individuals with a GPA greater than 3.0 were deemed to have high academic achievement and assigned to the "successful" academic performance group, while those with a GPA below 2.0 were deemed "unsuccessful". Those falling between these two parameters were termed as having "satisfactory" academic performance.

Data Analysis

Descriptive statistics (means and standard deviations) and tests of difference (One-way analysis of variance – ANOVA - with post hoc tests and paired samples t-test) between samples of data obtained by grouping the raw data in different ways (by academic performance group and/ or by learning dimension and/ or by time when the ELLI was completed) were carried out using PASW Statistics 18 software. Summary spider diagrams were constructed using the graphic facilities of Microsoft Excel.

Results

The learning power of the study group at the beginning of the academic year

A total of 33 medical students completed the ELLI at the beginning of their first semester of study at Northumbria University. The analysis of the data for the whole group revealed rather large differences between the mean scores for the seven ELLI dimensions. The learning dimensions with the highest mean scores were meaning making (79.8 ± 13.1) and changing and learning (78.3 ± 14.0), while the learning dimension with the lowest mean score was creativity (51.8 ± 13.0) (Table 1). There was also large variability in the

Table 1. The mean scores for each of the seven learning dimensions, for all the students who took the first ELLI (n=33), with standard deviations (SD), and notations to show which of the numerical differences between dimension scores were significant (based on the outcome of One-way Analysis of Variance, with post hoc tests, at p < 0.05 level of significance). The mean scores are arranged in increasing order; the lower case letters are used to denote means that are significantly different from each other, at p<0.05 level of significance; a mean score with a two letter notation is not significantly different from mean scores with notations containing either of its two letters, but is significantly different from mean scores with notations containing different letters.

Learning Dimension	Changing and Learning CL	Critical Curiosity CC	Meaning Making MM	Creativity CV	Strategic Awareness SA	Learning Relationships LR	Resilience RS
Mean Score (n=33)	78.3	60.0	79.8	51.8	62.6	65.6	58.5
(±SD)	(±14.0)	(±14.9)	(±13.1)	(±13.0)	(±12.3)	(±12.2)	(±15.9)
Oneway ANOVA	CV < RS < CC < SA < LR < CL < MM a < ab < ab < b < b < c < c						

individual student scores (measured by the relatively large standard deviations, SD).

Table 1 shows the mean scores and standard deviations for all seven learning dimensions, as well as their increasing order and which of the numerical differences between dimensions were statistically significant. The mean scores for the 'meaning making' and 'changing and learning' dimensions, although not significantly different from each other, were both significantly higher than the mean scores for the other dimensions. Of the other five dimensions, the mean scores for learning relationships and for strategic awareness were significantly higher than the mean score for the 'creativity' dimension, but only slightly higher (non significant at p<0.05 level) than the mean scores for critical curiosity and resilience.

In order to relate their initial learning power to the level of academic performance in a formal assessment completed at the end of the first term of their postgraduate studies, the data from the first ELLI were also analysed separately for each academic performance group. The students were assigned to the "successful", "satisfactory" or "unsuccessful" group based on their terminal grade point averages (GPAs) at the end of term 1, as described in the Data Collection section above.

As expected, based on the results of the analysis for the whole group, all three academic performance groups had the two highest mean scores for the meaning making and the changing and learning dimensions and the lowest mean score for the creativity dimension.

The detailed results for each academic performance group are shown in Table 2: mean scores for each learning dimension, standard deviations, the increasing order of the mean scores and notations to point out which numerical differences were statistically significant. A few differences could be noted with respect to the increasing orders of the mean scores for the seven learning dimensions and the extent of the statistical significance of the numerical differences between mean scores. For example, the students in the satisfactory group scored significantly higher for the meaning making and changing and learning dimensions (89.1 ± 4.5 and 83.3 ± 14.4, respectively) than for the other five learning dimensions, whereas the statistical significance of the numerical differences between learning dimensions is not that clear cut for the other two academic performance groups. Moreover, these two mean scores from the satisfactory group were higher than those of the students in both the successful and unsuccessful group, for the same learning dimensions.

Table 2. Analysis of the scores from the first ELLI by academic performance group. The mean scores for each of the seven learning dimensions, for each academic performance group, with standard deviations (SD) and notations to show which of the numerical differences between dimension scores were significant (based on the outcome of One-way Analysis of Variance, with post hoc tests, at p < 0.05 level of significance). The mean scores are arranged in increasing order; the lower case letters are used to denote means that are significantly different from each other, at p<0.05 level of significance; a mean score with a notation consisting of more than one letter is not significantly different from mean scores with notations containing any of its letters, but is significantly different from mean scores with notations containing different letters.

Academic Performance Group	Learning Dimension (mean score ± standard deviation)						
	Changing and Learning CL	Critical Curiosity CC	Meaning Making MM	Creativity CV	Strategic Awareness SA	Learning Relationships LR	Resilience RS
Successful (n=16)	77.1 (±15.7)	58.1 (±16.1)	73.2 (±14.7)	46.5 (±10.9)	63.6 (±9.3)	61.6 (±13.7)	53.4 (±15.7)
Oneway ANOVA	CV < RS < CC < LR < SA < MM < CL a < ab < ab < bc < bc < cd < d						
Satisfactory (n=7)	83.3 (±14.4)	69.8 (±13.3)	89.1 (±4.5)	60.0 (±10.7)	60.4 (±9.5)	67.5 (±11.1)	64.7 (±17.0)
Oneway ANOVA	CV < SA < RS < LR < CC < CL < MM a < a < a < a < a < b < b						
Unsuccessful (n=10)	76.7 (±11.0)	54.8 (±11.4)	83.8 (±8.5)	54.7 (±14.6)	62.6 (±18.0)	70.6 (±8.5)	62.2 (±14.5)
Oneway ANOVA	CV < CC < RS < SA < LR < CL < MM a < a < ab < ab < abc < bc < c						

The data presented in Table 2 were used to generate three superimposed spider diagrams (Figure 1), to make such differences between the three academic performance groups clearer, for each learning dimension. This graphical representation was similar to the summary profile the ELLI website returns to individual users upon completion of the online questionnaire and it revealed at a glance that there were quite a few differences between the three academic performance groups, and not quite as one might have predicted. The students placed in the satisfactory performance group were in fact those who, at the beginning of their programme of study at Northumbria University, had the highest mean scores for five of the learning dimensions: the two that were mentioned above, changing and learning and meaning making, but also critical curiosity, creativity and resilience (Figure 1).

Figure 1. The mean scores for each learning dimension, from the first ELLI, by academic performance group (successful group n=16; satisfactory group n=7; unsuccessful group n=10). The asterisks mark the learning dimensions for which there were significant differences between the mean scores of different academic performance groups (One-way ANOVA, $p < 0.05$ level of significance).
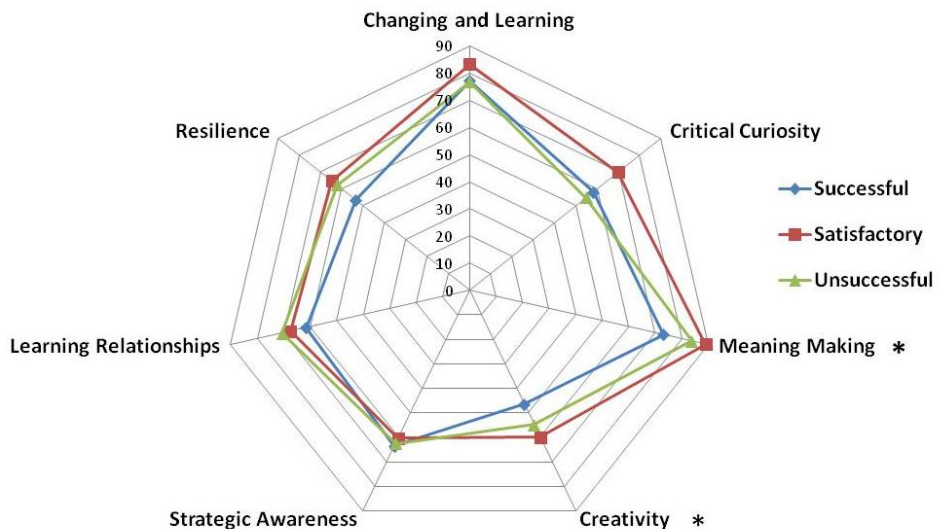
For three of these dimensions: meaning making; creativity and resilience, the mean score of the students in the unsuccessful group was the second highest, therefore higher than the mean score of the students in the successful group.

Strategic awareness was the only dimension in which the successful students scored marginally higher than both other groups, while for changing and learning and critical curiosity their mean score was the second highest after that of students in the satisfactory performance group. The students later placed in the unsuccessful group had a higher mean score than both other groups only for the learning relationships dimension.

The largest differences between the students in the satisfactory performance group and the students in the successful group were seen in the mean scores for meaning making (+15.9), creativity (+13.5), critical curiosity (+11.7) and resilience (+11.3).

The only statistically significant differences seen were those in the mean scores for the meaning making and creativity dimensions (One-way ANOVA with post hoc tests, $p<0.05$). For both of these, the students in the satisfactory performance group scored significantly higher than the successful students, with the score of those in the unsuccessful group lying in between, and not significantly different from either group.

## Changes in learning power after a period of study at Northumbria University

Figure 2. The mean scores for each learning dimension, from the first ELLI and second ELLI, (n=18). The asterisks mark the learning dimensions for which there were significant differences between the mean scores of the first and second ELLI (paired t-test, $p < 0.05$ level of significance).
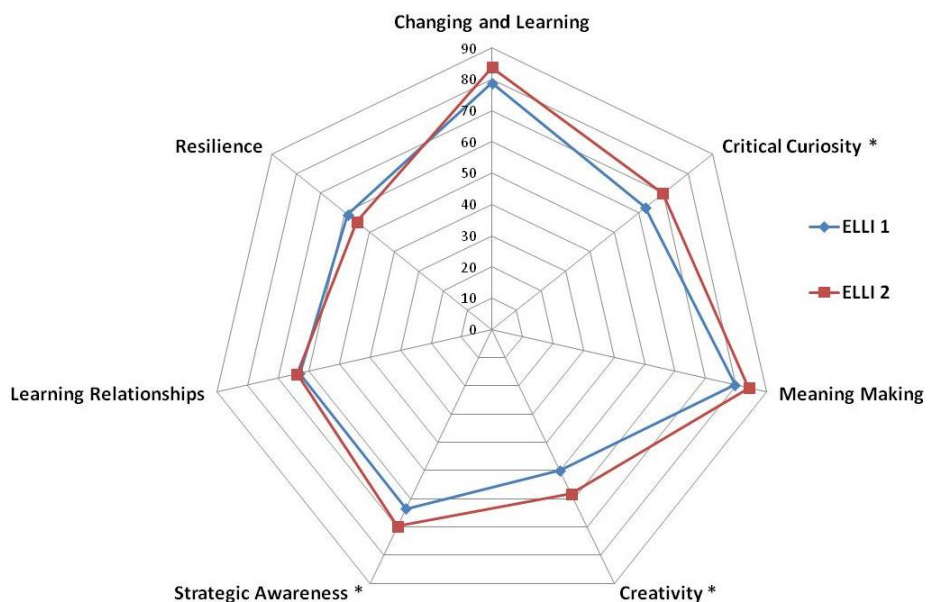
Of the 33 students who completed the ELLI at the beginning of the academic year, only 18 chose to complete the ELLI a second time, mid-term. The results presented in this section refer only to the students who completed the ELLI at both moments in time.The pair-wise analysis of the raw data collected from both ELLIs revealed that after a period of student and teacher-centred activities, supported by academic guidance on how to tailor learning on a medical degree programme, the students showed improvements in all of the learning dimensions, with the exception of resilience (Figure 2). The greatest increases, which were also statistically significant, were seen in three of these learning dimensions: critical curiosity (+7.2), creativity (+8.3) and strategic awareness (+6.3) (paired t-test, p<0.05). The decrease in the mean score for resilience (-3.8) was not significant.

These findings prompted us to pool the raw data for all seven learning dimensions, and compare the mean overall mid-term score to that at the start of term, as overall measures of learning power and direction of change in learning power after a period of study at Northumbria University (for the students who completed both ELLI questionnaires) (Figure 3).

Figure 3. Comparison of all the scores from the first ELLI and second ELLI, (n=126 values, 18 students x 7 dimensions); (box plots; the horizontal lines represent median value and quartiles, the vertical bars represent the minimum-maximum range; the asterisk represents a significant difference between the two means, based on paired t-test, p < 0.05 level of significance).
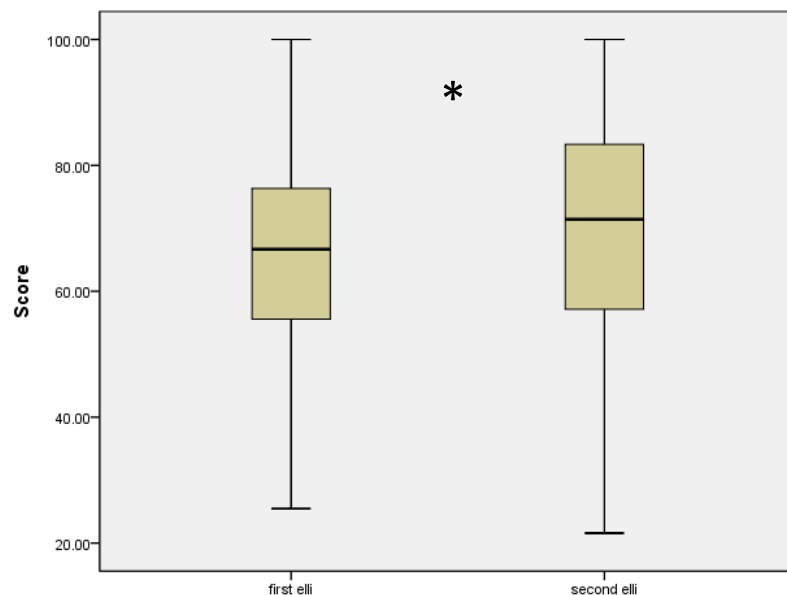
Interestingly, this analysis showed that there was a significant increase in overall learning power, from a mean score of 65.2+/- 16.5 to 69.3+/-18.1 (Figure 3, n=126, 7 dimensions x 18 students; paired t-test, p < 0.05). It must be noted that although the mean score for the first ELLI shown in Figure 3 included only the data for the 18 students who took the ELLI at both moments in time, this was not significantly different from the mean score calculated for all the 33 students who took the first ELLI, which was 65.2 ± 16.6 (n=231, 7 dimensions x 33 students).

The same overall learning power analysis (pair-wise, without separating the raw data by learning dimension) was carried out separately for each academic performance group and this showed that, in fact, only the successful group displayed a significant increase in the overall mean ELLI score, from 62.6+/- 17.1 to 69.9+/-18.9 (n=70, 10 students x 7 learning dimensions, paired t-test, p<0.05). The satisfactory performance group displayed a smaller increase (not significant at p<0.05 level), from 70.5+/-15.2 to 71.6+/-17.4 (n=28, 4 students x 7 dimensions), while the overall mean ELLI score for the unsuccessful group actually decreased from 66.6+/-15.4 to 65.6+/-16.6 (n=28, 4 students x 7 dimensions; not significant at p<0.05 level).

The detailed analysis by learning dimension showed that only the successful group (n=10) displayed improvements in six of the seven learning dimensions (Table 3). The only exception was resilience (-3). The increases in the mean scores for meaning making (+9.5) and creativity (+13) were statistically significant (n=10, paired t-test, p<0.05). The increases in the mean scores for the other four learning dimensions were fairly large (+7.5 for changing and learning; + 9.7 for critical curiosity; + 6.9 for strategic awareness; and + 7.5 for learning relationships), but not statistically significant (at p<0.05 level).

The satisfactory performance group (n=4) displayed increases in the mean scores for four learning dimensions: critical curiosity (+3.7), meaning making (3.6), creativity (+8.3) and strategic awareness (+8.3), but none of these were statistically significant. There were non-significant decreases in the mean scores for changing and learning (-2.1), learning relationships (-7.7) and resilience (-6.4).

The unsuccessful group (n=4) displayed increases in three learning dimensions: changing and learning (+6.2), critical curiosity (4.6) and strategic awareness (2.5), and decreases in the other four learning dimensions (-7.1 for meaning making; -3.3. for creativity; -6.3 for learning relationships; and -3.5 for resilience). None of these changes were statistically significant (at p< 0.05 level).

Table 3. The mean scores from the first and second ELLI, for each of the seven learning dimensions, for each academic performance group, with standard deviations (SD) (using only data from students who took both ELLIs): The mean scores from the second ELLI are arranged in increasing order, and lower case letters are used to denote means that are significantly different from each other, at $p<0.05$ level of significance; a mean score with a notation consisting of more than one letter is not significantly different from mean scores with notations containing any of its letters, but is significantly different from mean scores with notations containing different letters.

Academic Performance Group	Learning Dimension (mean score ± standard deviation)													
	Changing and Learning		Critical Curiosity		Meaning Making		Creativity		Strategic Awareness		Learning Relationships		Resilience	
	ELLI 1	ELLI 2	ELLI 1	ELLI 2	ELLI 1	ELLI 2	ELLI 1	ELLI 2	ELLI 1	ELLI 2	ELLI 1	ELLI 2	ELLI 1	ELLI 2
Successful (n=10) ± SD	80.0 ±14.8	87.5 ±13.7	59.6 ±17.6	69.3 ±14.8	71.9 ±14.5	81.4 ±12.4	45.3 ±9.8	58.3 ±16.1	65.4 ±7.7	72.3 ±15.2	60.0 ±15.3	67.5 ±14.8	55.7 ±16.5	52.7 ±22.0
	Oneway ANOVA Second ELLI: RS < CV < LR < CC < SA < MM < CL a < a < ab < abc < abc < bc < c													
Satisfactory (n=4) ±SD	77.1 ±15.8	75.0 ±18.0	78.7 ±4.7	82.4 ±13.0	90.5 ±3.9	94.1 ±7.1	56.7 ±12.5	65.0 ±16.0	60.3 ±10.8	68.6 ±9.7	65.3 ±12.5	57.6 ±11.9	64.7 ±14.4	58.3 ±16.6
	Oneway ANOVA Second ELLI : LR < RS < CV < SA < CL < CC < MM a < a < a < ab < ab < ab < b													
Unsuccessful (n=4) ±SD	77.1 ±8.0	83.3 ±6.8	53.7 ±15.3	58.3 ±15.2	88.1 ±8.3	81.0 ±6.7	55.0 ±15.5	51.7 ±19.0	62.2 ±13.1	64.7 ±7.7	68.1 ±1.6	61.8 ±10.7	61.8 ±11.4	58.3 ±22.0
	Oneway ANOVA Second ELLI : CV < CC < RS < LR < SA < MM < CL (not significantly different at p < 0.05 level)													

Figure 4. The mean scores for each learning dimension, from the first ELLI and second ELLI, for each academic performance group: a) successful (n=10); b) satisfactory (n=4); c) unsuccessful (n=4). The asterisks mark the learning dimensions for which there were significant differences between the mean scores of the first and second ELLI (paired t-test, $p < 0.05$ level of significance).

a) Successful group

b) Satisfactory performance group
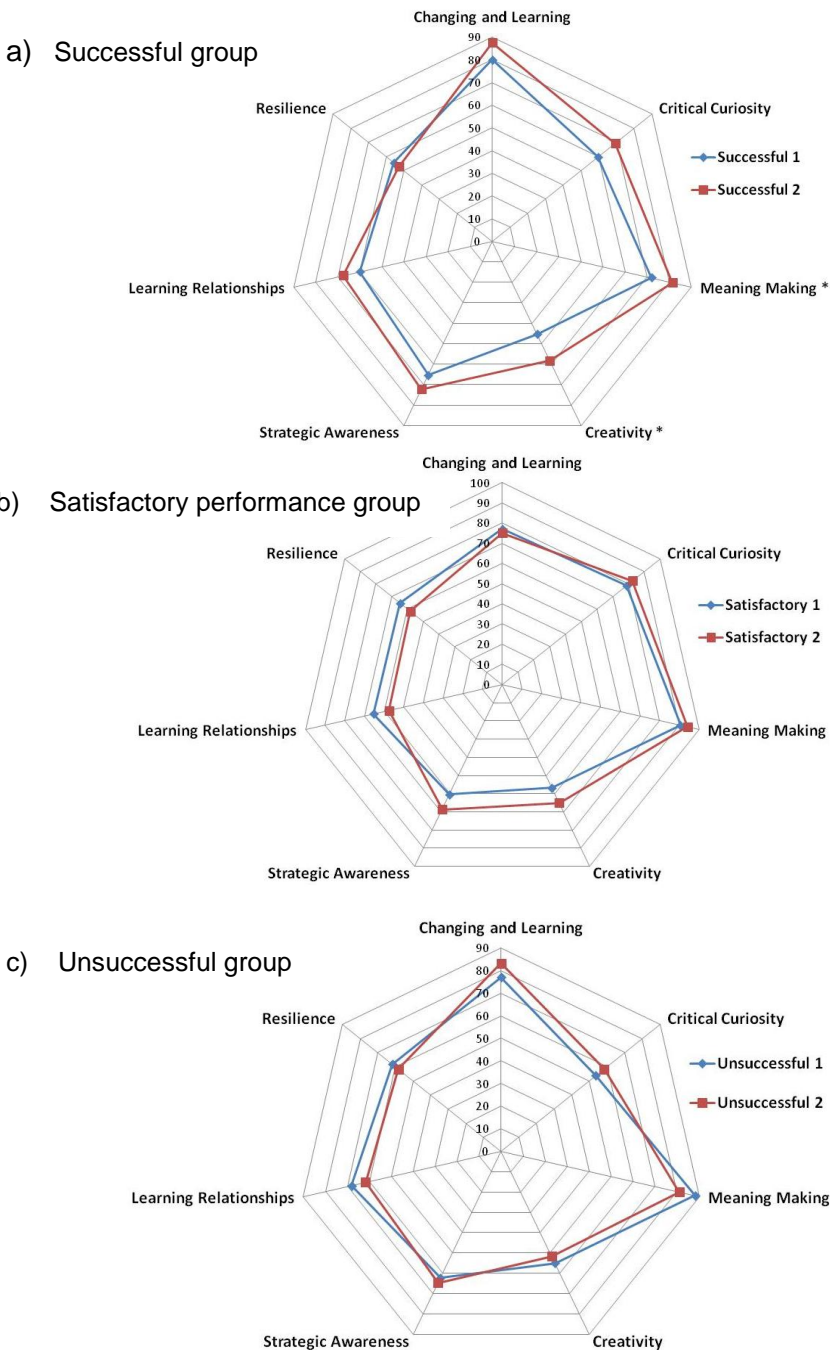
c) Unsuccessful group

Figure 4 illustrates the direction and magnitude of the changes described above for each academic performance group.

As a result of these changes in the mean scores for each learning dimension, the increasing orders of the mean scores for the seven learning dimensions changed slightly compared to those from the first ELLI, for all three academic performance groups (Table 3).

For the successful group, the learning dimension with the lowest mean score in the second ELLI was resilience (instead of creativity, in the first ELLI), while the mean score for changing and learning remained the highest. The mean score for changing and learning was significantly higher than the mean scores for resilience, creativity and learning relationships (Table 3).

The satisfactory performance group had the lowest mean score for learning relationships (instead of creativity, in the first ELLI), while the mean score for meaning making remained the highest and the only one that was still significantly higher than the mean scores for learning relationships, resilience and creativity (Table 3).

Creativity remained the learning dimension with the lowest mean score for the unsuccessful group, and the mean score for changing and learning became slightly higher than meaning making. For this group, none of the mean scores appeared to be significantly different from the others (Table 3).

The mean scores from the second ELLI (Table 3) were also used to produce superposed diagrams for the three academic performance groups (Figure 5), to illustrate differences between the successful, satisfactory and unsuccessful groups, with respect to each learning dimension.

The large increases in the mean scores of the students in the successful academic performance group placed them ahead of the other two groups for the changing and learning, strategic awareness and learning relationship dimensions. The students in the satisfactory performance group still had the highest mean scores for critical curiosity, meaning making and creativity, while the students in the unsuccessful group had the highest mean score only for resilience (Figure 5).

Although some of the numerical differences between the mean scores of the three academic performance groups were quite high, none of them appeared to be statistically significant (One-way ANOVA with post hoc tests, $p < 0.05$ level). For example, for changing and learning the mean score of the successful group was 12.5 points higher than that of the satisfactory group, and only 4.2 points higher than that of the unsuccessful group. For critical

curiosity the mean score of the satisfactory group was 13.1 points higher than that of the successful group, and 24.1 points higher than that of the unsuccessful group. For meaning making, the mean score of the successful group was only slightly higher than that of the unsuccessful group (+0.4), but 12.7 points higher than that of the satisfactory group. The mean score for strategic awareness of the successful group was only 3.7 points higher than that of the satisfactory performance group, but 7.6 points higher compared to that of the unsuccessful group. For learning relationships, the mean score of the successful group was 9.9 points higher than that of the satisfactory performance group and 5.7 points higher than that of the unsuccessful group.

Figure 5: The mean scores for each learning dimension, from the second ELLI, by academic performance group (successful group n=10; satisfactory group n=4; unsuccessful group n=4). There were no significant differences between the mean scores of different academic performance groups for any learning dimension (One-way ANOVA, p < 0.05 level of significance).
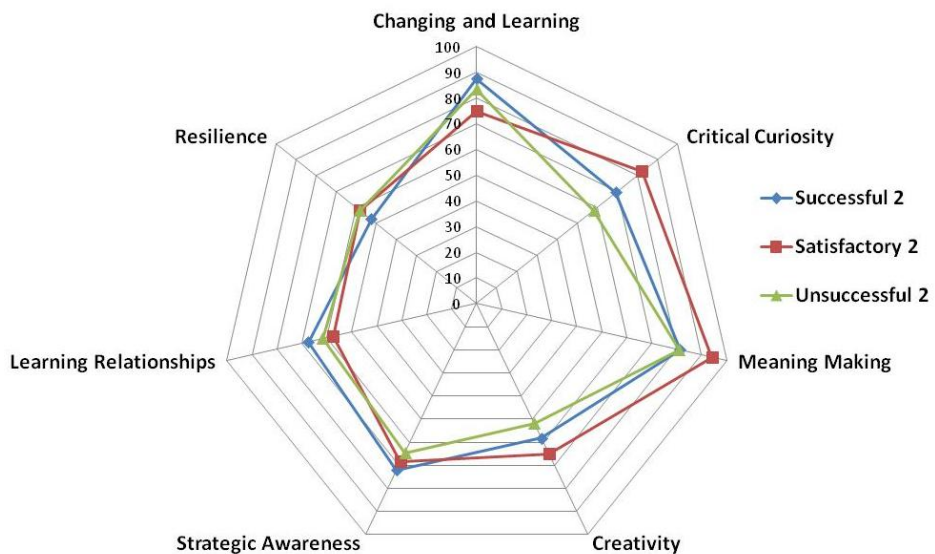
Discussion

A new learning environment presents with a plethora of challenges for the learner with a mismatch of the student's preferred strategies to learn and the demands of the new instructional environment (Vermunt and Verloop, 2000). This study aimed to explore and clarify those challenges by dissecting and identifying key dimensions scored on the Effective Lifelong Learning Inventory (ELLI).   Students in a medical learning environment are

encouraged to develop a self-directed learning (SDL) educational approach in most modern curriculums (Candy, 1991). However, on the programme at Northumbria University SDL alone is not sufficient to guarantee success; a large emphasis is placed on developing the first year learning experience amongst the students to include time management, study skills and test-taking and group learning opportunities.

The initial ELLI scores of the group of medical students from Northumbria University who participated in this study ranged from averages of 79.8 for meaning making and 78.3 for changing and learning, to values in the sixties for critical curiosity, strategic awareness and learning relationships and to values in the fifties for creativity and resilience. These scores were remarkably similar to those reported for adults by the researchers from the University of Bristol who developed the ELLI questionnaire. The scores reported by Deakin Crick and Yu (2008) for the meaning making, changing and learning, critical curiosity, strategic awareness and learning relationships dimensions in 19+ year olds were in the same ranges of values, and only the scores for creativity and resilience were higher, in the sixties rather than the fifties. The outcomes of a unique collaborative project on 'Personal Development in Higher Education' based on the use of the ELLI questionnaire (Small and Deakin Crick, 2008) showed mean scores for meaning making and changing and learning in the seventies, for critical curiosity and strategic awareness in the sixties, and for learning relationships, creativity and resilience in the fifties, for a much larger sample of students consisting of 1879 students from 12 universities (including Northumbria University), and 9 meta-disciplines.

It is proposed that these similarities in mean scores for the majority of the learning dimensions validate the results obtained for this comparatively small group of students, all from the same subject discipline, and add value to the other outcomes of this pilot study.

The main question asked by the authors of this study was a rather different and interesting one: whether the ELLI scores obtained at the start of a new course or at some point in time during the course can be a reliable predictor for academic success, measured by grades obtained for summative assessments later on during the programme of study.

Based on the comparative analysis of the three academic performance groups described in the results section, the answer to this first question was no, not really. The results presented in Table 2 and Figure 1 showed that the students assigned to the satisfactory performance group were those who had

the highest initial scores for the majority of the learning dimensions, followed by the scores of those in the unsuccessful group, and then of those in the successful group. This was no great surprise since the students came to Northumbria with different academic backgrounds, with first degrees in subjects ranging from French to Biomedical Sciences and had acquired a variety of teaching and learning experiences.

The relationships between the ELLI learning dimensions and academic performance were explored on a much larger scale in the 'Dispositions to Stay' project, led by Northumbria University, involving students from a variety of academic programmes from three UK universities (Harding *et al.*, 2010). Weak correlations were reported and student success, as measured by the mean mark at the end of the academic year was found to be significantly correlated only with two of the seven ELLI learning dimensions: critical curiosity and meaning making (Harding *et al.*, 2010).

A similar comparative analysis between academic performance groups applied to the results of the second ELLI (taken mid-term, after several weeks of study at Northumbria University) was not very conclusive, either, but began to suggest that some changes in learning power had taken place within the academic performance groups, because for the second ELLI the successful group displayed the highest scores for three learning dimensions: changing and learning, strategic awareness and learning relationships, instead of only one, as for the first ELLI (strategic awareness).

The pair-wise analysis of the scores for the first and second ELLI revealed that a more likely marker for success is the magnitude of the increase in learning power, rather than the actual numerical value at a given point in time.

The group of medical students as a whole showed an overall significant increase in the mean ELLI score from 65.2 to 69.3, with significant increases of 6-8 points in the scores for three learning dimensions: critical curiosity, creativity and strategic awareness and slightly lower increases in the scores for three other dimensions: changing and learning, meaning making and learning relationships. These overall findings were similar to those described by Small and Deakin Crick (2008), who reported significant increases in the scores for the same six learning dimensions as this study (all apart from resilience). However, the magnitude of the increases was slightly lower in their study, varying from 3.9 points for changing and learning, to 1.5 points for learning relationships. A similar pattern of change was observed when the

sub-sample of students from Northumbria University who participated in their study was analysed separately (Small and Deakin Crick, 2008).

The outcomes became more interesting when further data analysis, carried out separately for each academic performance group, revealed that the significant increase in the overall score was due mainly to increases in the scores of the students in the successful group, from 62.6 to 69.9, who made improvements of between 6.9 and 13 points for all learning dimensions, with the exception of resilience. Of these, the increases for meaning making and creativity were the largest and were statistically significant. The satisfactory performance and the unsuccessful groups had lower increases in the scores for critical curiosity and strategic awareness and decreases in the scores for three or four other learning dimensions, such as learning relationships and resilience.

In this study only the successful students showed improvements in six out of the seven dimensions. As mentioned above, these included critical curiosity, creativity and strategic awareness. Critical curiosity is described as the learner's orientation to develop as a deep learner and making this change from surface to a deeper approach allows for long-term retention of knowledge and an improved motivation for learning (Schwartz, Mennin and Webb, 2001). However, this study is not alone in making an association between deeper learning and academic success; others have made a similar observation in medicine (McManus *et al.*, 1998). Contrary to these findings, an earlier study reported that although high achieving students were self-confident and competitive they were reluctant to engage in collaborative learning and those high workloads encouraged a surface learning approach and teacher dependence (Raidal and Volet, 2009).

Those who seek to be more creative, explore more engaging and pro-active forms of learning resulting in improvements in their imagination and intuition. Successful students were found to experiment frequently with visual imagery including pictures, diagrams and concept maps to improve their learning.

Strategic awareness develops as learners become more aware of the ways they learn by experimenting with different approaches to improve both self-reflection and self-evaluation. A type of rigid, prescriptive professional programme, where coursework is predetermined and credit loads maximised contributes to the perception that students' lives are to a large extent externally controlled (Zenner *et al.*, 2005). There is much need within programmes such as ours for the learners to enhance their learning autonomy which is essential for successful performance prior to graduation

and for continued lifelong learning after graduation (Raidal and Volet, 2009). The ELLI questionnaire was proved once more to be a valuable tool for this process.

The results presented in this article support the idea that the learning dispositions can change in response to intervention, as shown by the extensive work of Deakin Crick and collaborators for both secondary school pupils (Deakin Crick and Yu, 2008) and higher education students (Small and Deakin Crick, 2008; Thompson, 2009; Thompson, 2010).

The changes in the learning dispositions of the study group were driven by core practices facilitated by the strong academic and pastoral support system that defined the means employed to achieve academic success throughout the term. These practices included the adherence to a prescriptive practice framework, incorporating both daily and weekly study skills and the development of their own learning resources. More work is needed to investigate whether these three key characteristics were evident in those students who consistently performed well.

The large and significant increases in the mean scores for meaning making and creativity found amongst the successful academic performance group suggested that the core practices recommended to the medical students had a positive impact on these learning dispositions. The mean score for the learning relationships dimension increased only amongst the successful group, and decreased for the satisfactory and unsuccessful groups. This disposition concentrated on flexible adaptation by working alone or within a group and indicated that the successful students recognised the value of collaborative learning situations and embraced opportunities to exchange information. This type of behaviour (group learning) was measured within the dimension of learning relationships and exemplified the cognitive benefits of social and collaborative forms of learning embedded into the curriculum in the form of peer-assisted learning. The importance of establishing effective learning relationships with other students and with academic staff has been recently identified as a key factor for student retention and academic success (Thompson and Harding, 2011).

Although the authors of this article do not align wholly to the belief that a process of rigorous reinforcement of key study skills and development of own learning resources is solely the route to success, and agree that there are, of course, student-specific predispositions such as their personality, age, gender, study experience (Vermunt and Vermetten, 2004), they are not alone in emphasising that reinforcement of study skills is known to lead to

improvements in independent learning, communication skills and reflective practice (Dearnley and Matthew, 2007).

The results presented do not enable yet the authors to write a prescription for success, but what this exploratory study did do very clearly was to confirm the key characteristics of successful learners described by several other authors and show that as a group, the successful students displayed the largest increases in the learning dispositions measured through the ELLI questionnaire. This suggests that the extent of the malleability of the learning dispositions is dependent on the interaction between personal attributes and the characteristics of the learning environment and could be used as an indicator of success. Large increases in the ELLI scores after a period of study may show that an individual is well on the pathway to success. At the same time, small or negative changes in learning power could be used as triggers for additional or different interventions to support individual learners or groups of learners. This leads on to the final recommendation of this article, that more students and more teaching practitioners should be introduced to ELLI.

Conclusion

This article has reported the outcomes of a study designed to explore the relationship between the ELLI dimensions and academic success. Academic success was identified as a cumulative grade point average of greater than 3.0. Students who were recognised as successful had increased their learning power in six out of the seven dimensions assessed by the ELLI questionnaire. Those making satisfactory academic progress and those who were unsuccessful showed lower increases in some of the learning dimensions and even decreases in others. The ELLI questionnaire should be used more by both learners and practitioners, to explore further the relationships between interventions, individual or group learning power and academic success.

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