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Do 'Top Up' students on computing courses think deeply?

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Background and rationale

For the last four years the School of Computing and Information Technology (SCIT) has offered a degree conversion programme from HND to degree, which is becoming increasingly popular, especially with students from local FE colleges. In addition about 15% of the students are recruited from overseas. However, the students on the 'Top Up' programme have demonstrated difficulty with the more academic aspects of their course, especially the individual project, which is taken in semester 2. Although the students rarely failed the project, the marks achieved were substantially lower than those they obtained for other modules, in particular modules that were more practically focussed. This was to be expected given the vocational nature of these students' previous studies.

In their first semester of the degree conversion programme, the students take a core module in Professional Aspects of Computing (PAC). As well as introducing them to professional issues associated with work in an IT environment, this module was designed to improve their key and intellectual skills, especially those required to complete the project successfully such as literature search, referencing and critical evaluation. An improvement in the project marks had been recorded in each of the three previous years through increasing emphasis on those skills in the PAC module.

Consideration of current educational research about learning styles led the award team to reflect on whether the students' learning styles could be an underlying issue in their struggling with the more academic aspects of the course. Marton and Saljo (1976) identified two contrasting approaches to learning: deep and surface, subsequently extended to include a third, strategic, approach (Entwistle, 1987). It is accepted, however, that strategic learners may also be either deep or surface learners. A deep approach to learning is believed to correlate with increased academic success. Entwistle (2000) defined a successful student as one who adopts a deep, strategic approach with no surface, apathetic elements. Initially, in this field of research, assessment of student learning style was by means of interview but that was superseded by inventory, 'Approaches to Studying Inventory, ASI' (Entwistle and Ramsden, 1983). Refinement of ASI led to the development of 'ASSIST, Approaches and Study Skills Inventory for Students' (Tait *et al.* 1998).

The research

This research formed a pilot study based on one module, PAC, using a methodology based on that of Fazey and Lawson (2001). The Top Up group was tested at the start and finish of the module using a version of the aforementioned, established educational measure, ASSIST (ETL Project, 2001). 61 students completed the pre-test, which was all but 1 of those initially registered for the module, and 57 of those the post-test. The other 4 omitted to complete ASSIST in the appropriate session. It was delivered by questionnaire, which was customised for the specific purposes and conditions of this study, as indicated by Richardson (2000).

The questionnaire was piloted with 3 students from the previous year's cohort, who suggested adjustments to the wording of the questions, to make them more meaningful to our students. In doing this some of the subtlety of the original may have been lost, and the SCIT study was rendered non-comparable with other studies based on ASSIST conducted elsewhere. However, it was important that the Top Up students answered the questions as accurately as possible, and were not deterred by wording composed for undergraduates at the University of Edinburgh.

Thus, question B11 became, 'I try to relate ideas I come across to ideas from other modules,' from 'I try to relate ideas I come across to those in other topics or other modules whenever possible.' Several references to 'books' in section C were changed to 'learning materials'. Despite these changes to the wording of individual questions, the order of questions was unchanged, with one exception: 'lecturers who encourage us to think for ourselves and show us how they themselves think' was split into two separate items and scored as the average of the two responses.

The data obtained by questionnaire was analysed using the statistical package SPSS¹, to determine whether any changes in learning style occurred during semester 1, in the context of the PAC module. It was anticipated that a shift would occur towards deep and away from surface learning, with a subsequent improvement in the project grades.

To achieve this outcome the learning environment of PAC was modified, the better to foster a deep approach to learning. Wherever possible it adopted the teaching methods advocated by Gibbs (1992), e.g. use of active and problem-based learning, as well as an assessment strategy which rewarded students adopting a deep as opposed to surface approach. For instance, the assessment strategy, which consisted of 100% coursework, replaced a presentation with a *viva voce* examination. Furthermore, successful completion of assessment elements required students to adopt a holistic understanding of the module contents.

The outcomes

The main part of the ASSIST questionnaire comprises 52 questions, each of which is to be answered on a 5 point scale from 5 = 'definitely agree' to 1 = 'definitely disagree'. 13 sub-scores are calculated by summing the replies to 4 questions, so a responder could achieve a maximum of 20 and a minimum of 4 for each sub-score. The sub-scores are listed in Table 1 which is situated in the Appendix.

Four sub-scores are then added to determine each of the deep (DA) and surface apathetic approach (SAA) scores; 5 sub-scores are added for the strategic approach (SA) score. The maximum score for each of the deep and surface apathetic approaches as a whole is thus 80, with 100 for the strategic approach. Notice that we used the same questionnaire items as the ETL Project (2001) to create each sub-score, although as mentioned above some of the question wording had been amended.

The totals for the three approaches are given in the first three rows of Table 1. Columns 2 – 4 of Table 1 give the sample minimum, maximum and mean for each scale total for the Top Up group at the start of the module. The same measures are then provided for each sub-scale.

ASSIST also records, by means of 4 questions, each responder's preferences for different types of course and teaching: a style which simply transmits information correlates to a

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surface apathetic approach and a style which enhances understanding correlates to a deep approach. Sample statistics for these are given at the bottom of the table.

Table 1, column 5, records the range of values for the 3 members of staff teaching on the professionalism module and column 6 records for comparison data obtained in semester 1 for a group of 97 first year SCIT undergraduates.

Comparison of data for the Top Up group with that of the 3 staff teaching the PAC module was used to assess whether ASSIST could be used with confidence as a measuring instrument for learning style. The staff values were higher than student means for all sub-scales associated with deep learning and with a preference for supporting understanding. Conversely, the staff values were lower for surface apathetic learning and a preference for transmitting information, except that the staff exhibited greater lack of purpose, i.e. the staff were less committed than the students. Examination of the data reveals that this is because the students were exhibiting great, and almost certainly unsustainable, enthusiasm for the course in week 1, rather than lack of commitment by the staff. Within strategic approach, the staff scored higher on the organised studying, time management and monitoring effectiveness sub-scales. There was no distinction between staff and students on the sub-scales for alertness to assessment demands and achieving orientation. These figures are in accordance with expectation, and hence indicate that ASSIST is a valid measuring instrument.

Figures obtained from a different study, using the same version of ASSIST, with 97 first year SCIT undergraduates are given for comparison, obtained from Lynda Holland: a project comparing learning style with performance on WOLF. The first year students were weaker in all aspects of the deep approach and all but one aspect of the strategic approach. They scored higher for all aspects of the surface apathetic approach. This could indicate that the two years the Top Up students had already spent in higher education had improved their learning style; it could reflect the fact that the Top Ups, who had progressed from the HND, had been among the better achievers on the HND, associated with a deep, strategic approach; or it could be a reflection on the quality of SCIT intake in different years.

Table 2 (Appendix) records the changes which occurred in the group's learning styles between week 1, semester 1, and week 13, semester 1. There was a statistically significant change in 3 out of 13 sub-scales and in 1 preference. 3 of the significant changes were associated with an improvement in learning style: increased importance attached to use of evidence, increased awareness of the importance of organised studying and a decrease in preference for a teaching style favouring transmitting information. More worryingly there was a significant change towards increased lack of purpose. However, closer examination of the data revealed that, as stated earlier, optimism was very high at the start of the course. For most students motivation remained high at the end of semester 1, but for a few their optimism had dwindled somewhat.

The Top Up group were subdivided into distinct cohorts depending upon their previous course: University of Wolverhampton HND, HND obtained from another institution in the UK, and overseas including discrete groups from France and Italy. (There was also a group from Shenzhen Polytechnic, but they were omitted from this research as they took a slightly different, but significant for this study, programme of modules.) It was decided to examine the data further by cohort to identify any trends, in particular whether any one group was demonstrating a pronounced reduction in motivation. The overseas groups were however too small on their own to generate meaningful data. Statistically significant changes are given in Table 3 (Appendix) and it can be seen that there are no universal trends registered.

It is reasonable to infer from the data that a shift occurred towards a deep and a more strategic approach to studying in the Top Up group as a whole during semester 1. However,

their semester 2 project results did not improve because a significant number of students deferred completion of their project until semester 3 of the course. There were three possible reasons for this, unrelated to this research. First, the SCIT project co-ordinator changed the project requirements, so that they became more exacting for this group. Second, as an external examiner observed, a universal trend in higher education, especially in post-92 universities, is towards students having less time for their studies as many are also in full-time employment. Third, there was a change of award leader for the Top Up group; the new award leader was more sympathetic than the previous one to students wishing to defer completion of their project.

Three aspects of the end-of-year results were analysed: the grade for the PAC module, the grade for the project (recorded as 0 if a project had not been submitted on time) and the arithmetical mean of the grades for all modules. Analysis of these measures showed a strong positive correlation between PAC grade and mean grade, but no correlation between the project grade at this stage and other results.

Finally, the learning style results were compared to the end-of-year results. These are summarised in Table 4 (Appendix). The grade obtained on Professional Aspects of Computing and the overall grade were both slightly but significantly (or in two cases “suggestively”, i.e. with P values between .1 and .05) correlated positively to a deep approach, to a strategic approach and to a preference for supporting understanding. They were negatively correlated to a surface apathetic approach. There were no significant correlations with the incomplete project grade data, nor with the change in the “lack of purpose” subscale mentioned earlier.

Benefits

The results of this pilot study indicate a relationship between a deep approach and a strategic approach to studying and increased academic success for the Top Up Computing students. They further demonstrate that improvements in learning style can be developed by use of appropriate teaching and assessment practices. This is, however, research in progress so the results should be viewed with caution; it is intended to repeat this study to validate these conclusions.

ASSIST has proved to be a valid and robust research instrument and is being utilised in other related studies in SCIT.

Lessons have been learned about improved teaching and assessment practices linked to the development of a deep approach to studying.

Future developments

As stated earlier this research is being progressed, looking more specifically at first year students and additionally to work-based learning. It is intended to relate the conclusions in relation to the first years, to a SCIT project examining issues affecting retention of first year Computing students.

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Appendix

Table 1

Descriptive statistics – at start of semester 1

	Minimum	Maximum	Mean	Staff	Year 1
Scale totals					
Deep approach (/80)	40	76	58.3	63 - 76	55.8
Strategic approach (/100)	47	90	74.2	77 - 85	72.1
Surface apathetic approach (/80)	23	66	45.8	36 - 40	47.6
Subscales of Deep approach					
Seeking meaning	9	20	14.8	16 - 19	14.1
Relating ideas	9	20	14.6	16 - 18	14.1
Use of evidence	8	20	14.2	15 - 20	13.4
Interest in ideas	9	20	14.9	15 - 19	14.2
Subscales of Strategic approach					
Organised studying	5	18	13.2	16 - 18	12.5
Time management	8	20	14.6	16 - 20	14.2
Alertness to assessment	10	20	14.5	12 - 16	14.0
Achieving	11	20	16.3	14 - 18	15.3
Monitoring effectiveness	10	20	15.7	16 - 17	16.1
Subscales of Surface apathetic approach					
Lack of purpose	4	14	8.2	8 - 9	8.3
Unrelated memorising	6	18	11.6	8 - 11	12.5
Syllabus boundedness	6	18	12.2	7 - 10	12.6
Fear of failure	5	20	13.7	11 - 13	14.2
Preferences					
Supported understanding	10	20	15.2	16 - 20	15.0
Transmitting information	8	20	16.3	8 - 14	16.4
Sample size	61	61	61	3	97

Table 2**Descriptive statistics – change during semester 1**

	Minimum	Maximum	Mean	Std. Dev	P-value
Scale totals					
Deep approach	-16	14	0.91	6.35	> 0.1
Strategic approach	-15	19	0.72	7.30	> 0.1
Surface apathetic approach	-13	24	0.60	7.84	> 0.1
Subscales of Deep approach					
Seeking meaning	-6	5	-0.19	2.55	> 0.1
Relating ideas	-6	4	0.12	2.11	> 0.1
Use of evidence	-4	7	0.74	2.39	< 0.05
Interest in ideas	-9	5	0.25	2.60	> 0.1
Subscales of Strategic approach					
Organised studying	-7	8	0.70	2.53	< 0.05
Time management	-4	6	0.04	2.33	> 0.1
Alertness to assessment	-5	6	0.26	2.50	> 0.1
Achieving	-4	4	-0.14	2.03	> 0.1
Monitoring effectiveness	-5	7	-0.14	2.20	> 0.1
Subscales of Surface apathetic approach					
Lack of purpose	-5	9	1.00	3.33	< 0.05
Unrelated memorising	-7	10	-0.11	2.66	> 0.1
Syllabus boundedness	-5	11	0.12	3.27	> 0.1
Fear of failure	-6	6	-0.42	2.56	> 0.1
Preferences					
Supported understanding	-5	4	0.10	2.03	> 0.1
Transmitting information	-11	5	-1.02	3.29	< 0.05
Sample size	57	57	57	57	

Table 3**Significant changes by cohort**

Cohort	No of students	Use of evidence	Organised studying	Lack of purpose	Transmitting information
Wolverhampton Uni.	36	+	+	+	-
Other UK	12		-	+	-
Overseas	9		+		

+ indicates significant increase in mean score

- indicates significant decrease in mean score

Table 4**Correlations (Pearson's r) between results and selected measures (n = 57)**

		PAC grade	Project grade	Mean grade
Scale totals at start				
Deep approach	r	.267	.058	.365
	P-value	.045	.667	.005
Strategic approach	r	.223	.089	.335
	P-value	.095	.511	.011
Surface apathetic approach	r	-.332	-.083	-.397
	P-value	.012	.539	.002
Preferences at start				
Supported understanding	r	.288	.077	.250
	P-value	.030	.567	.061
Transmitting information	r	.187	-.101	.050
	P-value	.163	.455	.714
Change in sub-scale				
Lack of purpose	r	-.101	.097	-.041
	P-value	.455	.472	.759

ASSIST

Approaches and Study Skills Inventory for Students (SCIT Version 2a)

This questionnaire has been designed to allow you to describe how you go about learning and studying. The technique involves asking you a substantial number of questions which overlap to some extent to provide good overall coverage of different ways of studying. Most of the items are based on comments made by other students. **Please answer all the questions.**

EnrolmentNo:.....

A. What is learning?

When you think about the term “LEARNING”, what does it mean to you?

Please rate each of these statements in terms of how close they are to your own way of thinking about learning by circling one number for each statement.

5 means “very close to my way of thinking” 1 means “very different to my way of thinking”

	Very close				Very different
a. Making sure you remember things well.	5	4	3	2	1
b. Developing as a person.	5	4	3	2	1
c. Building up knowledge by acquiring facts and information.	5	4	3	2	1
d. Being able to use the information you have acquired.	5	4	3	2	1
e. Understanding new material for yourself.	5	4	3	2	1
f. Seeing things in a different and more meaningful way.	5	4	3	2	1

B. Approaches to studying

The next part of this questionnaire asks you to indicate your agreement or disagreement with comments about studying. Please work through the comments, giving your immediate response by circling one number. In deciding your answers, think in terms of your experience on your present course.

5 means “definitely agree”

1 means “definitely disagree”

	Agree					Disagree
1. I manage to find conditions for studying which allow me to get on with my work easily.	5	4	3	2	1	
2. When working on an assignment, I keep in mind how best to impress the marker.	5	4	3	2	1	
3. Often I find myself wondering whether the work I am doing here is really worthwhile.	5	4	3	2	1	
4. I try to understand for myself the meaning of what we have to learn.	5	4	3	2	1	
5. I try to organise my study time carefully to make good use of it.	5	4	3	2	1	
6. I find I have to memorise a lot without really understanding it.	5	4	3	2	1	
7. I go over the work I have done carefully, to check that it is accurate.	5	4	3	2	1	
8. Often I find the amount of material we are having to cope with is too much.	5	4	3	2	1	
9. I try to look at the evidence carefully and reach my own conclusion.	5	4	3	2	1	
10. It is important for me to feel that I am doing as well as I can.	5	4	3	2	1	
11. I try to relate ideas I come across to ideas from other modules.	5	4	3	2	1	
12. I tend not to read much beyond what is needed to pass.	5	4	3	2	1	
13. I find myself thinking about ideas from lectures when I am doing other things.	5	4	3	2	1	
14. I think I am quite systematic and organised when it comes to revising for exams.	5	4	3	2	1	
15. I look carefully at tutors' comments on course work to see how to get higher marks next time.	5	4	3	2	1	
16. I find much of the work uninteresting or irrelevant.	5	4	3	2	1	
17. When I read, I try to find out exactly what the author means.	5	4	3	2	1	
18. I am pretty good at getting down to work when I need to.	5	4	3	2	1	

	Agree				Disagree
19. Much of the material I am taught makes little sense at the time.	5	4	3	2	1
20. I try to keep focused by thinking about what I want to get out of the module.	5	4	3	2	1
21. When I am working on a new topic, I try to understand how the ideas fit together.	5	4	3	2	1
22. I often worry about whether I'll be able to cope with the work.	5	4	3	2	1
23. I often question things I hear in lectures or read in books.	5	4	3	2	1
24. I put more effort into the work when I feel I am getting on well.	5	4	3	2	1
25. I concentrate on learning just what I need to know to pass.	5	4	3	2	1
26. I find that study can be quite exciting at times.	5	4	3	2	1
27. I am good at following up some of the reading suggested by lecturers or tutors.	5	4	3	2	1
28. I keep in mind who is going to mark an assignment and what they will look for.	5	4	3	2	1
29. I sometimes wonder why I came here.	5	4	3	2	1
30. When I am reading, I stop from time to time to reflect on what I am trying to learn.	5	4	3	2	1
31. I work steadily through the semester, rather than leave it all until the last minute.	5	4	3	2	1
32. I am not really sure what is important in lectures so I try to make as many notes as I can.	5	4	3	2	1
33. Ideas in course books or articles often inspire my own thoughts.	5	4	3	2	1
34. Before I start work on an assignment or exam question, I think about the best way to solve it.	5	4	3	2	1
35. I often seem to panic if I fall behind.	5	4	3	2	1
36. When I read, I examine the details carefully.	5	4	3	2	1
37. I put a lot of effort into studying because I am determined to do well.	5	4	3	2	1
38. I gear my studying closely to just what is required for assignments and exams.	5	4	3	2	1
39. Some of the ideas I come across on the course I find really interesting.	5	4	3	2	1
40. I usually plan out my week's work in advance, either on paper or in my head.	5	4	3	2	1
41. I keep an eye open for what lecturers think is important and concentrate on that.	5	4	3	2	1

	Agree					Disagree				
42. I am not really interested in the course, but had to take it.	5	4	3	2	1					
43. Before tackling a problem or assignment, I try to work out what the real meaning is.	5	4	3	2	1					
44. I generally make good use of my time.	5	4	3	2	1					
45. I often have trouble in making sense of the information I have to remember.	5	4	3	2	1					
46. I like to develop my own ideas even if they don't get me very far.	5	4	3	2	1					
47. When I finish a piece of work, I check to see that it meets the requirements.	5	4	3	2	1					
48. I sometimes lie awake worrying about work I think I won't be able to do.	5	4	3	2	1					
49. It is important for me to follow the argument and understand the reasoning behind it.	5	4	3	2	1					
50. I do not find it difficult to motivate myself.	5	4	3	2	1					
51. I like to be told what to do in essays and assignments.	5	4	3	2	1					
52. Some academic topics are so interesting that I would like to keep on studying them.	5	4	3	2	1					

C. Preferences for different types of course and teaching

5 means “definitely like” 1 means “definitely dislike”

	Like					Dislike
a. Lecturers who tell us exactly what to write down in our notes.	5	4	3	2	1	
b. Lecturers who encourage us to think for ourselves.	5	4	3	2	1	
c. Lecturers who show us how they think themselves.	5	4	3	2	1	
d. Exams which allow me to show that I have thought about the course material.	5	4	3	2	1	
e. Exams or tests which need only the material provided in the lecture notes.	5	4	3	2	1	
f. Modules in which it is made very clear which learning materials we have to use.	5	4	3	2	1	
g. Modules where we are encouraged to read around the subject.	5	4	3	2	1	
h. Learning materials that challenge me and provide deeper explanations.	5	4	3	2	1	
i. Learning materials giving straightforward information.	5	4	3	2	1	

Thank you very much for spending time completing this questionnaire: it is much appreciated.