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ABSTRACT

The current stage in an on-going research program of student learning is summarized. With two more years to run, provisional research provides the beginnings of a model of student learning which is neither static nor mechanistic. Recent research has placed emphasis on describing how students learn and how learning is affected by the academic environment. Three stages of learning are described (intention, process, and outcome), and serialist and holist learning styles are contrasted. Serialists rely on facts, and the logical relationship between them, in building up understanding (operation learning). The holist strategy involves building a conceptual map through complex ideas in which links are actively sought with previous experience (comprehension learning). A questionnaire has been developed, the first part containing items assessing dimensions related to the studying process, and the second part being a set of items indicating students' perception of their major department. The final part of the research program examines the extent to which students differ in personality characteristics. The outcome is intended to be a student learning model which can be computer simulated. (GK)

MOTIVATION, STYLES OF LEARNING, AND THE ACADEMIC ENVIRONMENT

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SUMMARY

Earlier research has demonstrated that previous scholastic attainment, motivation, study methods, and introversion all contribute to the prediction of academic performance in higher education. But the level of individual prediction is low. More recent research has examined important differences in the processes by which students learn. They approach learning with different intentions derived from previous experience. These intentions fundamentally affect whether a deep or surface level process is adopted in, for example, reading an academic article. Without a deep approach, thorough understanding is impossible. However, students adopting a deep approach may seek understanding in contrasting ways, using holist or serialist styles of learning. Each approach to learning appears to be related to characteristically different motivations, and is affected by aspects of the learning environment. The style of learning seems to be, in part, a facet of the personality of the individual student, but also a response to the academic tasks set, and the expectations of differing departments. On-going research is tracing interactions between students and their academic environments, in relation to differences between subject areas and among students of contrasting personality type. The outcome is intended to be a dynamic model of student learning, capable of computer simulation, and useful in underpinning the development of study skill programmes.

* The ideas reported in this paper depend on work by colleagues at Lancaster over a ten-year period, in particular by Sarah Burkinshaw, Maureen Hanley, Dai Hounsell, Keith Percy, Paul Ramsden, and Jennifer Thompson.

INTRODUCTION

This paper summarizes the current stage reached in an on-going programme of research into student learning. Although the research still has two years to run, provisional results provide the beginnings of a model of student learning which is neither static nor mechanistic. As such a model may have a considerable appeal to practising teachers, particularly those in higher education, it seems worthwhile to indicate preliminary findings and possible implications prior to the final report.

Earlier research at Aberdeen and Lancaster (Entwistle and Wilson, 1970; Entwistle and Entwistle, 1970) had developed scales of motivation and study methods which showed consistent correlations with academic performance. In a large-scale investigation of seven British universities (Entwistle and Wilson, 1977) attempts at improving the prediction of academic attainment were only partially successful. Although significant correlations were obtained between degree results and several predictors measured in the first year (scholastic attainment, academic aptitude, motivation, study methods and introversion), levels of overall prediction were generally disappointingly low. However, the use of cluster analysis revealed the existence of contrasting paths towards academic success (Entwistle and Brennan, 1972; Entwistle and Wilson, 1977) which to some extent, explained the lack of overall predictability. Interviews with students confirmed the existence of contrasting types of motivation (Entwistle, Thompson and Wilson, 1974), similar to Atkinson's 'hope for success' and 'fear of failure' (Atkinson and Raynor, 1974). It appeared that students dominated by fear of failure adopted what would have been described as ineffective study methods, yet their overall level of success was still quite high. Thus the next stage in the research was to examine variations in the processes of studying and learning.

Processes of Studying

Although it was already clear from this earlier, mainly psychometric, research that students with contrasting types of motivation used different strategies in coping with the demands of their academic environment, it was difficult to identify the precise nature of these differences. More recent research at Lancaster, and elsewhere, has placed greater emphasis on interviews and qualitative analysis in trying to describe how students learn and how the academic environment affects their learning strategies.

The current research at Lancaster has drawn substantially on the work of Marton in Gothenburg, Pask in London, and Biggs in Newcastle, Australia. Each of these research workers has contributed significantly to the view of student learning which is now emerging.

In conceptualising student learning it is useful to distinguish three stages - intention, process, and outcome. Marton (1976) has demonstrated the functional relationship which exists between these three stages. He finds that students who adopt a deep approach to, say, reading an academic article - who intend to understand it - are active in their learning process, examining facts in relation to conclusion, and generally reach a deep level of outcome (thorough understanding). In contrast a surface approach involves an intention to identify important facts or ideas and to memorize these. The surface approach prevents a student from obtaining an overall grasp of the author's meaning.

What is missing from Marton's description of these distinctive approaches to learning, is the recognition that the intention to understand may still lead to characteristically different learning processes. Pask (1976) has contrasted serialist with holist styles of learning. A student using a serialist strategy relies on facts, or single ideas, and the logical relationship between them, in building up understanding (operation learning). This produces a self-contained and narrowly constrained view of the topic being learned. In contrast the holist strategy involves building up a conceptual map of the topic (comprehension learning) through analogies, illustrations, anecdotes, and complex ideas in which links are actively sought with previous experience and other areas of knowledge. The perspective built up in this way is broad, but may be lacking in logical progression and detailed evidence. In fact both types of process - description building and operation building - are necessary to develop full understanding (see Entwistle, 1978). Pask argues that many students exhibit characteristic learning pathologies through their tendency to prefer one or other of the styles of learning. Serialists, by ignoring important interconnections between ideas, exhibit improvidence, while holists, through failing to give sufficient attention to detail, may lapse into globetrotting - seeing inappropriate connections between ideas. Some students are able to use a versatile style, choosing whichever strategy is most appropriate to each task, but most students seem to rely more on one or other of the more restricted styles. Pask has also found that if students who use extreme styles are deliberately matched or mismatched

with learning materials which have been developed in terms of either holist or serialist principles, there are very large differences in how readily and effectively they learn.

Biggs (1979) has developed a questionnaire through which students are asked to report their typical study processes. Initially Biggs found it necessary to use 10 dimensions to describe various aspects of studying. Subsequently he identified three second-order factors, each of which had its own associated form of motivation. The students were describing orientations towards meaning or understanding, reproducing or rote learning, and achieving. Meaning orientation was linked to intrinsic motivation (learning for learning's sake), reproducing went with extrinsic motivation (obtaining a qualification), and with fear of failure, while, perhaps tautologically, achieving was associated with achievement motivation (hope for success). Here the link with the previous research at Lancaster becomes clear; students with contrasting motivations adopt different study strategies. And the link with Marton's ideas is also evident, although the programmes of research had developed entirely independently.

A model of the learning process

The more recent research at Lancaster has developed in two directions. The first was an extension of the psychometric approach to include the dimensions now shown to be more useful in describing study processes. The second involved the use of semi-structured interviews to determine the extent to which students were consistent in their approaches to studying, and to examine how these approaches were affected by the academic demands made by different departments.

The questionnaire developed at Lancaster is in two parts. The first section contains items which assess up to sixteen* dimensions related to the process of studying; the second is a set of items designed to indicate how students perceive their major department. In one study this questionnaire was given to 767 first year (second term) students from nine departments in three universities. Principal components analysis (using the SPSS program) was used, followed by rotation to oblique simple structure. The analyses were carried out separately for arts, social science, and science students, but the factor structure showed little inter-faculty variation.

* the number of scales has varied from version to version as the inventory has been developed

Table 1* thus presents the factor structure matrix for the fifteen scales in this inventory for the complete sample. Four factors had eigen values of above unity and these explained 56% of the overall variance in the correlational matrix.

TABLE I: Factor Loadings of Study Strategy Scales

	I	II	III	IV
Deep approach	62		33	
Comprehension learning	73			
Intrinsic motivation	54		47	
Internality	61			
Openness	50			
Surface approach		67		
Operation learning		67		
Extrinsic motivation		61		
Fear of failure		36		-32
Syllabus bound	-41	50		
Strategic approach		41		
Organised study methods			64	
Achievement motivation		36	45	
Disillusioned attitudes			-55	
Sociability				58

The four factors can be described as follows.

I *Deep Approach/Comprehension Learning*

This factor is very close to Bigg's "internalising". It carries the same emphasis on intrinsic motivation and active search for personal meaning, but it contains its highest loading on comprehension learning. This factor may thus be considered to contain a stylistic component in addition to those elements identified by Biggs.

* Table 1 and Figure 1 and their descriptions were initially published in Higher Education, 1979, Volume 8 Number 4, pages 372 & 376.

II *Surface Approach/Operation Learning*

This shows a close similarity to the "utilising" factor. It shows high loadings on surface level approach and also on extrinsic motivation, syllabus-boundness and fear of failure. But again the high loading on operation learning could imply an additional stylistic component.

III *Organised, Achievement-Orientated Studying*

This is the "achieving" factor with high positive loadings on organised study methods and achievement motivation, and a high negative loading on disillusioned attitudes. There are also significant loadings on both deep approach and intrinsic motivation without any hint of a stylistic component in this case.

IV *Stable Extraversion*

The final factor appears to be a combination of the two most basic personality traits described by Eysenck (1970). A similar factor was reported earlier in work on primary school children where scales of both motivation and personality were included (Entwistle and Bennett, 1973). It is essentially stable extraversion.

This analysis appears to support the claim by Biggs that three second-order factors

> "seem to offer a parsimonious and theoretically coherent model for conceptualising the more important ways in which students may feel about, and behave towards, their study" (Biggs, 1979, p. 383).

The only reservation which should be added on the basis of the Lancaster analyses would be that it may be important to take account of stylistic differences in study processes which were not included in the Biggs inventory.

If we now return to the descriptions given by Marton and Pask of the deep and surface approaches and the holist and serialist styles of learning, the pattern of empirical relationships shown in Table 1 suggests a way of integrating the two sets of ideas into a more complete way of interpreting student learning. Figure 1 presents a framework which is necessarily tentative at this stage of our research, but which fits the empirical findings so far obtained.

FIGURE 1

Factor	Orientation and intention	Motivation (personality type)	Approach or style	Process		Outcome
				Stage I	Stage II	
I	Understanding	Intrinsic (Autonomous and syllabus-free)	Deep approach/	All four processes below used appropriately to reach understanding		Deep level of understanding
			Comprehension learning	Building overall description of content area	Reorganising incoming information to relate to previous knowledge or experience and establishing personal meaning	Incomplete understanding attributable to globetrotting
II	Reproducing	Extrinsic and fear of failure (Anxious and syllabus-bound)	Operation learning	Detailed attention to evidence and steps in the argument	Relating evidence to conclusion and maintaining a critical, objective stance	Incomplete understanding attributable to improvidence
			Surface approach	Memorisation	Overlearning	Surface level of understanding
III	Achieving high grades	Hope for success (Stable, self-confident, and ruthless)	Organised/ achievement orientated	Any combination of the six above processes considered appropriate to perceived task requirements and criteria of assessment		High grades with or without understanding

Categories describing distinctive approaches to learning

The first three columns of the diagram describe the factor structure of the inventory, while the fourth column indicates the overlap that was found between approach and style of learning. The main advance provided by this figure is to isolate four distinct processes of learning, all of which are essential to a deep level of understanding. These processes are shown as occurring in two stages. The first stage involves initial attention either to the overall description (comprehension learning) or to the details of the evidence and to steps in the argument (operation learning). This initial focus of attention leads on to the second stage of considering relationships, which may involve either examining links between ideas or concepts and with personal experience (comprehension learning), or the way pieces of evidence fit together to build up a logical argument (operation learning). To reach a deep level of understanding all four processes would normally be required, but our factor analyses suggest a tendency for each factor identified to have a pathology, as well as a desirable attribute. The orientation towards understanding may be accompanied by a tendency towards the superficiality identified with globetrotting. The orientation towards reproducing may be partially compensated by the attention to detail found in operation learning. And finally the orientation towards success may sacrifice understanding for attainment, unless a demand for full understanding is built into the criteria of assessment.

The effects of content and context

One weakness in the psychometric approach to understanding study processes is that the questions asked are necessarily general. They ask how the student typically studies. They do not allow the more subtle response which indicates that the approach depends on subject matter content and on the demands of the particular task.

Marton's colleagues, Saljö (Marton and Saljö, 1976) and Fransson (1977) have shown that the approach to learning is affected by the perceived interest and relevance of the task (interest encourages a deep approach), by the amount of stress generated by the situation (anxiety is associated with a surface approach), and by the types of questions used in assessment (detailed factual questions induce a surface approach). Thus Marton would argue that it is impossible to describe students in terms of inventory scores of study processes. The approach used will depend on the specific task and on the conditions under which it is presented.

However, another colleague of Marton, Svensson (1977), has demonstrated that a general approach to studying can be identified and this is closely

related to examination success. Thus we must accept both overall consistency and some inter-task variability in describing study processes.

Marton has examined some specific environmental effects on the approach to learning using controlled experimental conditions. It is also important to discover how differences between departments affect students' learning strategies.

The effect of departmental ethos on approach to learning

One way of investigating departmental ethos would be to interview academic staff, to examine prospectuses and hand-outs, and to analyse the content of examination papers. It would, however, be extremely difficult to bring together such disparate data into any overall index of departmental ethos. In fact the simpler, and more effective, way is to ask the students. What is important in affecting student learning is not how lecturers describe their objectives, but how the students perceive the academic demands being made on them. It was this approach which led to the development of the second part of the Lancaster questionnaire by Paul Ramsden (1979). After a series of semi-structured interviews with students, he was able to produce a list of items typical of students' comments about their departments. Subsequent refinement of this 'course perceptions questionnaire' led to a version which contained the following eight scales.*

"Relationships with students	Closeness of lecturer/student relationships; help and understanding shown to students.
Commitment to teaching	Commitment of staff to improving teaching and to teaching students at a level appropriate to their current understanding.
Workload	Pressure placed on students in terms of demands of the syllabus and assessment tasks.
Formal teaching methods	Formality or informality of teaching and learning (e.g. lectures v. individual study).
Vocational relevance	Perceived relevance of courses to students' careers.

* Ramsden, P. "Student Learning and Perceptions of the Academic Environment" Higher Education, 1979, Volume 8 Number 4, page 416.

"Social climate	Frequency and quality of academic and social relationships between students.
Clear goals and standards	Extent to which standards expected of students are clear and unambiguous.
Freedom in learning	Amount of discretion possessed by students in choosing and organising academic work."

Subsequent interviews have confirmed that these eight dimensions provice a useful way of describing students' perceptions of departments, although it is still not clear how distinct the separate scales really are.

The interviews also enabled Ramsden to ask students how they tackled different academic tasks in the different departments in which they were studying. Analysis of these data is not complete, but it is already clear (Entwistle et al, 1979) that the previous argument for both consistency and variability still holds true. It is possible to describe a student as showing, overall, a deep approach to studying. It would, however, be rare to find any student who consistently approached every task in this way. Dead-lines for presenting an essay, or revising for an examination, might necessitate a surface approach on these occasions, but taken as a whole, most students could be placed on a dimension of approach to studying in a meaningful way.

The interviews showed some interesting indications of what influences the variability in approaches. Students tended to report that their approach was affected by their previous knowledge (particularly in science departments) and by interest (particularly in arts or social science departments). It was also clear that departmental variations in work-load, and in the interest taken by staff in students as individuals, affected the general approach of many students, but the detailed relationships between perceptions of departments and approaches to learning have yet to be investigated.

It is already clear, however, that there are consistent differences in styles of learning between areas of study. Students in science departments tend to make more use of operation learning than arts or social science students. The nature of knowledge in science necessitates close examination of detail, and its teaching makes use of mainly mathematical or mechanical models. Thus the predominance of operation learners in the sciences could be either part of a matching process, whereby students preferring this style of thinking choose scientific disciplines, or part of a formative process which trains students to value cautious logical processes over hasty intuitive judgements.

Personality effects on style of learning

The links between styles of learning and subject area preferences have parallels with other psychological dimensions. For example, Hudson (1966) described convergers and divergers in terms of styles of thinking - their relative scores on verbal reasoning and divergent thinking tests. Among sixth-formers, convergers consistently chose the sciences, and divergers the arts subjects. Again Witkin (1978) has argued for the importance of cognitive (or perceptual) style in affecting curricular choice. He distinguishes between field-dependent students whose thinking is described as 'global', and field-independent students who can discern structure within geometrical figures and who tend to impose their own structure on whatever they learn. The articulated style of the field-independent students allows them to cope with both arts and science faculties, but a majority of them will be taking science courses. Field-dependent students, who have more social interests, predominate in the arts, humanities, and social sciences. The similarity in these descriptions of learning and thinking suggests some more fundamental underlying difference, either in personality or in cognitive structure. There is, in fact, a striking parallel between the stylistic distinctions identified by Pask, Hudson, and Witkin, and Ornstein's (1977) descriptions of the functions of left and right hemispheres of the brain. If these learning styles did reflect cerebral dominance, it would at least explain the recurring dichotomies emerging from these research studies.

The final part of the on-going research programme at Lancaster, conducted by Sarah Burkinshaw, is examining the extent to which students who exhibit extreme learning styles and approaches to studying differ in terms of psychological characteristics such as convergence/divergence, field-independence/dependence, impulsitivity/reflectivity, and various personality traits, and the strength of visualisation (as an index of cerebral dominance).

Students having scores well above or below the average (± 0.5 σ) on deep approach/comprehension learning and surface approach/operation learning were identified and invited to volunteer to take place in a series of experiments and test sessions (for details, see Entwistle et al; 1979). Of 130 students identified in this way, 72 initially volunteered and 60 have completed an extensive battery of tests, learning experiments, and interviews. Analysis of these data is just beginning, but one exploratory analysis has been completed. It was decided initially to group students in terms of their predominant study orientations (meaning, reproductive and achieving) and their style of learning (comprehension or operation). Dividing the frequency distributions of scores on these dimensions into high, medium and low categories to form approximately equal groups, the pattern shown in Table 2 was obtained.

TABLE 2: Predominant orientations and styles

Learning Style	Meaning Orientation		Reproductive Orientation		Low scores or indeterminate orientations	(N)
	Achievement Orientation					
	High	Not High	High	Not High		
Both high (versatile)	7	0	2	0	0	9
Comprehension Learning	4	4	0	2	5	15
Operation Learning	2	0	6	4	2	14
Both Low	7	1	8	2	4	22
(N)	20	5	16	8	11	60

Table 2 shows the now familiar links between meaning orientation and comprehension learning, and between reproductive orientation and operation learning. But it is also interesting to note that a substantial group of students adopting the orientation towards meaning had high scores on both comprehension and operation learning. These might be seen as Pask's 'versatile' students - at least in terms of our inventory scores.

As an exploratory analysis it was decided to contrast the characteristics of this group of 7 versatile students with those of students most typical of the comprehen-ion (n = 8) and operation (N = 10) styles (see cells outlined in Table 2). Table 3 presents the mean scores of these admittedly very small groups. Later analyses will use multivariate analyses of the whole set of data. In interpreting this table it may be helpful to bear in mind that both versatile and comprehension learners are also within the high category for meaning orientation. While the operation learners are uniformly in the high reproductive category.

TABLE 3: Mean scores and standard deviations of students most clearly representative of contrasting learning styles

	Versatile learners (N = 7)	Comprehension learners (N = 8)	Operation learners (N = 10)	Significance of difference between CL and OL (t)	(p<)
Verbal Reasoning	125.9 (11.98)	126.1 (10.06)	[122.3] (9.80)	(0.76)	N.S.
Uses of Objects - Number	26.1 (6.82)	[35.9] (14.36)	23.9 (7.50)	2.15	.05
- Weighted for Originality	62.9 (18.00)	[96.4] (53.76)	59.6 (23.42)	1.83	.05
Field Independence	16.7 (1.80)	[13.8] (3.49)	16.1 (2.13)	1.62	N.S.
Reflectiveness	[54.7] (12.61)	32.4 (16.98)	34.9 (11.53)	0.35	N.S.
Visualising	9.7 (1.80)	9.4 (1.30)	[8.3] (2.00)	1.26	N.S.
Omnibus Personality Traits					
Thinking Introversion	58.6 (7.00)	60.9 (3.48)	[42.7] (5.95)	7.22	.001
Theoretical Orientation	48.0 (7.02)	[58.3] (4.13)	42.5 (9.78)	4.03	.001
Aestheticism	59.1 (9.58)	56.9 (7.40)	[41.2] (9.91)	3.51	.01
Complexity	53.0 (13.22)	[63.4] (9.32)	47.3 (8.92)	3.51	.01
Autonomy	59.9 (11.81)	61.5 (6.52)	[54.3] (7.82)	1.97	.05
Religious Orientation	57.3 (6.92)	[61.4] (8.16)	57.8 (10.40)	-	-
Social Extraversion	45.7 (11.44)	[52.0] (7.27)	47.5 (5.60)	-	-
Impulse Expression	48.3 (17.26)	[63.1] (13.88)	51.0 (7.16)	2.25	.05
Personal Integration	[42.3] (9.18)	55.8 (7.34)	51.7 (10.39)	-	-
Denial of Anxiety	[39.9] (11.07)	55.3 (6.27)	51.3 (8.03)	-	-
Altruism	51.1 (9.86)	59.3 (5.63)	[46.7] (9.65)	3.09	.01
Practical Outlook	41.0 (7.96)	37.4 (5.48)	[48.8] (8.80)	3.02	.01
Masculinity	38.1 (7.56)	44.8 (7.34)	51.1 (13.51)	-	-
% Male	42.9	50.0	60.0	-	
% Language & Humanities	85.7	75.0	40.0	-	
% Social Science	14.3	25.0	40.0	-	
% Pure or Applied Science	0.0	0.0	50.0	-	

In Table 3 whichever mean score is most different from the other two is outlined. Some of the differences can be attributed to sex or subject area, but there remain interesting variations between the groups, particularly between the opposite learning styles. Comprehension learners have markedly higher scores on originality, theoretical orientation, complexity and impulse expression. Their tendency towards field-dependence (global thinking) is also linked with social extraversion. The operation learners are much lower in thinking introversion, which is in keeping with their empirical orientation (see Jung, 1937). Their lower verbal reasoning scores may be unexpected in view of Hudson's (1966) link between convergent thinking and scientists, but lower scores on 'visualising' implies the possibility of left-hemisphere dominance which is in line with the earlier speculations.

It would be unwise to treat this set of results as more than indicative, but the patterns are largely in line with predictions and suggestive of interesting links between learning styles and underlying personality characteristics.

Possible outcomes

Where is this research programme leading? What are its likely outcomes? Already it is clear that a more complex model of student learning will emerge. The first study at Lancaster (together with a parallel study in Aberdeen) led to the development of a simple dynamic model - the Academic Achievement Game (Entwistle and Wilson, 1977). This was a board game designed to help students understand some of the ways in which their academic performance might be affected by aspects of their previous experience and personality, and by significant events during their time at university. At that time we knew too little about the processes of learning to produce a convincing simulation for students. The findings from this study, combined with advances in computer programming and microprocessors, open up the possibility of presenting students with an interactive simulation of university studying based on a model containing both student variables and contrasting learning environments.

The model should also provide a firmer rationale for study-skill programmes and contribute to discussions of student learning in staff development workshops. The concepts outlined in the model provide a more exact language through which to discuss important issues affecting teaching, learning, and assessment in higher education. Of course, this model is still no more than a beginning. But it is hoped that it will provoke others to carry out much-needed research in this area.

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