Deconstructing Students' Attitude to Learning: A Case Study in IT Education

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Abstract

Decreasing enrolment in IT programs suggests it is important to understand how students learn a discipline in order to support student success. This paper describes a study to examine student attitude to learning in the IT discipline of Engineering (ie Software Engineering). The *Approaches to Study Inventory* was applied to successive cohorts of students. The results describe a level of orientation (meaning or reproduction) for each participant and the cohort as a whole. However, examination of the subscales of the ASI indicate that the level of coherence in study approach exhibited by individual students is somewhat masked in their overall ASI result. Student reflective comments support the interpretations made of the subscale scores. The results suggest such a deconstruction enables teachers to assist students to know themselves as learners, thus raising their metalearning awareness, which, in turn has the potential to enhance student success.

Keywords: learning styles, ICT education, software engineering, approaches to learning, Approaches to Study Inventory.

Introduction

Practitioner studies suggest there is an increasing need for IT professionals – although Zwieg et al. (2006) suggest stability in the short term, other predictions indicate a shortfall over the period 2005 plus (e.g. in the Australian context (Australia, 2002, 2006; Bolger, 2000)), a shortfall that will become critical as baby-boomers approach retirement. In addition, tertiary education in IT related disciplines (Information Systems (IS), Computer Science (CS), Software Engineering (SE)) report a disturbing downward trend in student enrolments (Davidson, 2005). Practitioners studies suggest an issue is that formal education does not model the needs of industry (Lee, 2004; Trauth, Farwell, & Lee, 1993) – attrition of students who have enrolled, but do not complete may be partially due to this disconnect, as well as to the quality of their classroom experience (Astin, 1993).

This paper examines student attitudes to learning as an approach to addressing this issue – Lucas and Meyer (2004) conclude that, once educators know more about their students, they can support them in developing a better awareness and understanding of themselves as learners. Given current concerns about student performance in higher education generally, and their success as practitioners, investigation of factors that affect learning, in order to enhance that experience, is important.

Background

Students bring a complex assortment of beliefs, past experiences, and expectations to a learning situation, which influence the approach to learning they take. In turn, this approach to learning affects the quality of their learning outcomes. Their future learning intentions and behaviours will also reflect this (Prosser & Trigwell, 1999).

There is a need, therefore to identify aspects of the learners' conceptions of learning and approaches to it so that appropriate support can be provided. Early work in the UK and Australia (e.g. Biggs, 1970; Entwistle, Thompson & Wilson, 1974) identified motivation and personality as of prime importance, with the later addition of information processing (Craik & Lockhart, 1972) and intention factors (Marton & Saljo, 1976) (i.e. rote versus meaningful, deep versus surface) to the web of interrelationships. The approach to learning that a student takes is very sensitive to the context in which learning is done, with a demonstrated correlation between more advanced conceptions (e.g. abstraction of meaning and understanding of reality (van Rossum & Schenk, 1984)) and a deep approach to learning. This conception to a large extent determines the student's expectation of what the learning process and teaching entail.

There is a general consensus that a deep approach to learning is desirable in higher education. There is also research evidence to support an association between deep approaches and enhanced learning outcomes: students using a deep approach appear more able to demonstrate their understanding, develop their conceptions of material and report greater development of generic skills (see Wilson and Fowler, 2005, for a discussion of the relevant studies). Therefore, while the achievement of high quality learning is important in all graduates, it has an increased relevance where the context of practice is continually changing and the professions are continuously developing. The IT disciplines are a prime example of these characteristics (Garlan, Gluch, & Tomayko, 1997).

Research Approach

Procedure and Context

The focus of the study was on students progressing through the IT-related discipline of Engineering (Software Engineering) at Murdoch University. Over successive semesters these students were involved in a long-term study of learning behaviour: they responded to specific inventories, provided qualitative feedback in School- and University-based surveys and reported on their learning through reflective journals included as part of the deliverables of specific units (courses). This feedback was used to drive changes in the learning environment, in order to achieve alignment between professional practice, (formal) discipline learning and learner characteristics.

In this paper the focus is on the Approaches to Study Inventory (ASI) (Entwistle & Ramsden, 1983) as an indicator of student learning. The particular interest is to examine student attitude to the learning environment provided in the units that make up their discipline content. These units were based on non-traditional models of learning and therefore challenged the students' expectations of an engineering learning environment. Specifically, approaches based on authentic, constructivist models were the basis of student learning of Software Engineering, in order to align with characteristics of professional practice in the discipline: problems are complex and ill-structured, requiring creativity and opportunism in addressing them. Higher order learning is seen as essential to enable the skills to be acquired to deal with these characteristics (Scott & Wilson, 2002; Turley & Bieman, 1995).

The rationale for focusing on this group was, in part, based on the 'newness' of undergraduate Engineering degrees of software (in Australia, programs accredited by the professional engineering body (Engineers Australia) date only from the mid-1990s, with US programs dated later). While there is a long educational history in both engineering education (with many studies reporting on student attitude to learning (a prime example is the work undertaken by Felder. Felder & Spurlin, 2005, and Felder & Brent, 2005, which includes a concise summary of this work) and IT education (Lee, 1999; Lee, Trauth, & Farwell, 1995; Scott & Wilson, 2002) the learning of IT as a profession within an Engineering ethos is not well reported. In particular, the alignment between the discipline and the learning environment (and consequently student attitude to the environment provided) has not been much investigated.

Instruments

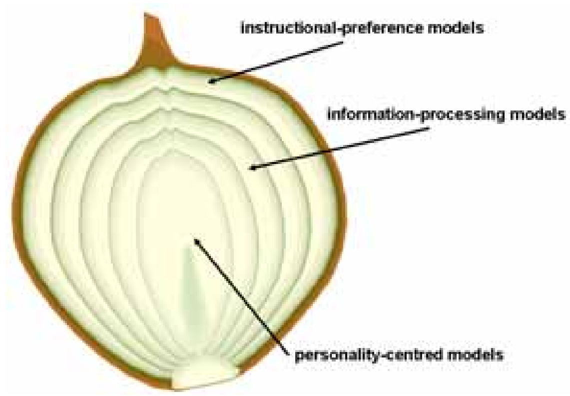

Figure 1 Onion model (Curry, 1983)

A variety of self-reporting questionnaires have resulted from interest in different aspects of student learning behaviour, and from the underlying requirement to demonstrate effectiveness and efficiency in teaching. In general these apply similar formats and psychometric principles, usually based on Likert scales. Curry (1983)'s onion model (see Figure 1) originally described three layers: a central core made up of personality-centred models specifically related to how learners prefer to acquire and integrate information (such as the LSI described below); a stratum of information-processing models to examine a learners intellectual approach to assimilation of new information, based on the approaches to studying literature (such as ASI, also described below) and an outer layer of instructional-preference models relating to external factors such as physiological and environmental stimuli associated with learning activities. These layers assist in the choice of over 70 models reported in the literature (Coffield, Moseley, Hall, & Ecclestone, 2004).

Personality-centred models

These serve as an indicator of how an individual interacts with and responds to the learning environment. The study of learning style involves the investigation of individual differences: people perceive and gain knowledge differently, they form ideas and think differently, and they act differently. The value of investigating personality-centred learning models is two-fold: to help teachers design a balanced approach that addresses the learning needs of all of their students by attempting to provide variation in teaching style and to provide individual students with both an understanding of the learning implications of their style and strategies to address their strengths and weaknesses.

The Learning Style Inventory (LSI) (Kolb, 1984) addresses this aspect of learner profile. While detailed discussion of the learning styles is available in the numerous works of Kolb (e.g. 1995), in summary this is a simple test to measure an individual's intrinsic learning style or predisposition in any given learning situation. It looks at four stages of the learning process: concrete experience (CE), reflective observation (RO), abstract conceptualisation (AC), and active experimentation (AE). The user's learning style can be identified as one of four archetypes:

- *Accomodator* : (concrete, active) What if? people
- *Diverger* : (concrete, reflective) Why or why not? people
- *Assimilator* : (abstract, reflective) What? people
- *Converger* : (abstract, active) How? people.

Information processing models

Despite a wide variety of methodologies and descriptive terms, a clear consensus has emerged that students approach learning with either a *surface* or a *deep* orientation, originally identified by Marton & Saljo (1976). Those with a surface orientation tend to take an approach characterised as instrumental, reproductive and minimalist, relying on rote memorisation and mechanical formula substitution, making little or no effort to understand the material being taught. Those with a deep orientation tend to adopt a meaningful approach, characterised as striving for meaning and understanding, probing and questioning and exploring the limits of applicability of new material. These orientations are complemented by motives and strategies that are dependant on a specific learning context.

While personality-centred models are considered a relatively stable indicator of how an individual interacts with and responds to the learning environment, information-processing models capture students' responses and adaptations to learning contexts. As well as being determined, to some extent, by past experience, the choice of approach is also influenced by student perception of the nature of the unit they are studying, so that students may be inclined to approach their learning in one of several ways. The work of Entwistle and Ramsden (1983) confirms this, while that of Ramsden (1988) adds that the manifestation of deep and surface learning is also dependent on the discipline of study.

There is a general consensus that a deep approach to learning is desirable in higher education. There is also research evidence to support an association between deep approaches and enhanced learning outcomes: students using a deep approach appear more able to demonstrate their understanding, develop their conceptions of material and report greater development of generic skills. However, it is also shown that students of either orientation prefer teaching methods that encourage those approaches to learning (Entwistle, Hanley, & Hounsell, 1979; Entwistle & Tait, 1990). The value of investigating information-processing learning models is therefore to provide justification for educators seeking to influence students towards deeper approaches to learning.

The Approaches to Study Inventory (ASI), by Entwistle and Ramsden (1983), was developed to address a range of concepts, including motivation and study methods. It describes four study orientations, and is one of the most widely used questionnaires on student learning in higher education. In its most commonly used version, the ASI contains 64 items in 16 scales, however, a shortened version (32-item) of this instrument has been confirmed by Richardson's (1990) work to possess adequate internal consistency and test – retest reliability. This focuses on two of the four orientations (see Table 1):

Table 1 ASI Scales for *Reproduction* and *Meaning* Orientation (Richardson, 1990)

Scale		**Meaning**
Meaning Orientation		
Deep Approach	DA	active questioning in learning
Interrelating Ideas	RI	relating to other parts of the course
Use of Evidence	UE	relating evidence to conclusions
Comprehension Learning	CL	readiness to map out subject area and think divergently
Reproduction Orientation		
Surface Approach	SA	preoccupation with memorisation
Syllabus-boundness	SB	relying on staff to define learning tasks
Improvidence	IP	overcautious reliance on details
Fear of Failure	FF	pessimism and anxiety about academic outcomes

- a *meaning orientation* (MO) indicates an intention to understand for oneself – comprehension learning, relating ideas, and using evidence, being all motivated by interest in the ideas presented. This orientation is characterised by a holistic style and intrinsic motivation
- a *reproducing orientation* (RO) indicates the use of a surface approach, with an emphasis on rote memorising, and a narrow syllabus-bound attitude, associated with both extrinsic motivation and fear of failure.

Instructional-preference models

Instructional-preference models of learning style relate to external factors such as physiological and environmental stimuli associated with learning activities. Although in this study no formal instrument was applied to this layer, components of other instruments were seen to address some of the aspects of affective and habitat preferences noted below. Dunn and Dunn (1978) identify five dimensions that mark various preferences:

- environmental preferences regarding sound, light, temperature, and class design
- emotional preferences addressing motivation, persistence, responsibility and structure
- sociological preferences for private, pair, peer, team, adult or varied learning relations
- psychological preference related to perception, intake, time, and mobility
- psychological preferences based on analytic mode, hemisphericity, and action.

It can be seen that many sociological and psychological elements of these categories overlap with other layers of Curry's model and the instruments used in this study.

Collecting Data and Interpreting Results

As noted previously, data on student learning were collected over successive semesters, using a variety of instruments. Some of these were included as components of the learning environment (e.g. reflective questions directly posed, journals and activity logs maintained and commented on by the students themselves), others were additional and possibly voluntary (e.g. School- and University-based surveys of learning). In particular, instruments which identified the 'coherence' of student approach to the learning environment were applied, examined and compared to the results of data collected through qualitative instruments.

The results of this examination show that student preconceptions predispose them to view learning in a discipline in a certain way, and may lead to the adoption of less than coherent learning processes. This comparison of individual student results shows that finer granularity provided by subscale mapping enables teachers (and learners) to isolate specific issues individual students face within their learning environment. The instrument then becomes a component of the 'pastoral care' of students – it enables teachers to address specific issues individual students face during their learning, and to support them to raise their metalearning awareness.

Learning Styles

As noted, the term learning styles refers to an individual's preferences for receiving, integrating and presenting ideas and information. Examples include: finding it easier to understand a new concept by reading a textbook, whilst others prefer a pictorial explanation; variety in how students most effectively demonstrate their understanding: graphically, verbally, or in writing (Mills, Ayre, Hands, & Carden, 2005).

Table 2 provides a comparison between first year students attending a regional campus of Murdoch University over the period 1999-2003. As can be seen, there is a weighting towards the characteristics of theorists (*Assimilators*) (which features a preference for abstract conceptualisation and reflective observation, with a forté in the basic sciences) in our CS/IT students. Our Engineering students, however, lean towards pragmatists (*Convergers*) who revel in active experimentation (labs, fieldwork) with a tendency to narrow technical interests (Kolb, 1984).

Table 2 Kolb *Learning Style Inventory* 1999-2003 cumulative results (percentages)

	Eng 1st Year	CS/IT 1st Year	Eng 4th Year
Accomodator	8	5	3
Diverger	18	12	7
Assimilator	33	56	38
Converger	41	27	52

This leaning appears to grow stronger as student engineers progress through their program of study (either through transformation, or attrition), so that the *Converger* characteristic, to seek "single, correct answers or solutions to a question or problem" (Kolb, 1995) becomes the dominant learning style. Although studies with computing students have consistently shown that abstract learners (such as indicated by our CS/IT students above) are more effective in learning computing skills (see Kolb & Kolb, 2005, 2006, for published studies to this effect), neither *Convergers* nor *Assimilators* exhibit strengths in design and innovation (requiring a divergent approach) nor business management (requiring accomodative skills). Yet practitioners suggest these are crucial in the IT disciplines (Holt & Solomon, 1996). In addition, the *Converger* approach to learning is considered the antithesis to the development of the generic learning skills (Boyce, Williams, Kelly, & Yee, 2001) required for professional practice in a changing discipline.

Approaches to Study

The shortened version of the ASI was administered to the student cohort, at the completion of the initial mandatory unit in Software Engineering in 2003. This had been offered, for the first time, in a PBL (Problem-based Learning) environment, developed to more closely map to discipline characteristics. The results are as indicated in **Figure 2** (note that some students declined to complete the survey).

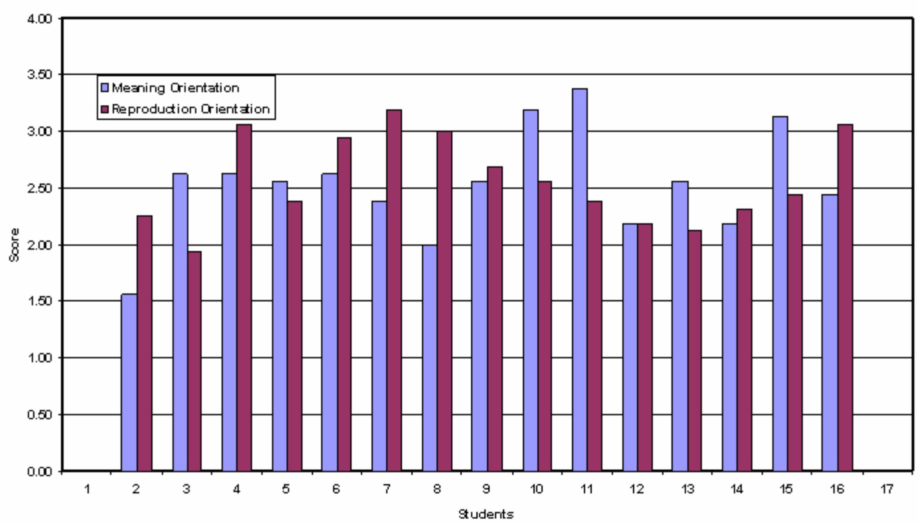

Figure 2 Results of the ASI (2003 cohort)

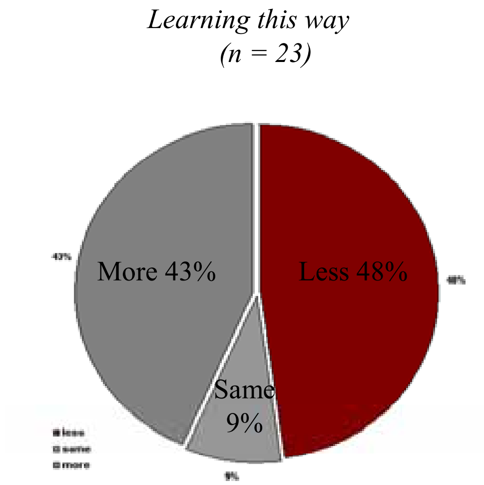

Figure 3. Student perception of their learning

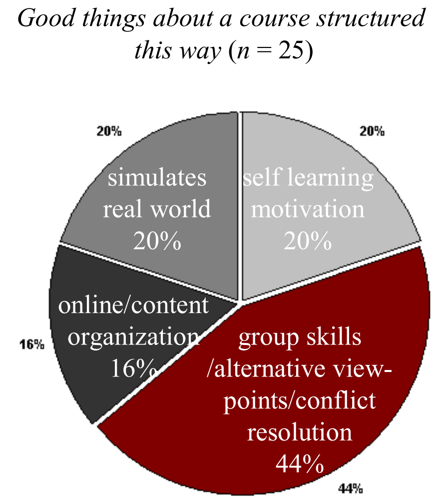

Figure 4. Thematic analysis of reflection (2003 cohort)

This post-hoc ASI showed that students were very much sitting on the fence between learning for meaning (MO) (mean 2.53, standard deviation 0.43) and learning for reproduction (RO) (mean 2.56, standard deviation 0.41). Asked, as part of a reflective component of an assessment item, whether they perceived they had learnt more or less from the PBL approach, the students' 'fence-sitting' was confirmed (see Figure 3). Further alignment can be discerned between the tenor of comments made in the reflective assessment component and results of the ASI. Among other questions, students were asked to reflect on *what is good/bad about a unit structured this way*. Figure 4 shows the results. While some students could appreciate the authentic nature of the environment (*like* [professional] *practice*), the learning environment did not sit well with many students (*intimidating learning style; sudden change in study style*). However, the group-work was almost always viewed positively (*project+ team improve individual learning/group lottery*). In effect, supporting the work of Entwistle and Tait (1990, 1995) meaning-oriented students were more likely to see their learning environment in positive terms while reproduction orientation was associated with the view that the learning environment was difficult. These results were also supported by a later study by Tynjälä, Salminen, Sutela, Nuutinen, & Pitkänen, (2005), which indicates that students' conceptions of the characteristics of their learning environments were related to their study orientations and strategies.

A further theme that emerged referred to the level of work perceived by students (*far too much content to read; too much workload leading to no marks*). Drew (2001) discovered that a heavy workload tends to affect the depth at which students studied, while Chambers (1992) found that a 'reasonable' workload is a precondition of good studying and deep learning. More recently Cope & Staehr (2005) confirmed that perception of workload appeared to be a key to encouraging the use of deep learning approaches, while surface learning have been associated with perceptions of too high a workload. Student comments on this aspect suggested the motivation to deep learning could be enhanced through an understanding of individual student attitude.

The ASI results therefore indicated at least as strong a bias to surface learning as there was to deep learning in the student cohort. From the teacher's perspective, this confirmed that students seem to need greater preparation in order to tackle a different learning model (e.g. a better understanding of the PBL process), even when it modelled their chosen discipline more closely, as well as support structures (examples, guidelines) so that they have a clear indication of the appropriateness of their learning. This would appear to be borne out by results of the ASI undertaken by a few of the same students after an additional semester of a similar learning environment (see Figure 5): they did exhibit a greater leaning towards meaning although many other factors (including increasing student maturity) are at play.

It has been suggested that a limitation of instruments such as the ASI is the focus on relating conceptions of learning to other broad aspects of learning, rather than to the specific learning activities in which students engage. Some researchers (e.g. Meyer, 1991), therefore, suggest what is needed is some indication of the relationship between the subscales components of the instrument. The value of this is to represent student attitude as a personal 'profile' of learning that is contextualised – a student will approach study for each unit differently, depending on the demands placed on them by the learning environment, their previous experience and personal stance at the time, and is not 'innate'.

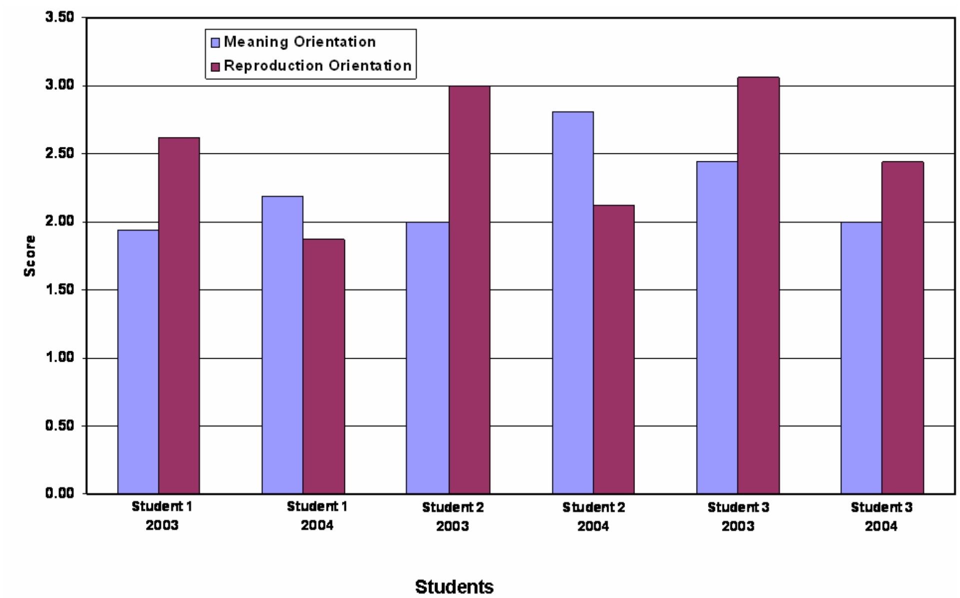

Figure 5. ASI results for selected students - 2003 and 2004

Research undertaken in Finland (e.g. Lindblom-Ylänne, 2004) has shown that *coherent* or *dissonant study orchestration* is developed through interaction between these all components (study orientation, factors such as learning experiences and regulatory skills, and the learning environment). A high level of dissonance indicated, in that study, an individual student's study habit problems and lack of metacognitive skills to evaluate study practices and quality of learning. This high dissonance is characterised by the inclusion of elements from both the surface (consisting of scales measuring a reproduction-directed approach to learning) and deep (consisting of scales measuring a meaning-directed approach to learning scales). Slightly dissonant study orchestrations are characterised by elements from either a deep or surface profile, but also contained theoretically atypical combinations of subscale scores.

Figure 6 extracts the students enrolled in a final software discipline unit in 2005. What this graph shows is that, while all students are meaning oriented (with three students above the mean), two students are also above the mean for reproduction. The ASI breakdown to subscale granularity for these student is based on categories identified in Table 1. It should be noted that each student was identified by a *Converger* learning style, and therefore was considered 'typical' of engineering students.

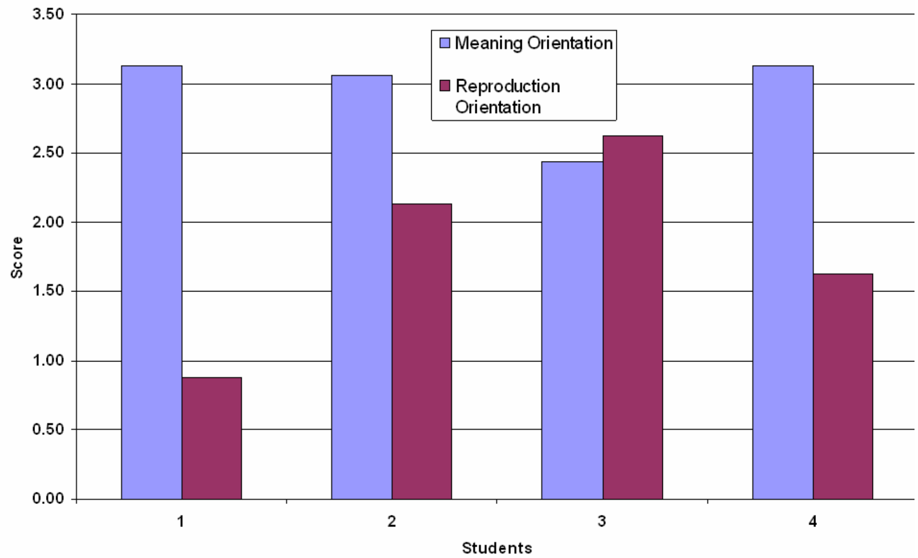

Figure 6. ASI Results for selected students (2005 cohort)

Student 1 would be classed as strongly coherent in Lindblom-Ylänne's (2004) terminology – high score for MO with commensurate low score for RO. Student 4 also shows coherence (though less strong), while Student 2 exhibits as somewhat dissonant and Student 3 as strongly dissonant. Examining the subscale scores reveals some issues the students bring to the learning environment. As a benchmark, Table 3 provides the mean for this group, for each of the ASI subscales.

Table 3. Mean scores for ASI subscales

Meaning Orientation mean scores	DA 3.31	CL 2.00	RI 3.44	UE 3.00	Overall mean 2.94
Reproduction Orientation mean scores	SA 1.88	IP 1.25	FF 1.67	SB 2.58	Overall mean 1.81

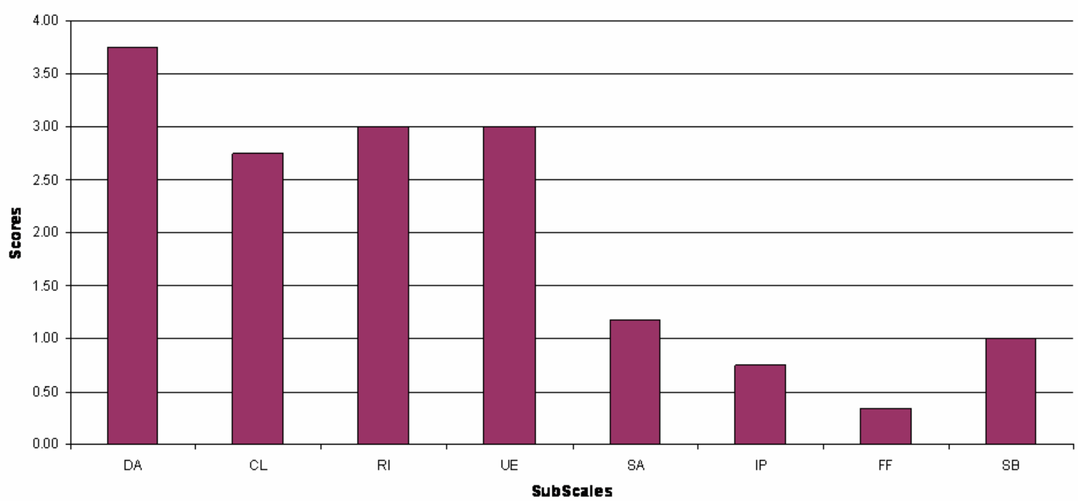

Figure 7 ASI breakdown - Student 1

As noted, Student 1 (see Figure 7) is strongly coherent – although some reliance on memorisation (SA) and teacher direction (SB) is exhibited, there are no real conflicts in the subscale scores.

Reflective comments confirm the student came to the unit with some anxiety and lack of confidence – not convinced the material undertaken in earlier units had been *learnt* – it was *easier to recall than I thought*. Over this final semester, the student gained confidence in the level of proficiency (*more confident with working within the java environment, acting as manager of project, back on schedule, completed implementation report. Personally enjoying the Java coding in real world application. Been helping group members with their Java coding*).

Student 2 is somewhat dissonant (see Figure 8). The ASI suggests that, although the student is bent on understanding and working out the material in the unit (*Even though I did some reading, it has not really understood yet*), there is a tendency to fall back on reproducing when that understanding is reduced, and to focus on detail (IP) in order to achieve understanding (*I could not work out how those architecture styles in text books are used in actual systems. Personally it took some time to play around with the sequence diagrams and make sense how the system works*). In this case, both teacher-direction (SB) and concern about academic outcomes (FF) are culturally based, and in direct conflict with the high scores for meaning. From the teacher perspective, this insight to the student's behaviour has increased impact given the multicultural composition of our student cohorts.

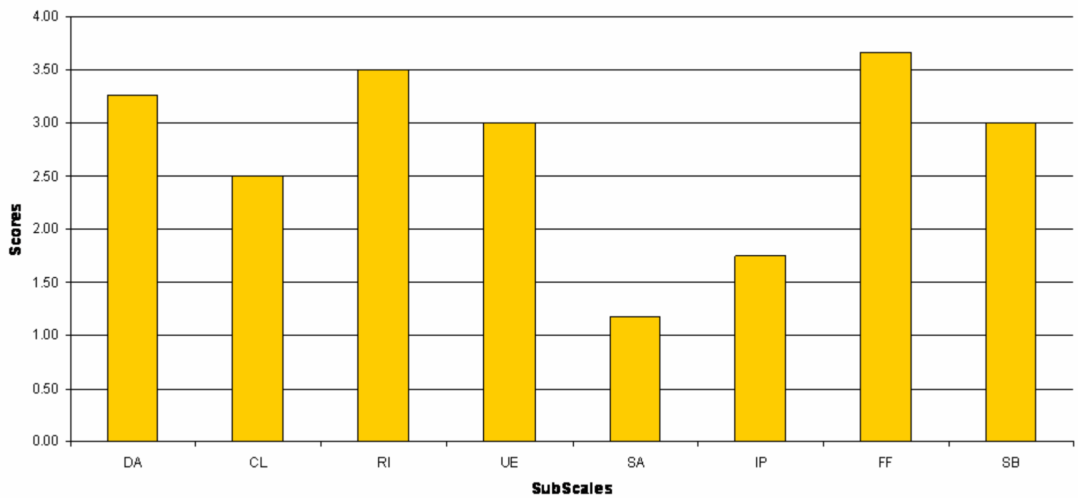

Figure 8 ASI breakdown - Student 2

The third student (see Figure 9) exhibits a high level of dissonance – high scores across most of the subscales (excepting CL). These scores indicate a significant level of learning pathology. According to Lindblom-Ylänne (2004) this are characteristics of students who lack the metacognitive skills to reflect on their own learning approaches and conceptions. Reflective comments support this interpretation (*I guess this is not my style of learning. It is as good as me taking a unit externally and just staying at home and teaching myself, and if I have problems asking a friend, or researching further. I guess however teaching yourself things you do tend to understand concepts better. However I feel that I am an audio visual learner, thus listening to someone explaining the concepts, PowerPoint's and teaching it to us makes life easier for me. I believe I gain a better understanding in this way*).

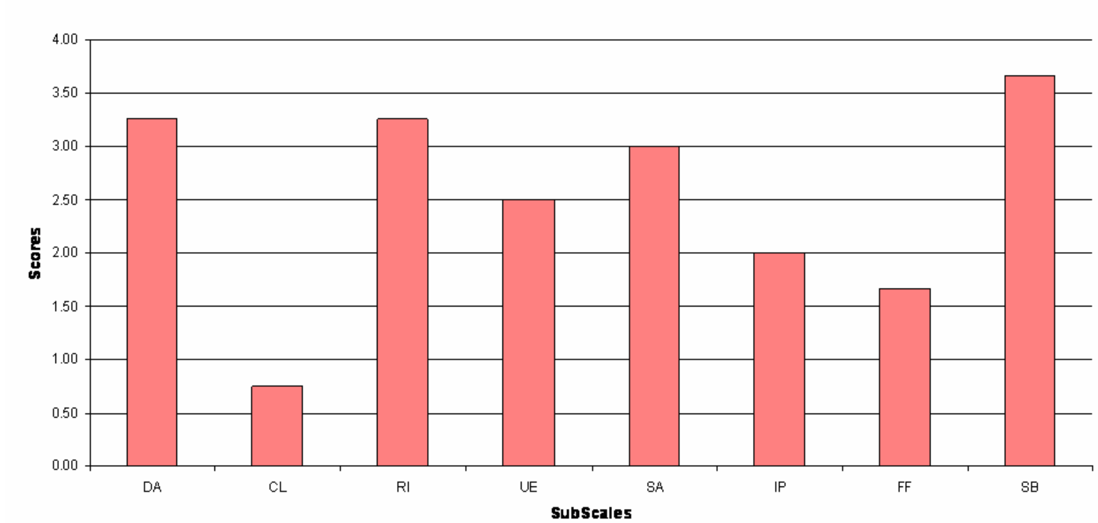

Figure 9. ASI breakdown - Student 3

Although the ASI result for Student 4 (see Figure 10) indicates an orientation towards reproduction below the mean, closer examination highlight some contrasting subscales. These indicate a didactic/reproductive belief about learning and teaching, so that the student may consequently struggle with tasks that demand more than memorisation (SA) and teacher-direction (SB). This student's reflective comments indicated a feeling of being *under pressure*, needing *to catch up* and feeling *guilty about not helping other members more*.

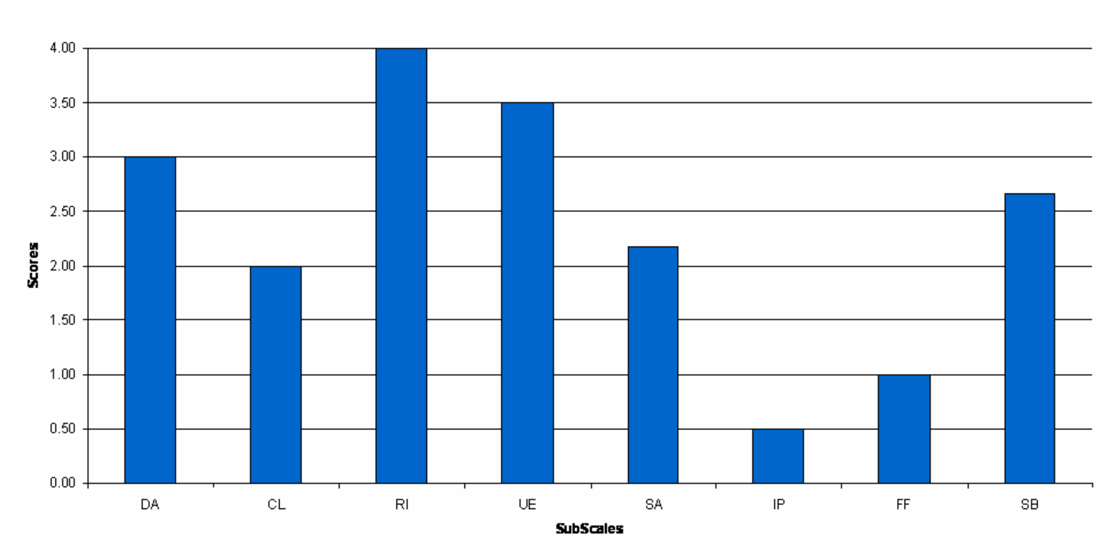

Figure 10. ASI breakdown - Student 4

Discussion

The purpose of this study was to examine whether the results of the ASI instrument provided a true picture of student attitude to study, in the context of specific units and learning environments, and whether there was a strong relationship between perception of their learning and academic achievement. Previous research has, in general, focused on student perception of their learning as a whole, rather than contextualised to specific courses/units within a discipline. This is particularly true of learning styles diagnostics studies, which are generally undertaken only once or twice across a program of study.

Table 4 Final Grades mapped to Study Orientation (2003 cohort)

	Students with…	
Final Grade	**MO ≥ RO (41%)**	**MO < RO (59%)**
HD, D or C	72%	37.5%
P	14 %	14%
N	14%	48.5%

The results of the ASI showed that while a correlation between a high(er) score for Meaning Orientation and final result did exist, it was not very strong – of the 88% of students who completed the ASI, 41% showed same or higher MO to RO. Of these, 72% achieved either a H(igh) D(istinction), D(istinction), or a C(redit), while 14% achieved each of a P(ass) or a fail (N). Students in this latter category exhibited equal orientation to meaning and reproduction (e.g. MO 2.65, RO 2.38). All other students who failed exhibited much higher ROs to MOs (between 0.43 and 0.81 difference). Of the students who indicated higher ROs, 62.5% achieved a P(ass) or lower. Table 4 provides a summary of this data. Since the assessment components for this unit included a final exam, it should be noted, perhaps as a caveat, that learning for understanding is less reliably assessed than memory learning and learning that achieves some form of creativity (one of the aims of the unit) will be quite radically different for different students (Elton, 2000).

Deconstructing the ASI results provides valuable information of student approaches to learning, and the issues they may face in addressing a learning context. If one of the goals of the learning environment is to increase deep and/or decrease surface approaches to learning, as a mechanism for engaging students with the learning, and ultimately to support their success in a discipline, it is important to address these issues specifically. In particular, the coherence of each student's approach may be considered an indicator of mixed messages (Norton, Owens, & Clark, 2004) provided within the learning environment, so that students do not have a clear indication of the appropriateness of their learning. According to Elton (2000), such conflict leads to *student schizophrenia*. The results of such a study therefore have strong impact in the area of unit review and development, both in order to ensure students are made aware of the appropriateness (or otherwise) of both their learning and their 'fit' for the discipline they are studying. This increased awareness goes some way to addressing the issue of student attrition from IT programs.

From the teaching perspective, deconstructing student attitudes to their learning informed significant changes to the environment provided for the Software Engineering program (Armarego, 2007), and flowed on to change the learning environment for all engineering programs at this university (Armarego & Fowler, 2005). From the learning perspective, students were provided with increased scaffolding and strategies to address their learning dissonances.

Conclusion

Student preconceptions predispose them to view learning in a discipline in a certain way, and may lead to the adoption of less than coherent learning processes. Lucas and Meyer (2004) suggest that teachers should reflect back to students their preconceptions The value of this comparison of individual student results therefore depends on feedback to students. It shows that finer granularity provided by subscale mapping enables teachers (and learners) to isolate specific issues individual students face within their learning environment.

As we learn more about how students learn, and what they need to learn in order to practice as competent professionals in their chosen discipline, we move further from traditional teaching and closer to the concept of learning as a reflection on professional practice. Such a small study does not allow conclusions to be drawn, except in very general terms. Students appear to be receiving mixed messages regarding the importance of deep versus surface approaches to learning, and appear ready to hedge their bets. However, once teachers know more about their students, they can support them in developing a better awareness and understanding of themselves as learners (Lucas & Meyer, 2004). Given current concerns about student performance in higher education, and their success as practitioners, the question of how to help students raise their metalearning awareness should be of keen interest.

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Biography

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