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Running head: Learning predispositions in preclinical students

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Preclinical students' predispositions towards social forms of instruction and self-directed learning: A challenge for the development of autonomous and collaborative learners

Abstract

Self-directed and social forms of learning are fundamentally different from traditional didactic educational settings from which students are selected for veterinary, medical and other professional degree courses. It is therefore expected that a mismatch may emerge between students' conceptions of effective learning and expectations inherent to the new learning environments. The present study addressed this issue by examining 128 preclinical students' predispositions towards two key elements in problem-based and case-based learning, namely self-directed and social forms of learning. A mixed method approach revealed converging evidence of students' overwhelming preference for external, teacher regulation and individual forms of learning. External regulation was consciously invoked as a coping strategy in managing large amounts of complex information. Constructivist conceptions of learning were positively related to an appreciation of the cognitive benefits of social forms of learning, a relationship that has attracted little attention in the higher education literature. These findings stress the importance of guiding students' transition towards learning autonomy required for social forms of learning and continuous lifelong learning after graduation.

Keywords

Learning predispositions; Social forms of instruction; Self-directed learning; Collaborative learning; Conceptions of learning; Self-regulation; External regulation; Constructivist conceptions; Lifelong learning; Veterinary medical education

Introduction

Concerns regarding university students' preparation for lifelong, autonomous learning after graduation are widespread among educators in professional degree courses. Consistent across disciplines is the view that traditional didactic instructional approaches are not well suited to achieve this graduate outcome. A number of professional courses have addressed this issue through the introduction of problem-based or case-based learning to replace or complement traditional teaching approaches. These forms of instruction are fundamentally different to the teaching methods that students are familiar with and have mastered. It is therefore expected that a mismatch may emerge between students' conceptions of effective learning and expectations inherent to the new learning environment. The present study was designed to examine this issue. It is argued that such insight is necessary for designing instructional approaches that take into account students' cognitive and affective development in relation to these new forms of learning.

Concerns regarding university students' preparation for lifelong autonomous learning are neither new nor limited to veterinary education, the applied field in the present empirical study. At the beginning of the twentieth century, William Osler was arguing that the complexity of medicine had progressed beyond the ability of teachers to impart everything that students would need to know (Osler 1913). Recent educational approaches, which promote self-directed learning (e.g. Candy 1991) and 'learning how to learn' (e.g. Schraw et al. 2006) have been advocated as critical in preparing graduates for continuous professional development. Ensuring that graduates have not just heard information, but know and use that knowledge effectively when solving clinical or research problems (Stickle et al. 1999) is widely considered a major aim of professional courses at university.

To this end, student-centered group activities, such as problem-based (e.g. Boud and Feletti 1997; Wilkerson and Gijselaers 1996) and case-based learning (e.g.Lundeberg et al. 1999; Blumberg 2000) have been advocated as particularly effective, because they offer teachers opportunities to guide students through effective self-directed professional learning and problem solving. Furthermore, it is hoped social learning activities that bring students closer to professional practice may foster the development of additional generic skills that are highly valued in vocational spheres.

The value of self-directed learning is well established in the tertiary education literature (e.g. Biggs 1999; Candy 1991; Ramsden 1992). Students' capacity to engage in self-directed learning is viewed as a highly desirable goal of professional education because it is a requisite for autonomous lifelong learning after graduation. In addition to the development of self-regulation, Vermunt and Verschaffel (2000) have argued that process-oriented forms of instruction, which foster the development of conceptions of learning in a constructive direction, may induce the development of deep approaches to learning. Consistent with the wider tertiary literature (e.g. McManus et al. 1998; Zeegers 2001), a deep-strategic approach has been associated with academic success in pre-clinical veterinary students (Ryan et al. 2004). Despite this finding, these authors reported that high workloads associated with a traditional content heavy curriculum have been associated with a surface approach to learning and 'fear of failure' as a motivating factor for study (Ryan et al. 2004).

The promises of problem-based and case-based learning to foster students' engagement in constructivist, meaning-making forms of learning, in a context relevant to their future professional careers (Neufeld and Barrows 1974) are therefore most attractive. Whereas traditional curricula in

most professional degree courses suffer from overloading students with an excessive emphasis on memorisation, collaborative, self-directed instructional approaches lend themselves to the development of effective clinical reasoning processes (Boud and Feletti 1997). There is evidence that students who have participated in such programmes are more likely to display a deep approach to study, long-term retention of knowledge and enhanced motivation for learning (Schwartz et al. 2001).

However, the introduction of student-centred, social instructional approaches represents a major curriculum shift for any programme characterised by a high level of curriculum content. Veterinary students - the target group of the present study - for the most part, seem generally comfortable with an approach to education that vests control for learning with the teacher, regularly examines content recall and promotes a dualistic (right or wrong) conception of knowledge. In common with most professional degree courses, these students are selected on the basis of high academic achievement and must function within a competitive and demanding programme that requires mastery of a vast amount of information and mandates a requisite level of competency before graduation (Williams et al. 2005). Consequently, and as could be expected, students groomed and selected for performance on this basis display a poor attitude to collaborative learning and prefer teacher directed forms of instruction (Canfield 2002; Parkinson and St George 2003).

The didactic pedagogies traditionally used in pre-tertiary courses and first year science units that form the foundation of many professional courses are significantly different from social forms of instruction that rely on self-directed learning. This issue is mentioned in both the medical (e.g. Albanese 2000) and the veterinary (e.g. Turnwald et al. 1993) education literature. According to Vermunt and Verloop (2000), students entering a new educational environment can experience a

temporary misfit, or 'friction' between, on the one hand, their conceptions, orientations and preferred strategies related to learning, and on the other hand, the perceived demands of the new instructional environment. The extent to which these frictions are constructive and lead to students' productive engagement in the unfamiliar learning activities depends to a large extent on teachers' capacity to guide the process. New motivational and behavioural characteristics must be induced and practiced if students are to develop as lifelong learners (Schmidt 2000).

In addition to the educational context, strategies, conceptions and orientations to learning adopted by students may be influenced by personality, epistemology and personal traits such as prior educational level, study experience, age and gender (Vermunt and Vermetten 2004). Educators need to understand such predispositions in order to design forms of instruction that accommodate student characteristics, especially where these could present barriers to learning. Students' cognitive and affective responses to different instructional approaches must therefore be considered to allow instructors to best anticipate and respond to student learning needs in the design of collaborative and self-directed learning activities. Relationships between students' conceptions of learning, regulation of learning and attitudes towards collaborative learning are central to the efficacy and success of group-based, self-directed learning activities but have to date received scant attention in the education literature.

The present study was designed to address this gap by investigating pre-clinical students' predispositions of self-directed and social forms of learning, identified as key elements in problem-based and case based learning. Capitalising on the unique opportunity provided by the recent establishment of a new veterinary programme with innovative selection criteria and increased emphasis on rural practice, the learning profiles of two cohorts of pre-clinical veterinary science

students were examined using qualitative and quantitative methods. A multi-institution research design was considered valuable on the ground that this would decrease the likelihood that findings were idiosyncratic to a particular institution. In addition, it was expected this design would extend the range of conceptions and approaches to learning, as well as attitudes towards social forms of learning, beyond what could be found within a single student group.

In view of the exploratory nature of the study and the diversity of related concepts, a mixed methods approach was expected to facilitate triangulation of results from the study, in this way increasing the credibility, validity and transferability of research findings and therefore providing a more comprehensive overview of relationships between factors evaluated. Qualitative analysis of students' own accounts of their dispositions to social and self-directed forms of learning was combined with quantitative analyses of selected aspects of students' learning styles, including conceptions of learning, regulation of learning and attitudes towards group assignments. The data therefore involved a holistic qualitative analysis of students' own accounts of their learning preferences and traditional quantitative analyses of standard measures.

On the basis of existing literature and our own academic and professional experience, it was expected that high achieving students would be self-confident, competitive, and therefore, reluctant to engage in collaborative learning. It was also expected that the workload associated with a professional degree programme might encourage surface learning approaches and teacher dependence. Importantly, this study was designed to investigate the relationship between student attitudes to collaborative learning and their conceptions and regulation of learning.

Methodology

Sample

The study involved two groups of second year Veterinary Science students, approximately 18 months after commencing study at their respective universities. One group, referred to as TRAD (traditional entry and course), comprised 87 students, of whom 55 (63%) were over 20 years of age (mature age students). These students were selected essentially on the basis of stringent academic merit criteria. The University Admission Index (UAI) was higher than 98, indicating that these students had been in the top 2% of school leavers, or equivalent if transferring from other tertiary studies. Students not entering directly from high school (mature-age and overseas applicants) had to provide a letter of intent, references and evidence of practical experience in addition to meeting academic merit criteria. The other group, referred to as ALT (alternative entry and course), comprised 41 students (43% mature age students) selected on the basis of strong academic merit (UAI higher than 90) and other selection criteria, established through written application and interview, including evidence of a commitment to rural Australia, and a strong interest in veterinary science and animal production.

The Veterinary Science courses

TRAD students were enrolled in a five-year traditional, science-based course. All first and second year units were predominantly science subjects, many of them involving large classes common to students from different degree courses. All teaching during their first 18 months of study involved didactic methods, with no clinical exposure. ALT students were enrolled in a six-year course founded to redress the shortage of graduates in rural practice. The first year was less scientifically demanding and placed some emphasis on practical aspects of animal production. Although a

didactic format was maintained, clinical placements and the development of clinical competencies were embedded within the course from the beginning of first year. At the time this study was conducted, ALT students had been involved in discussions on the value of collaborative learning, as part of preparation for the second (clinical) phase of the course, to be delivered in a problem-based learning format.

Procedure and Instruments

The two groups of students who participated in the study were recruited in a similar second year physiology unit at their respective universities, a unit taught by the same teacher in two consecutive years. A mixed methods approach was used to examine the two groups' approaches to study. Performance goals, learning styles and attitude towards group assignments were investigated via questionnaire data collected at the beginning of the second year unit, and learning preferences were elicited through a guided reflective assignment completed at the end of that same unit. It should be noted that data from the two instruments could not be linked at the individual level because the questionnaire data was collected anonymously. The questionnaire was part of a larger research project that examined other aspects of learning not reported in this study. Human ethics approval was obtained prior to this study at both universities.

Performance goals

The importance given by the two groups to getting high marks was obtained through their rating of the importance of 'Getting the highest possible mark, ideally a High Distinction' for a forthcoming group learning activity in the target second year unit (where 1 indicated lowest importance and 4

indicated a top priority). This single-item scale was part of an instrument investigating the importance given by students to several aspects of their academic progress.

Learning styles

Vermunt's (1994) Inventory of Learning Styles (ILS) instrument was selected to explore two aspects of learning styles: *Conceptions of learning* and *Regulation of learning*. This instrument is well established in the higher education literature (Busato et al. 1998; Vermetten et al. 1999; Boyle et al. 2003). Two ILS scales were selected to investigate conceptions of learning: *Construction of knowledge* and *Intake of knowledge*; and three to investigate regulation of learning: *Self-regulation of processes, Self-regulation of content* and *External regulation of processes.* After checking for internal consistency of Vermunt's original scales with the target population, some items were removed and some scales adapted. Table 1 presents an overview of the ILS scales selected and adapted in this study, and the reliability coefficient (Cronbach alpha) for each scale.

TABLE ONE ABOUT HERE

Attitudes towards group assignments

A measure of students' views of the social aspects of learning was obtained using the Students' Attitudes towards Group Assignments (General-SAGA) instrument (Volet 2001; Volet and Mansfield 2006). This instrument contains six scales that measure cognitive, motivational, affect, management, group assessment and interpersonal dimensions of students' attitudes towards group assignments. The six SAGA scales were analysed separately, using Rasch modelling (Andrich

1978; Andrich et al. 2000). The tests of fit and reliability for the six scales were satisfactory with separation indexes, similar to Cronbach alphas, ranging from 0.62 to 0.78. The analyses yielded six attitude scores for each individual (one per scale).

Learning preferences

Students' learning preferences were examined in a holistic way based on their responses to several open-ended questions from a reflective assignment. The conceptual framework for holistic coding was based on two dimensions: preference for self directed versus external directed learning and preference for individualistic versus social forms of learning. The dimension self versus external direction in learning is closely related to the concept of self-regulation versus external regulation measured by the ILS regulation scales. The dimension individualistic versus social form of learning was expected to complement the questionnaire data on attitude towards group assignments. A 3x3 matrix (Figure 1) was conceptualised to represent all combinations generated by the two dimensions. Ideas that could be coded within each cell were generated first on a theoretical basis and then refined through piloting and discussion among three researchers.

FIGURE ONE ABOUT HERE

All data were analysed by two independent judges, one blind to the design of the study. Coding was holistic in nature, trying to capture each student's dominant approach to learning. Information provided by students was sometimes limited, or poorly expressed, with the result that one or both judges in some instances found it difficult to discriminate between adjacent cells ('fence sitters').

Inter-judge agreement was computed to establish the reliability of the coding. Both judges were in full agreement for 91 (of 120) responses (75.8%), and selected adjacent cells for a further 23 responses (19.2%). All instances of 'fence-sitting' were reviewed by the two judges and decisions made by consensus, taking into account additional information from other responses. Two cases were excluded due to poor or inadequate responses.

Results

Holistic analysis of learning preferences

As illustrated in Figure 2, the two groups' overall profiles, generated on the two-dimensional holistic coding were remarkably similar, both clustering in the solo learning / external direction (Cells A, B, D, E) corner of the matrix. Results are given as the percentage within each cohort assigned to each cell.

FIGURE TWO ABOUT HERE

Students displaying a dominant preference for external direction of learning and studying alone (Cell A) formed the largest proportion of both TRAD (32%) and ALT (26%) students. Very few students displayed a dominant preference for self-direction (Cells G, H, I) or social forms of learning (Cells C, F, I). The other students displayed different combinations of mixed preferences (Cells B, D, E). Results of the holistic analyses of learning preferences are presented in three

sections: Preference for external direction and study alone (Cell A); Preference for mixed forms of learning (Cell E); and Emerging autonomy and appreciation of social forms of learning (Cells H, F or I).

a) Preference for external direction and study alone (Cell A)

Four key elements were identified as underlying students' preference for external direction and studying alone: Passing exams and/or getting high marks as driving study; Teachers and learning objectives as determinants of what should be learned; Awareness of prior academic success with teacher directed learning; and Resentment or frustration with self-directed learning activities.

i. Passing exams and getting high marks as driving study.

There were extensive comments about marks or assessment in responses from both groups of students. ALT students however tended to refer to passing the subject, whereas TRAD students typically reporting a drive to achieve high marks:

> *"Lectures are normally just crammed to pass the exams and not because much thought went into learning and understanding them; it's much harder to remember later on." [ALT]*

> *"… I have often leant material just to pass exams, feeling that it wasn't interesting or relevant." [ALT]*

> *"… I tend to just memorise the learning objectives that will be examined and don't necessarily understand the concepts involved… I want to get the highest mark possible." [TRAD]*

In both groups, the distribution of marks was often explicitly linked to concerns about group work and thus to a preference to study alone. Some concerns, such as the difficulty of finding a convenient time to meet, issues related to the fair division of labour and problems related to group dynamics, were typical of the literature on group work.

> *"... for assessments I prefer to work alone. I think this preference stems from high school when there were always arguments over workload and there was always the slacker"* [ALT]

Many TRAD comments were explicitly related to the fact that having to rely on peers presented a risk for learning and ultimately for marks.

> *"I don't trust other people's research - ie. if I don't know the person, I don't know whether they're a HD or a P student and this governs how willing I am to believe the work they produce is correct."* [TRAD]

> *"I am driven to receive good marks at university… even though the workload can be broken up in a group, I would much rather do the whole assignment individually to maintain a high standard."* [TRAD]

> *"…in effect it is not really a group project at all, but a group of people trying to use each other to get a good individual mark."* [TRAD]

ii. Teacher and learning objectives as determinants of what learning is required.

The heavy workload associated with the Veterinary Science course was equally noted across the two groups, *"Veterinary science is a difficult degree in that it requires learning a voluminous amount of complicated information…"* [TRAD]. For some students, workload was inevitably associated with the use of surface learning approaches as a 'survival' mechanism:

> *"... in some respects [lecture material] is about memorising areas you don't have time to work through to understanding."* [TRAD]

> *"...vet science is huge and I would never have even scratched the surface of it without lectures because I wouldn't have known where to start."* [ALT]

The perception that a vast amount of information had to be mastered in a short amount of time seemed to naturally lead to reliance on teacher guidance, typically offered in lectures.

> *"From lectures, we are told what to learn, the depth we were expected to understand and what to expect from exams. It [is] more like having a clear target and work[-ing] towards it."* [TRAD]

> *"In lectures all the important and relevant info is given to you so you don't have to rifle through lots of irrelevant stuff to find what you are looking for, and this can waste time… it is sometimes good to have someone spoon-feed us information as this involves less work and effort on my behalf."* [ALT]

iii. Awareness of prior success with teacher directed learning.

Reliance on teacher regulation, lectures and learning objectives was familiar territory to most students in both groups. Some students noted that strong teacher guidance had played an important role in their prior academic success:

> *"… working … from pre-set learning objectives has proved an extremely useful and effective method in studying at university so far for me."* [ALT]

> *"It sounds terrible, but having been a child of the TEE, I love studying, then answering questions and then looking up the answers to check that I got them right…"* [TRAD]

iv. Resentment or frustration with self-directed learning activities.

Heavy workload was used to explain a sense of frustration with self-directed learning tasks, even when there was awareness that deeper learning outcomes could be achieved with self-directed learning,

> *"there is no time for it[SDL]!...Lectures offer an efficient way of presenting large volumes of information in a palatable form."* [TRAD]

Frustration with self-directed forms of learning was also linked to prior educational experience including what works best to get high marks,

> *"During my entire schooling I have always been told exactly how to do a task and what exactly must be covered. The transition from a dictator to self-directed style of learning can be frustrating as it feels like there is something missing in the form of someone telling me exactly what to do. As a result I fear failure as my judgement might be wrong."* [ALT]

"[with SDL] you spend considerable time trying to work out what areas of the topic will gain maximum marks." [TRAD]

Self-directed forms of learning were found unsettling by some students due to the amount and complexity of the information to be mastered.

"I find that SDL requires sifting through vast amounts of information, and usually finding either only very small amounts of information that is conflicting, or masses of information that is impossible to digest." [ALT]

Qualitative differences were noted between the two groups in regard to reasons for their frustration with self-directed learning activities. TRAD students often pointed to lack of confidence with higher order processing of information,

"I couldn't always be assured that my interpretation of some of the more complex material was correct."

"I lack the confidence to assume that similar physiologic/biochemical processes are occurring in differing situations"

By comparison, ALT students often commented on basic coverage of material,

"…working it out for ourselves is something that we are learning now after all our schooling."

"I'm scared that I will leave something out, and that I will do it all wrong… I didn't have enough confidence in my knowledge."

Students in both groups, however, expressed frustration with information of a complex, contradictory or ambiguous nature, which was sometimes linked to a sense that information had to be correct or incorrect. For example, *"The biggest frustration … is [when] there is not always a perfect answer, … which can be a hard thing to accept as a group of highly motivated perfectionists!!"* [TRAD]

b) Preference for mixed forms of learning (Cell E)

Students in this category valued strong teacher guidance, but also opportunities for self-regulation. They also displayed an interest in social forms of learning along side studying alone. No qualitative differences emerged between the two groups. Across groups, students valued the opportunity for enhanced construction of knowledge, alongside the pleasure of working with peers,

"…I think the learning is synergistic – being able to bounce ideas off one another as well as hearing different ways of understanding concepts and information works very well." [ALT]

"… being the social individual that I am, I find working with others much more fun and interesting and often I learn more as they correct me when I am wrong and provide a different angle on things." [TRAD]

A number of ALT students stressed the role of the group as a motivational factor. They said they enjoyed explaining concepts to other members and were keen not to let the group down,

> *"Being in a group keeps you accountable with staying on top of the workload…" [ALT]*

> *"There is more motivation to do the learning as you do not wish to let others in your group down." [ALT]*

The role of the group as a motivating factor was less apparent among TRAD students, suggesting that they may have been already highly motivated and did not need the group to play that role.

References to self-regulated forms of learning referred to self-initiation and implementation of strategies aimed at effective preparation for exams or assessment items. Students described active processing of information (rewriting, summarising, making concept maps or diagrams, relating different topics) in preparation for exams,*"... my real learning comes when I start to actively memorise and integrate this information [presented in lectures] in preparation for the exams"* [TRAD]. Few students in this mixed learning preference group expressed any desire to pursue learning in response to personal interest.

c) Emerging autonomy and appreciation of social forms of learning (Cells H, F or I).

As illustrated in Figure 2, very few students were classified as dominantly self-regulated (categories G, H or I) or entirely socially driven (categories C, F or I). A few comments, were indicative of increased autonomy, such as a preference for setting their own direction and pace ("…*mov[-ing] at*

your own pace, as opposed to the lecturer's and/or class's pace" [TRAD]). The limitation of autonomous learning inherent to the nature of the course was noted, however: *"Personal learning objectives, while important, may not necessarily correlate well with what the person setting the exam thinks is important in terms of the course"* [ALT].

One TRAD student noticed a change in her own approach to study towards greater self-regulation and optimum learning from social opportunities.

> *"… [now that I am in the vet school]… I am very motivated to learn and so teacher feedback should not be what I'm looking for…. In other words, I am still seeking the most effective learning process for myself, but find that I do like becoming "an expert" on a topic (from research) and then discussing the finer points of that topic with someone else."*

A similar comment from an ALT student suggested this was an inherent component of early tertiary study for any student: *"In the early part of any degree, students are likely to require more directed learning until they gain the maturity and knowledge of 'how to learn'."*

In conclusion, the holistic analysis of students' overall approach to study, based on their answers to open-ended reflective questions, highlighted how both groups of veterinary science students overwhelmingly tended to prefer solo forms of learning, strong teacher guidance and survival study strategies to pass exams and/or get good marks. Students justified their preference on the basis of their prior successful study experience of teacher structured individual learning combined with the current heavy workload associated with the study of veterinary science, which they saw as requiring

the acquisition of a vast amount of complex information. A few qualitative differences were noted between the two groups, notably, ALT students' tendency to be less concerned about getting the highest possible marks and more concerned about their development of effective study strategies. In contrast, TRAD students' comments were systematically stressed the importance of getting high marks. There was no difference apparent between groups in preference for more social forms of learning, but ALT students' comments suggested that the group was a greater motivating factor for them, and revealed a general lack of confidence in their study strategies.

Quantitative analyses of students' performance goal, learning style and attitude towards group work

a) Performance goal

Consistent with their respective academic history and comments in the guided reflective exercise, the two groups differed significantly with regard to the importance they gave to getting the highest possible mark, ideally a High Distinction, for their forthcoming group assignment. TRAD students' mean response (3.31, sd 0.58) was significantly higher than ALT students' (x=3.02, sd 0.91; $p<0.05$). The relatively small standard deviation for the TRAD students highlights the homogeneity of that group in this regard.

The high achievement orientation displayed by TRAD students contrasted with a number of ALT students' apparent struggle to remain self-motivated, as reflected in their spontaneous comments (Reflective assignment):

"No motivation - You come from 13 years of a learning situation where you are pushed day after day, questions from the textbook have to be done by a set date, un-assessable mini-tests, etc then to be faced with 'self-directed' learning without any lead up into it, is a steep ask for someone like me who is not self-motivated." [ALT]

"... although I still have trouble motivating myself, clinical material is a big help". [ALT]

b) Learning styles

Table 2 presents an overview of students' learning styles, broken down into conceptions of learning and regulation of learning.

TABLE TWO ABOUT HERE

There was a main effect of group overall (MANOVA, $p<0.01$), with ANOVAS showing some similarities and some differences across scales. Overall, the questionnaire findings were remarkably consistent with the independent holistic analysis of students' comments on self- versus external regulation in their reflective assignment. Students' questionnaire responses indicate that their main conception of learning in their respective course was to rely on what their teachers say is important to learn (highest rating overall and for both groups). Furthermore, their responses also indicate that students' major form of regulation of learning was external, involving following instructions from textbooks, study materials and unit objectives (highest rating overall and for both groups).

Conceptions of learning

As is evident in Table 2, the constructivist conception of learning scale, (*Learning involves taking some initiatives*) differentiated significantly between the two groups. TRAD students' responses indicated that their conceptions of learning involve a more active role for the learner than ALT students ($x=3.80$, sd 0.72; $x=3.43$, sd 0.57, $p<0.01$). Based on the items that form the *Learning involves taking some initiatives* scale, active learning refers to monitoring learning progress, thinking up examples related to the study material, looking for relationships between different aspects of what they are learning, and trying to approach problems from many different angles.

Breaking down Vermunt's *Intake of knowledge* scale into two sub-scales, in order to distinguish between *Learning involves relying on what teacher says is important* from *Learning is reproducing information from the course*, was conceptually useful, suggesting that students in this study relied on teacher guidance to avoid being overwhelmed by the large body of information inherent in a professional degree programme like veterinary science. The notion that learning involves reproducing information from the course has, however, a different connotation and, accordingly, was endorsed differently by the two groups ($x=3.37$, sd 0.97; $x=3.60$, sd 0.81; test marginally significant, $p=0.059$). ALT students were more likely to conceive of knowledge acquisition as reproducing information from the course than TRAD students.

ALT students' strong endorsement of a non-constructivist (reproduction) conception of learning was consistent with their widespread lack of confidence in their approach to study. Many ALT students' comments, in the guided reflective assignment, revealed their awareness of the need to develop more effective learning strategies:

"I'm still trying to work out an effective way to study, so I might have to get back to you on this one…"

"That [ie 'How do I learn most effectively?'] for me is the million dollar question!!! Everyday that I learn I discover something new about the way that best suits me and my ability to retain and understand information… "

When evaluated across both cohorts and within each group in the present study, students' general conceptions of learning were not significantly correlated with their intentions to get the highest possible mark in their forthcoming assignment.

Regulation of learning

Table 2 also presents the results for Regulation of learning overall and by group. The two groups appeared to differ significantly in regard to their self-regulation of the learning content (x=3.22, sd 0.87; x=2.54, sd 0.91; $p<0.001$), which represented the extent to which they regarded going beyond required readings and looking for additional resources as part of learning. TRAD students' ratings were significantly higher on this aspect than ALT students. This finding was however confounded with age, as mature age students (20 years and above) across groups scored significantly higher than school leavers on the scale *Self-regulation of learning content* (x=2.65, sd 0.83; x=3.26, sd 0.93; $p<0.01$). In the present study, the proportion of mature age students within the TRAD group (63%) was higher than within the ALT group (43%; χ^2 8.60, $p<0.05$), which suggests that age was a confounding factor and also contributed to higher levels of self-regulation of learning content among TRAD students. As was observed for *Conceptions of learning* items, students' ratings of their general regulation of learning processes and content were not significantly correlated with

their intention to get the highest possible mark for their forthcoming assignment. Finally, and as mentioned above, both groups relied heavily on external regulation of learning processes (highest rating overall and for both groups) and much less on self-regulation of learning processes (lowest rating overall and for both groups).

Relationship between conceptions of learning and regulation of learning

Table 3 presents the correlations between conceptions of learning and regulation of learning for the whole sample.

TABLE THREE ABOUT HERE

As evident in Table 3, positive correlations were found between constructivist conceptions of learning and self-regulation of learning processes (0.38) and content (0.31). Reciprocally, positive correlations were found between conceptions of learning (indicating a reliance on what the teacher says is important) and external regulation of learning processes (0.38). Unexpectedly, conceptions of learning involving reproducing information from the course were not correlated with any of the regulation of learning scales for the whole sample. This finding is not consistent with previous studies, which have suggested that a reproduction orientation to learning is more typically associated with external regulation (e.g Ramsden and Entwistle 1981; Newble and Gordon 1985). Differences emerged between cohorts in this respect because, whilst this lack of correlation was evident for the TRAD group (0.01), the ALT group demonstrated a significant positive correlation between these factors (0.33*). Another within group difference emerged for the relationship

between Intake conceptions of learning and *Self-regulation of learning processes* (-0.29** for the whole group; TRAD 0.37**, ALT -0.09). Overall and across groups, these results highlight that reproduction of information is a survival strategy, common to all students. It is directed at coping with a high workload and may reflect a predominantly exam driven assessment process.

c) Attitudes towards group assignments

Table 4 presents an overview of students' attitude towards group assignments (as measured by the General-SAGA instrument), overall and by group, and broken down into six dimensions.

TABLE FOUR ABOUT HERE

Consistent with the findings of the holistic analyses (both groups displaying a preference for individualistic approach to learning), there was no main effect of group overall (MANOVA), nor for any of the six measures of students' attitudes towards group assignments (General-SAGA) (ANOVAs). Both groups displayed remarkably similar mid-level attitudes on all dimensions. Consistent with other studies (Volet 2001; Volet and Mansfield 2006), the highest score overall and for each group was for *Cognition*, and the lowest for *Management*.

Given the SAGA instrument was used for the first time with veterinary students, further analyses were carried out at the item level, in order to obtain a more fine-grained picture of students'

attitudes towards group assignments. Group differences were found for only three items, one from the assessment scale, one from the management scale and one from the motivation scale.

ALT students as a group were more prepared than TRAD students to risk a lower mark in a group assessment because of all the benefits of group work ($x=2.32$, sd 0.76; $x=2.00$, sd 0.77; $p<0.05$). This finding appeared consistent with the lesser importance given by ALT students to getting top marks and may explain why they reported greater difficulty to motivate their peers in comparison with TRAD students ($x=2.44$, sd 0.68; $x=1.94$, sd 0.90; $p<0.01$). ALT students also rated significantly higher the item 'it is quicker to do an assignment as a group' ($x=2.44$, sd 0.69; $x=1.94$, sd 0.90; $p<0.01$). This finding may be related to their lower tendency to conceive of learning within a constructivist perspective (*Learning involves taking some initiatives*) and lower engagement in self-regulation of learning content in comparison to TRAD students.

Relationship between attitude towards the cognitive benefits of group assignments and learning style

The correlations, overall and broken down by groups, between attitude towards the cognitive benefits of group assignments and students' conceptions and regulation of learning are presented in Table 5.

TABLE FIVE ABOUT HERE

For the whole sample, a moderate positive correlation was found between students' attitudes towards the cognitive benefits of group assignments (SAGA cognition scale) and constructivist conceptions of learning. Examination of this relationship within groups demonstrated that this association came from the TRAD group ($r=0.49$) and was almost non-existent within the ALT group ($r=0.17$). This suggests a more consistent learning profile within the TRAD group, with constructivist conceptions linked to positive attitudes towards a social constructivist learning activity. The consistency of TRAD students' learning profile was further supported by the significant relationship between their attitude towards the cognitive benefits of group assignments and their self-regulation of learning processes ($r=0.32$) and content ($r=0.31$). In contrast, ALT students' learning profile appeared less well established, and relatively inconsistent. This could be related to their lack of confidence in the effectiveness of their own learning strategies, evidenced by their comments in the reflective assignment, and suggests that these students may still be in the process of developing effective study strategies, in order to master the vast amount of complex, scientific knowledge.

Discussion

The use of a mixed methods approach and a multi-institution research design provided valuable insight into preclinical students' predispositions towards self-directed and social forms of learning. Students' spontaneous expressions of their learning preferences were remarkably consistent with the results obtained from quantitative analysis of their responses to established scales, and thus provided rich qualitative data to augment the interpretation of quantitative findings. Despite selection and programme differences, the two cohorts were remarkably alike in the strong preference expressed for external, teacher regulation and for individual forms of learning. Such

preferences are of concern for educators, because they are antithetical to those inherent to student-centred social learning environments, such as problem-based or case-based learning. Consistent with the literature, constructivist conceptions of learning were significantly and positively related to self-regulation. Finally, the study also revealed that constructivist conceptions of learning were related to an appreciation of the cognitive benefits that can be gained from social forms of learning.

Students' preference for external, teacher regulation can be linked to a number of factors. Firstly, as students' comments indicated, most had enjoyed prior success with this form of learning. As has been observed for medical students (Dolmans and Wolfhagen 2004), entry into veterinary school is typically via a secondary education and examination system that rewards a good memory and close attention to teacher directions. It is therefore not surprising that students, selected for success in a particular educational environment, should express a preference to continue to operate in a similar environment.

Aspects of the course itself, particularly the volume of information inherent to the veterinary programme at both universities, may also have contributed to students' preference for close teacher guidance as a survival mechanism. This is consistent with findings from previous veterinary (Ryan et al 2004) and medical studies (Newble and Gordon 1985), and is a well-recognised phenomenon in the general higher education literature (Ramsden 1992; Biggs 1999). In a professional degree programme like veterinary science, which requires the mastery of a vast body of complex information, students naturally seek precise instructions from their teachers to avoid being overwhelmed. It has been suggested that the nature of the veterinary course – typically a rigid, prescriptive professional programme where course work is predetermined and credit loads maximised – contributes to the perception amongst veterinary students that their lives are to a large

extent externally controlled (Zenner et al. 2005). There is a need therefore, within such programmes, to facilitate students' transition to learning autonomy.

As one student's comment indicated, it is reasonable to expect that students should develop such strategies during the course of their tertiary studies. Students in the current project still had three to four years of university study ahead of them. This may partly explain why most had made little movement from a preference for familiar pre-tertiary teacher regulation. Awareness of the need to change was however evident in the spontaneous reflections of many ALT students. The challenge then remains to find effective instructional approaches to support students in this transition, whilst simultaneously ensuring that an acceptable body of professional knowledge, skills and competencies is attained by graduation. The development of effective self-directed learning strategies is of particular importance, because veterinary science graduates, like other professionals need to keep up to date with a continuously developing body of knowledge.

Given the different course structures of the two veterinary programmes, as well as the selection of ALT students based on additional characteristics, with a lower emphasis on elite academic performance prior to university, it is not surprising that differences emerged between the two groups. TRAD students in this study displayed a more consistent learning profile, appeared more confident in their learning behaviours and were more likely to 'do more than required' in their studies. That is, they had a stronger conception of learning as being constructed, which was related to their self-regulation of learning, in both processes and content. The learning profile of the TRAD group was however confounded by age, as mature age students' stronger engagement in self-regulation of content is a phenomenon widely reported in the literature (Newble and Gordon 1985; Vermetten et al. 1999; Mattick et al. 2004; Vermunt and Vermetten 2004).

By contrast, the tendency displayed by ALT students to conceive of learning as the reproduction of information presented in the course, with less of an inclination for going beyond what is formally required by teachers, may be linked to the lesser importance they gave to striving for top marks. Whilst both groups indicated that marks played a major role in driving their studies, it seemed that TRAD students' efforts were more commonly directed at getting the highest possible mark, whereas ALT students seemed more concerned about not failing. TRAD students appeared more marks focussed and more competitive than ALT students, and this may have been the reason for their engaging in more pro-active forms of learning. Alternatively, such behaviours may be attributed to the competitive edge developed in order to attain the high academic admission requirements of a traditional selection process. Shuler and Fincham (2001) observed that 'successful' university students develop an incredible competitive drive and independent motivation to achieve. Their grades become the measure of their accomplishment, other classmates become competitors, and results become an important measure of 'self'. In light of evidence that an over-emphasis on performance and grades can be detrimental to learning (Baerheim and Meland 2003; Parkinson and St George 2003), these findings suggest that tertiary students need to be guided towards effective and autonomous forms of learning.

Reasons for such differences between the two groups were not elucidated in the present study. Previous Australian studies have documented that, like students in other professional degree courses such as medicine and law, students in traditional, city-based veterinary programmes differ from the community generally, in that they are increasingly from independent schools and have parents with higher levels of formal education than the general population (Heath 1997). Based on these observations, Heath has been argued that, "students from rural backgrounds suffer the potential

disadvantage of reduced educational opportunities, especially if family finances and/or philosophies do not permit attendance at private schools." Whether the rural students selected to the ALT programme in this study may have experienced such disadvantages is not known. In any case, the present study provides no support for the view that these students' learning profile is of any concern. In fact, many expressed an explicit desire to enhance their learning strategies, and would therefore be highly receptive to interventions aimed at the development of autonomous forms of learning. These observations may be of relevance to other professional degree programmes seeking to recruit and retain students likely to practice in rural communities after graduation.

Despite ALT students' attitudes being less performance–oriented, and explicit attempts to establish the benefits of collaborative learning as part of the ALT programme, both groups demonstrated very similar attitudes to group learning. Overall, the cognitive advantages associated with collaborative learning were recognised by all students, as evidenced by the highest rating (SAGA instrument) given to this dimension within both groups. For TRAD students, constructivist views of learning and high self-regulation were positively correlated with the perceived value of the cognitive advantages of group learning, indicating that these students found the exchange of information within a group helpful for learning. Consistent with prior research (Volet 2001), the dimension of attitude towards group work that was rated most negatively related to management or logistical aspects, such as division of labour and other organisational matters. Given the importance and widespread implementation of collaborative learning strategies in both traditional and alternative programmes, a continued emphasis on the development of strategies to help students manage group challenges would therefore be advantageous.

Finally, the finding that constructivist conceptions of learning and self-regulation of learning processes are both linked to positive attitudes towards the cognitive value of group work extends our understanding of effective self-regulated learning by adding a social dimension. In light of the growing development of teaching practices based on principles of social constructivism, the conditions that facilitate the development of these relationships will need to be explored in future research.

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References

Albanese, M. (2000). Problem-based learning: Why curricula are likely to show little effect on knowledge and clinical skills. *Medical Education, 34*(9)*,* 729-738

Andrich, D. (1978). Application of a psychometric rating model to ordered categories which are scored with successive integers. *Applied Psychological Measurement, 2*(4), 581–594

Andrich, D., Sheridan, B., & Luo, G. (2000). *RUMM2020: A Windows interactive program for analyzing data with Rasch unidimensional models for measurement.* Perth, WA: RUMM Laboratory

Baerheim, A., & Meland, M. (2003). Medical students proposing questions for their own written final examination: Evaluation of an educational project. *Medical Education, 37*(8), 734–738

Biggs J. (1999). *Teaching for quality learning at university: What the student does*. Buckingham, UK: Open University Press

Blumberg, P. (2000). Evaluating the evidence that problem-based learners are self-directed learners: A review of the literature. (In D.H. Evensen & C.E. Hmelo (Eds.), *Problem-based learning: A research perspective on learning interactions* (pp. 199-226). Mahwah, NJ: Lawrence Erlbaum Associates.)

Boud, D., & Feletti, G. (Eds.) (1997). *The challenge of problem based learning.* (2nd ed.). (London: Kogan Page)

Boyle, E.A., Duffy, T., & Dunleavy, K. (2003). The validity of Vermunt's inventory of learning styles in a Scottish Higher education setting. *British Journal of Educational Psychology*, *73*, 267-290

Busato, V., Prins, F., Elshout, J.J., & Hamaker, C. (1998). Learning styles: A cross-sectional and longitudinal study in higher education. *British Journal of Educational Psychology, 68,* 427-441

Candy, P.C. (1991). *Self-direction for lifelong learning: A comprehensive guide to theory and practice*. (San Francisco: Jossey-Bass)

Canfield, P.J. (2002). An interactive, student-centered approach to teaching large-group sessions in Veterinary clinical pathology. *Journal of Veterinary Medical Education, 29*(2), 105-110

Dolmans, D.H.J.M., & Wolfhagen, I.H.A.P. (2004). The relationship between learning style and learning environment. *Medical Education, 38*, 800-804

Heath, T.J. (1997). Personal and family backgrounds of first-year veterinary science students at the University of Queensland. *Australian Veterinary Journal, 75*(12), 902-905

Lundeberg, M.A., Levin, B.B., & Harrington, H. (Eds.) (1999). *Who learns what from cases and how? The research base for teaching and learning with cases.* (Mahwah, NJ: Lawrence Erlbaum Associates)

Mattick, K., Dennis, I., & Bligh, J. (2004). Approaches to learning and studying in medical students: Validation of a revised inventory and its relation to student characteristics and performance. *Medical Education, 38*(5), 535-543

McManus, I.C., Richards, P., Winder, B.C., & Sproston, K.A. (1998). Clinical experience, performance in final examinations, and learning style in medical students: Prospective study. *British Medical Journal, 316*(7128), 345-350

Neufeld, V.R., & Barrows, H.S. (1974). "The McMaster philosophy": An approach to medical education. *Journal of Medical Education, 49*(11), 1040-1050

Newble, D.I., & Gordon, M.I. (1985). The learning style of medical students. *Medical Education, 19*(1), 3-8

Osler, W. (1913). An introductory address on examinations, examiners, and examinees. *Lancet, 2*, 1047-1050

Parkinson, T.J., & St George, A.M. (2003). Are the concepts of andragogy and pedagogy relevant to Veterinary undergraduate teaching? *Journal of Veterinary Medical Education, 30*(3), 247-253

Ramsden, P. (1992). *Learning to teach in higher education.* (London: Routledge)

Ramsden, P., & Entwistle, N.J. (1981). Effects of academic departments on students' approaches to studying. *British Journal of Educational Psychology, 51,* 368-383

Ryan, M.T., Irwin, J.A., Bannon, F.J., Mulholland, C.W., & Baird, A.W. (2004). Observations of Veterinary medicine students' approaches to study in pre-clinical years. *Journal of Veterinary Medical Education, 31*(3), 242 - 254

Schmidt, H.G. (2000). Assumptions underlying self-directed learning may be false. *Medical Education, 34*(4), 243–245

Schraw, G., Crippen, K.J., & Hartley, K. (2006). Promoting self-regulation in science education: Metacognition as part of a broader perspective on learning. *Research in Science Education, 36*(1-2), 111-139

Schuler, C., & Fincham, A. (2001). To admit or not to admit? That is the question. In P. Schwartz, S. Mennin & G. Webb (Eds.), *Problem based learning: Case studies, experience and practice* (pp. 132-133). (London: Kogan Page)

Schwartz, P., Mennin, S., & Webb, G. (Eds.) (2001). *Problem-based learning: Case studies, experience and practice*. (London: Kogan Page)

Stickle, J.E., Lloyd, J., Keller, W.F., & Cherney, E. (1999). Learning styles in veterinary medicine: Relation to progression through the professional curriculum and integration into the profession. *Journal of Veterinary Medical Education, 26*(2), 9-12

Turnwald, G.H., Bull, K.S., & Seeler, D.C. (1993). From teaching to learning: Part II. Traditional teaching methodology. *Journal of Veterinary Medical Education, 20*(3), 25-30

Vermetten, Y.J., Vermunt, J.D., & Lodewijks, H.G. (1999). A longitudinal perspective on learning strategies in higher education: Different viewpoints towards development. *British Journal of Educational Psychology, 69*, 221-242

Vermunt, J. D. (1994). *Inventory of Learning Styles in higher education*. Tilburg University, Department of Educational Psychology

Vermunt, J.D., & Verloop, N. (2000). Dissonance in students' regulation of learning processes. *European Journal of Psychology of Education, 15*(1), 75-89

Vermunt, J.D., & Vermetten, Y.J. (2004). Patterns in student learning: Relationships between learning strategies, conceptions of learning and learning orientations. *Educational Research Psychology Review, 16*(4), 359-384

Vermunt, J.D., & Verschaffel, L. (2000). Process-oriented teaching. In R.J. Simons, J. van der Linden & T. Duffy (Eds.), *New learning* (pp. 209-225). (Dordrecht, Boston: Kluwer Academic Publishers)

Volet, S. (2001). Significance of cultural and motivation variables on students' attitudes to group work. In F. Salili, C.Y. Chiu, & Y.Y. Hong (Eds.), *Student motivation: The culture and context of learning* (pp. 309-334). (New York: Plenum)

Volet, S., & Mansfield, C. (2006). Group work at university: Significance of personal goals in the regulation strategies of students with positive and negative appraisals. *Higher Education Research & Development, 25*(4), 341–356

Wilkerson, L., & Gijselaers, W.H. (Eds.) (1996). *Bringing problem-based learning to higher education: Theory and practice.* (San Francisco: Jossey-Bass Publishers)

Williams, S.M., Arnold, P.K., & Mills, J.N. (2005). Coping with stress: A survey of Murdoch University veterinary students. *Journal of Veterinary Medical Education, 32*(2), 201-212

Zeegers, P. (2001). Approaches to learning in science: A longitudinal study. *British Journal of Educational Psychology, 71*(1), 115-132

Zenner, D., Burns, G.A., Ruby, K.L., Debowes, R.M., & Stoll, S. (2005). Veterinary students as elite performers: Preliminary insights. *Journal of Veterinary Medical Education, 32*(2), 242-248

Table 1

Overview of Vermunt's Inventory of Learning Styles (ILS) scales adapted in this study

Selected ISL scales	Adaptation of selected ILS scales
Conceptions of learning	
Construction of knowledge (Items 79, 81, 85, 92, 98)	(Renamed) *Learning involves taking some initiatives* (Items 81, 87, 92, 98), Cronbach 0.72
Intake of knowledge (Items 77, 80, 87, 91, 94)	(Split and renamed) *Learning involves relying on what teacher says is important (*Items 77, 87, 94), Cronbach 0.60) *Learning involves reproducing information from the course* (Item 80)
Regulation of learning	
Self-regulation of learning processes (Items 20, 23, 30, 35, 43, 47)	*Self-regulation of learning processes* (Items 23, 43, 47), Cronbach 0.64
*Self-regulation of learning content (*Items 16, 27, 39, 49)	*Self-regulation of learning content* (Items 16, 27, 39, 49), Cronbach 0.85
External regulation of learning	*External regulation of learning processes*

processes (Items 4, 5, 18, 31, 44)	(Items 18, 31, 44), Cronbach 0.60

Table 2

Conceptions of learning and Regulation of learning, in order of preference for the overall sample

Measure of learning style	Overall n=108 mean (*sd*)	TRAD n=68 mean (*sd*)	ALT n=40 mean (*sd*)	t	p value
Conception of learning (Learning involves ...)					
Constructivist (… *taking some initiatives*)	3.66 (*0.69*)	3.80 (*0.72*)	3.43 (*0.57*)	-2.788	p<0.01
Intake *(... what teacher says is important*)	3.94 (*0.72*)	3.93 (*0.73*)	3.97 (*0.70*)	0.280	ns
Intake (… *reproducing information from the course*)	3.37 (*0.97*)	3.24 (*1.04*)	3.60 (*0.81*)	1.905	p=0.059
Regulation of learning					
Self-regulation of learning content	2.97 (*0.94*)	3.22 (*0.87*)	2.54 (*0.91*)	-3.758	p<0.001
Self-regulation of learning processes	2.44 (*0.82*)	2.49 (*0.86*)	2.34 (*0.74*)	-0.903	ns
External regulation of learning processes	3.28 (*0.68*)	3.29 (*0.74*)	3.26 (*0.63*)	-0.222	ns

Table 3

Relationships between conceptions of learning and regulation of learning

	Self-regulation of learning processes	Self-regulation of learning content	External regulation of learning processes
Conceptions of learning (Learning involves ...)			
Constructivist (*... taking some initiatives*)	0.38***	0.31**	-0.17
Intake (*... relying on what teacher says is important*)	-0.29**[1]	-0.23*	0.38***
Intake (*... reproducing information from the course*)	0.00	-0.04	0.17[2]

*p<0.05 **p<0.01 ***p<0.001

Differences within groups were found for the following relationships:

[1] TRAD -0.37**; ALT -0.09

[2] TRAD 0.01; ALT 0.33*

Table 4

Attitude towards group assignments overall and by group

Dimension	Overall n=108 x (*sd*)	TRAD n=68 x (*sd*)	ALT n=40 x (*sd*)	t	p value
Cognition	0.40 (*1.13*)	0.37 (*1.19*)	0.45 (*1.03*)	0.39	ns
Interpersonal	0.36 (*1.11*)	0.37 (*1.22*)	0.34 (*0.89*)	-0.16	ns
Group assessment	0.27 (*1.22*)	0.15 (*1.15*)	0.47 (*1.31*)	1.27	ns
Affect	0.31 (*1.48*)	0.12 (*1.58*)	0.64 (*1.25*)	1.90	ns
Motivation	-0.13 (*1.01*)	-0.14 (*1.06*)	-0.12 (*0.91*)	0.15	ns
Management	-0.36 (*0.98*)	-0.44 (*1.06*)	-0.22 (*0.84*)	1.18	ns

Table 5

Relationships between attitude towards the cognitive aspect of group assignments (SAGA Cognition scale) and learning style (i.e. Conceptions and Regulation of learning)

	Correlations between attitude towards the cognitive aspect of group assignments		
	Overall n=108 x (*sd*)	TRAD n=68 x (*sd*)	ALT n=40 x (*sd*)
& Conception of learning			
Constructivist (… *taking some initiatives*)	0.34***	0.49***	0.17
Intake (*... relying on what teacher says is important*)	-0.15	-0.17	-0.11
Intake (*... reproducing information from the course*)	0.19	0.19	0.19
& Regulation of learning			
Self-regulation of learning processes	0.23*	0.32**	0.02
Self-regulation of learning content	0.13	0.31*	-0.18
External regulation of learning processes	0.01	-0.07	0.18

*p<0.05 **p<0.01 ***p<0.001

Figure 1

Two-dimensional matrix of learning preferences

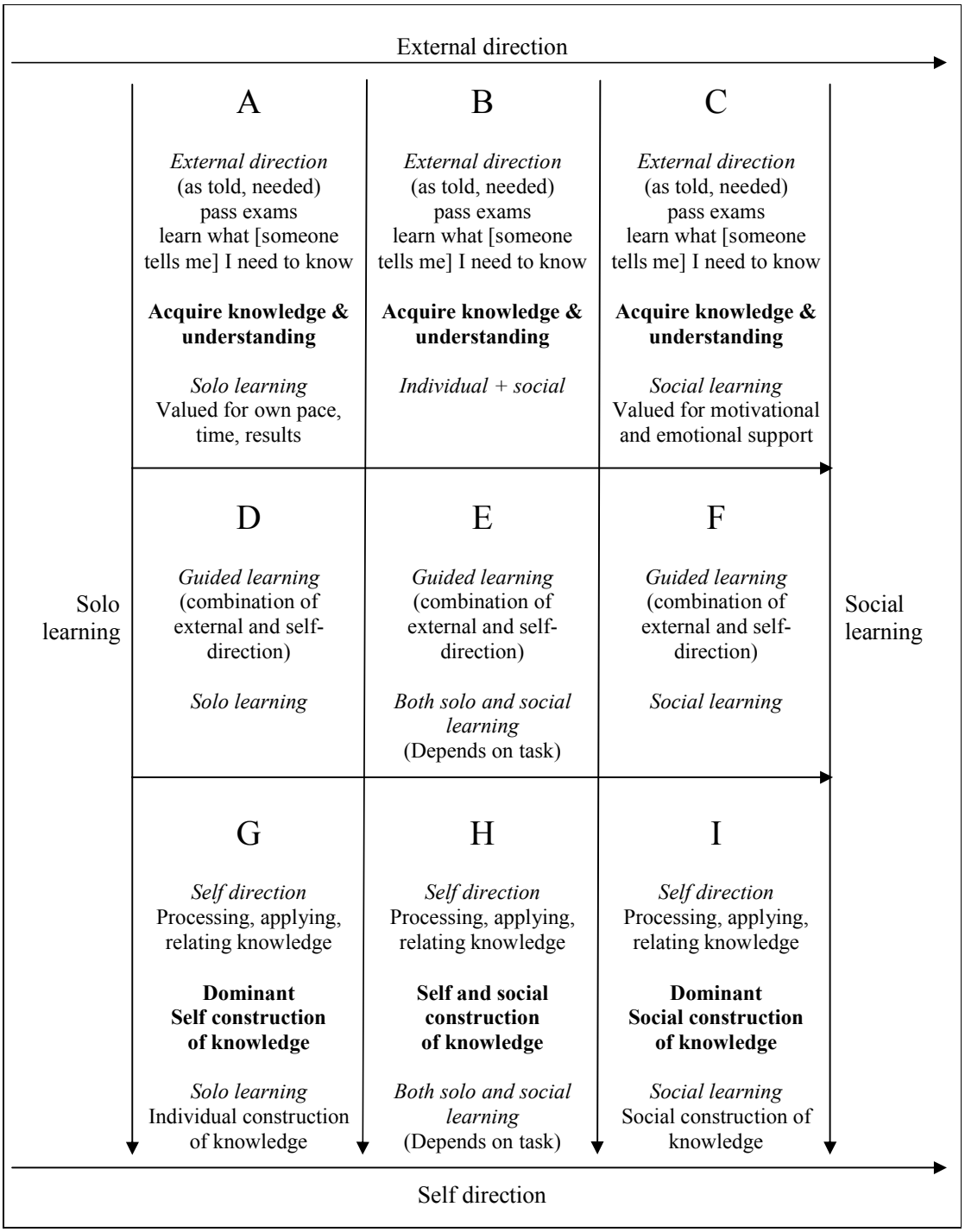

Figure 2

Learning preferences of two groups of students