TEACHER EDUCATION STUDENTS' KNOWLEDGE ABOUT HOW CLASS DISCUSSIONS HELP THEM TO LEARN

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Abstract

Self-regulatory perspectives of learning imply that students need to possess knowledge about 1) themselves as learners, 2) how to build effective knowledge structures, and 3) how to further develop and apply their knowledge. In a teacher education context we would hope that students would be able to explicitly articulate such knowledge, not only in relation to themselves as learners, but also as potential teachers of other learners. This paper describes one part of a study that sought to investigate pre-service teachers' knowledge about learning. We asked final year Bachelor of Education students to provide a short written answer to the question, "What happens in your university classes that helps you to learn." The students' most frequent response was, "Discussions." We then conducted follow up interviews where students elaborated upon their written responses. We created a framework for analysing students' responses based upon principles of classroom climate, motivation, self-regulation and psychological- and social-constructivism. We draw conclusions about 1) the value of discussions as a teaching and learning technique, 2) the quality of participants' knowledge about how discussions help them to learn, and 3) the implications of participants' knowledge about discussions for their future roles as teachers.

Key words:

Teacher education - general; Learning and assessment; Class discussion; Complexity

Considerable time has been spent developing our schools' values statements, mission statements and policies about teaching, and, of course, we have put these on the web. On the web you will find that universities and schools have produced some fine statements about teaching and learning, saying such things as:

> *This school is dedicated to learners knowing themselves profoundly as learners and thinkers.*
>
> *At this school we intend to develop a community of learners who confidently and enthusiastically direct their learning, cooperate, solve problems and communicate ideas.*

> *In our classes we will engage students as active participants in the learning process... [we will] engage students in discussion of ways in which study tasks can be undertaken*

Some serious commitments are made in these statements. Just in the small selection included here we are committing ourselves to take some responsibility for our students having quite complex knowledge that will allow them to:

- Have profound knowledge of themselves as learners, as constructors of knowledge;
- Be confident and enthusiastic directors of their own learning;
- Actively participate in their own learning;
- Know how their study tasks can be undertaken;

In making these statements it seems clear that we are requiring that our students will not only develop knowledge in a disciplinary domain, such as music or mathematics. They will also develop knowledge in another distinct domain, the domain of learning.

The commitment, of course, is not ours alone. Contemporary descriptions of learning as a self-regulated activity make clear that the development of knowledge is a shared responsibility, shared among cultures, parents, schools, students and teachers. However, it is a substantial commitment for us as teachers and it begs the question, "Do students know themselves as learners in such a 'profound' way?" This question is the focus of attention in this paper that describes the knowledge that our students have about what helps them to learn and then describes a procedure for estimating how 'profound' that knowledge might be.

We were interested to seek information on this question with respect to our final year teacher-education students because they are undertaking study in order that they, in turn, will be able to help their own students to develop knowledge about learning. Teacher education students need professional knowledge to be able to generate the designs for the teaching episodes that will enable them to facilitate their own students' learning .

Within a teacher education program we might expect students to engage with ideas about learning developed within contemporary educational literature, such as

- A constructivist perspective on learning .
- The cognitive, metacognitive, and motivational influences on problem solving and self-regulated learning .
- Teaching procedures, including those specific to a curriculum domain .
- Influences of social context and culture external to a school .

Because these students have been involved practically in learning in schools and university for a long period we might also expect them to have developed knowledge about:

- Habits of mind associated with university education .
- The role of learning environments, of collaboration, of community, of environments that encourage different approaches in students .
- The role of practical experience .

Previous research with teacher education students has indicated that students do indeed identify many themes that are explicit in the bodies of literature just noted. When Lawson and Askell-Williams asked students "What helps me to learn in my university classes?" the most common responses referred to learning activities such as discussions and group work. Other high frequency responses included active learning involvement, cognitive qualities of set readings, personal qualities of the tutor/lecturer, supportive learning environments,

critical thinking opportunities and practical activities. Very few responses mentioned the affective or motivational state of learners that is a central focus in descriptions of learning as a self-regulated activity.

Neither was it clear from the Lawson and Askell-Williams' research how well-developed was the students' knowledge about these topics. Although students showed clear preferences for teaching approaches and situations that are valued highly in the educational research literature, it is not clear whether the students' knowledge of these approaches and situations was at the level of mere familiarity with key terminology, or whether it was more elaborated, or had greater complexity. A similar concern existed for Woolfolk-Hoy and Tschannen-Moran :

> *[prospective teachers] lack understanding of the connections between teaching strategies and students' learning ... our students have great difficulty explaining the mechanism of learning and how teaching influences these processes ... Few students are able to connect the activity to cognitive processes that lead to learning, and few prospective teachers articulate what they want students to learn in ways that adequately represent academic content or cognitive outcomes (p. 280-281)*

Hence in Phase 1 of this study we set out to replicate the survey reported by Lawson and Askell-Williams with a cohort of final-year teacher education students. In the second phase of this study we interviewed a sample of students to probe their knowledge about the topics they regarded as most helpful for their own learning. For this paper we have analysed the results of this probing of knowledge focusing on the topic of class discussions.

Class discussions

Early work by Winne and Marx drew attention to the mediating effect that learners' understandings have upon teachers' instructions. Rather than being a passive observer of people and events, like a sponge absorbing water, the learner is seen to be an active agent in his or her own learning, "continuously involved in cognition about self and environment" . One important influence on the process of individual knowledge construction is the learner's involvement in social transactions, particularly discussions . For example, Palinscar wrote that, "from a social-constructivist perspective, discourse is the primary symbolic, mediational tool for cognitive development."

A substantial body of literature exists on the topic of class discussions. Cazden provided an early, and Nuthall a later, overview. To begin, it is important to explicate what is meant by "discussions" in the teaching and learning context. Many authors have provided definitions, especially drawing distinctions between discussions and other forms of verbal interaction such as conversations, show and tell, teacher led question-answer sessions, statements of intentions, or discourse about non-problematic (known) situations . We have adopted Pontecorvo's (1987) definition that stresses both a collective approach and a problematical situation as being essential ingredients for a knowledge building discussion.

> *[A discussion is] ... that particular kind of conversation or verbal interaction in the classroom that is designed to* solve a problem collectively *that can be interpreted in many different ways; namely, to delimit a topic or define terminology; to clarify a conceptual field on which some work has already been done, to link up different experiences by comparing observations and interpretations, to work out a satisfactory explanation of a phenomenon, etc. (p. 240).*

Early studies analysed features of students' discussions. For example Resnick et al. conducted an analysis of conversations among triads of university students and identified

various facets of discourse including premises, conclusions, challenges, responses to challenges and concessions. Building upon foundations established by Vygotsky, Resnick et al. argued that individual reasoning is an internalisation of public practices. Pontecorvo (1987) investigated discussions in elementary classes and suggested that discussions allowed people to "think together" with an openness or "permeability" to each other's thoughts. The effort of thinking is "shared out" and anxiety associated with producing an answer is reduced. Pontecorvo suggested that discussion is a "process" that is translated into a "progress" in a group's thinking.

Pontecorvo and Giradet audiotaped discussions about an historical problem by small groups (5 members) of fourth grade students. The researchers concluded that, "autonomous interactional activities can be extremely rich situations in terms of the production of high level reasoning, even in young children" (p. 391). Pontecorvo and Giradet likened their participants' group discussions to situations of cognitive apprenticeship as discussed by Collins, Brown and Newman . In Brown and Campione's communities of learners, reciprocal teaching and jigsawing provided the ritual participant structures that fostered student-student and student-teacher discourse. Such discourse underpins the 'dialogic base' that Brown and Campione identified as one of a number of first principles of learning, and which "provide(s) the format for novices to adopt the discourse structure, goals, values and belief systems of scientific practice" .

Recently, Nuthall and Alton-Lee's "listening in" studies probed how discourse contributes to knowledge construction in classrooms:

> *If, for example, a student acquires knowledge of a concept by being told the relevant information by a teacher, the student's understanding will incorporate the single dependent perspective of the student-teacher relationship. If, on the other hand, the student acquires the knowledge in the context of a classroom discussion in which different perspectives are described, explained and debated, the student's representation of the schema will incorporate a larger network of intertwined social and logical relationships. Such a network defines the dimensions of a mental space within which the student can explore, interact with, and try out alternative beliefs, arguments, and conclusions.*

Nuthall described how "putting it into your own words" represents the process of moving between the formal language of the discipline to the informal language that students use. Interpreting between the two languages is considered to be essential to constructing understanding .

As well as turning their attention to the "cold" aspects of knowledge construction, researchers have addressed "hot" cognition, such as the importance of students' discussions for maintaining motivation (especially interest) and for developing moral positions. Tobin, Tippins and Gallard stated

> *Group discussions can play a significant role in students' learning by providing time for interaction with peers to answer student generated questions, clarify understandings of specific science content, identify and resolve difficulties in students' understanding, raise new questions, design investigations, and solve problems. Group interactions also provide a milieu in which students can negotiate differences of opinion and seek consensus. Perhaps even more important, opportunities for students to generate questions and interact with each other develop their ability to speak out, unafraid in order to take a moral stand. (p. 49)*

Dillon provided an extensive treatment of discussions in classrooms including delineating what a discussion is (as opposed to a non-directed conversation or a teacher led question-answer session), what things should be discussed, how to conduct a discussion, how to engage in a discussion, and why to use discussions. Dillon's clear analysis of the reasons for using discussions provides compelling reasons for incorporating discussions into teaching and learning programs . In Dillon's view discussions can impact on: Understanding of subject matter and resolution of issues related to the subject matter; understanding of the discussion process and its educative function; personal growth; and understanding of the value of group reflection and deliberation .

Our research brings a new dimension to investigations into class discussions. Earlier studies have identified the features and potential value of class discussions from philosophers', researchers' and practitioners' perspectives. However, in our research, the category of class discussions arose from the perspectives of the learners: *they*argued that class discussions helped them to learn. Phase one of the research reported in this paper investigates participants' views about *how* class discussions help them to learn. We take our research further in Phase 2, where we investigate the complexity of participants' knowledge about class discussions as a teaching and learning process.

Knowledge complexity

Researchers have addressed issues of quality of knowledge from different perspectives and using different terminology (e.g., depth of processing; levels of outcomes; connectedness; schemas; elaboration). Problems of connotation and boundary drawing have been associated with each of the terms favoured within those different perspectives. For example, Jacoby and Craik pointed out that the proposition that more deep and meaningful analyses led to better memory was troubled by the fact that "some difficulty has been encountered in specifying exactly what is meant by 'deep' and 'meaningful'" . Twenty years later the same problem underlies Mintzes and Novak's questions: "What does it mean to understand ...?" and "How will I know when my students have developed this ability?" (p. 42).

A major reason for the continued use of a variety of perspectives about knowledge quality is that such quality is multidimensional, as McKeown and Beck argued;

> *Knowledge is not a one dimensional phenomenon and, thus, "having knowledge" is not a yes/no proposition; there are many subtleties in the character and arrangement of individuals' knowledge. (p. 689)*

The varied perspectives on knowledge quality have arisen as researchers have focussed on different dimensions of quality. When Biggs and Collis addressed the question of identifying quality in students' learning outcomes their SOLO taxonomy included dimensions such as capacity (of memory), relatedness of constructs, and conceptual abstraction and extension beyond the instructional material given. White and Gunstone took an even more multi-dimensional perspective on the qualities of cognitive (memory) structure. White's initial dimensions were 1) extent, 2) precision, 3) internal consistency, 4) accord with reality, 5) variety of types of memory element, 6) variety of topics, 7) shape, 8) ratio of internal to external associations, and 9) availability. White and Gunstone proposed that students' knowledge should be evaluated along (at least) these nine dimensions if a true account of the quality of their knowledge was to be obtained.

Other researchers have focussed upon a dimension of knowledge relatedness, or connectedness, when addressing knowledge quality . More recently Hogan and her colleagues produced a series of papers that documented eighth grade students' depth of cognitive processing and reasoning complexity. To assess students' reasoning complexity

Hogan et al. created a rubric containing six criteria: generativity, elaboration, justifications, explanations, synthesis and logical coherence.

Our concern in this project was with a subset of dimensions of knowledge quality, in particular the degree of development of the students' explanations about how class discussions facilitated their learning. We have labelled this subset *complexity* of knowledge We were interested in the amount of knowledge generated by students, the detail that can be produced, and the type of explanation of facilitation of learning.

We have set three objectives for this paper:

1. To report on student teachers' perceptions of procedures that facilitate their learning in their university classes.

2. To describe the range of ways in which student teachers regard class discussions as facilitating their learning.

3. To apply a coding system designed to provide information about the complexity of students' knowledge about how class discussions help them to learn.

Method

Participants

Seventy-eight students in the final semester of their final year of the junior primary, primary, middle school and secondary strands of the Bachelor of Education (B Ed) program in an Australian university, participated in this study. Students had undertaken at least 80 days of supervised practical teaching experience in schools. Participants comprised a mix of mature age students and those aged in their early 20s. Students were mostly female and predominantly of Anglo-Saxon background.

Procedure

Phase 1

In Phase 1 of the study participants provided written responses to the probe question, "What happens in my university class that helps me to learn?" These responses were tabulated and sorted into categories. Two researchers worked on the categorising procedure independently and then compared categories. We discussed and resolved disagreements and accounted for all statements in 49 discreet categories. Class discussions emerged as the most frequently cited category, accounting for 81 of the total of 365 statements.

Phase2

At the same time as we gathered written responses, we asked participants to volunteer to attend an interview to discuss their written responses in more detail. We offered a payment for the time spent in the interview. Forty students volunteered to be interviewed. Interviews were held with the 10 students who could attend at the times available for interview.

The interview began with the student's response to the probe question. The student was asked to:

> *Look over the statements you made on the card (during Phase 1) and select the statement that you think is most important in terms of helping you to learn in your university classes. Pick the statement that refers to the procedure/strategy/thing that you think is most important for helping you to learn in university classes.*

The student was asked questions about the chosen statement that were designed to probe their understanding of how this helped them to learn. The interviewer asked the student to expand on the meaning of the statement, to give an example, to explain how it helped his/her learning, what part of the learning process was affected by it, and how this effect occurred. Students were invited to use any form of explanation they thought helpful and were encouraged to express their theories of how learning was affected. They could, and did, draw diagrams and discussed their theories of learning.

A key component of the interview procedure was the probing of terms used in explanations. Thus if a student explained that class discussion helped her to "*bounce ideas off others*" she was asked to explained what 'bouncing off' involved and how it had an influence on her learning. The purposes of this method of probing was to extend students as far as they could go in discussing how their learning was assisted. The probing ended when the student could generate no new information or indicated that there was nothing more to add. Each interview ran for approximately an hour. Interviews were transcribed verbatim.

It is relevant to note that use of this interview procedure meant that we did not always cover the same topics with each student, though class discussion was mentioned by each student, and it is this topic that we have focussed on in this report.

Categorising the interview transcripts for content

We read, coded and discussed the relevant sections of transcripts on several occasions until all three researchers agreed upon major categories and overarching themes.

Coding the interview transcripts for complexity

To take our analysis of the transcripts further, each transcript was segmented into statements. Major statements identified distinct ways in which class discussions had a facilitating effect on learning. A major statement could be further expanded with minor statements. Each statement was coded to identify different degrees of complexity in reasoning about how the topic of the statement facilitates learning. The coding scheme consists of Levels One to Four: higher levels represent greater complexity, as detailed in Table 1. Coding of the section on class discussion in a sample transcript was carried out independently by two raters and disagreements resolved prior to final coding.

Table 1. Complexity of knowledge coding levels

Level 0	Some statements were repetitions or rephrasing of an earlier statement.

Level 1	Some statements provided further detail, such as features of a construct or a definition, or an example, of that construct. *Sometimes I'm never confident* *It could be the language of the article or something like that that's just a bit heavy.* Other statements simply noted relationships between constructs without any explanation of the nature of the relationship. *I can really gain a lot from other people's understanding*
Level 2	These statements made explicit more complex relationships, such as cause-effect or conditional relationships, between one construct and another. *It reduces the amount of fear I have about doing an assignment and getting it right.* *If it can connect somehow to what I'm thinking then I'll connect it.*
Level 3	Finally, a student could draw a relationship between the construct and a higher-level construct, perhaps making a link between the construct and a construct that is explicit in contemporary learning theory. *Well then I know it's not me, I know I'm not a dunce.*

Results

Phase 1: Written responses about what facilitates learning

The frequencies of the statement categories made by students in answer to the question 'What facilitates learning in my university classes?' are shown in Table 2. Participants referred to many of the issues raised in the introduction to this paper as being of contemporary interest in literature on learning and teaching. For example, participants suggested that the features of the class atmosphere, learning resources (e.g., visual aids, readings, handouts), the personal qualities of teachers (e.g., teachers, humour), the procedures used in teaching (e.g., hands- on, practical activities, demonstration lessons), and the characteristics of the teaching presentations (e.g., clarity, relevance, topic integration) all facilitated learning. Participants also referred to their own personal qualities as students (e.g., time management, self-direction), habits of mind (e.g., personal reflection), and motivation, though these nominations were less frequent than the previous teacher-based set. As noted earlier, the most frequent nomination for facilitating learning was discussions. Sixty-nine of the 78 participants referred explicitly to class discussions and/or group work in their written responses. Of the remaining nine participants, four made implicit reference with words such as "interactive" and "social interaction." Only five participants made no reference to discussions or group work.

Table 2. Statement categories

Category	Frequency		Category	Frequency
Discussions	81		Lectures	4
Teachers	26		My point of view	4
Assignments	16		Real life	4
Visual aids	16		Attendance	3
Clarity	15		Facts	3
Readings	15		Feedback	3
Hands-on	14		Prior knowledge	3
Practical applications	13		Practicum	3
Personal reflection	10		Self direction	3
Relevance	10		Ideas	2
Active involvement	9		Individual	2
Groups	9		Negative examples	2
Interest	9		Problem solving	2
Atmosphere	8		Social interaction	2
Demonstration lessons	8		Freedom	1
Topic integration	7		Flexibility	1
Humour	7		Field trips	1
Questioning	7		Listening	1
Time management	7		Learning partnerships	1
Communication with tutor	6		Note taking	1
Examples	6		Own way	1
Handouts	5		Revision	1

Interactive	5		Role plays	1
Journals	4		Scaffolded learning	1
			Workshops	1

Phase 2. Knowledge about class discussions in interviews

Each of the 10 interviewees spoke about discussions and working in groups. Although negative thoughts about discussions and group work were few, it is important that they are not overlooked.

> *I don't actually like group work very much. I feel I need to perform for the group as often group members do not contribute very intelligently.*

One interviewee spoke about negative aspects of class discussion as they related to the assessment requirements of the course. She felt that; 1) class discussions and group work could cause a compromise solution that might achieve a lower grade than she could achieve on her own; 2) by sharing her ideas other people might steal them for their own gain, and; 3) people strayed off the discussion topic and wasted time. However, it is interesting to note that this participant told us that even if she did not contribute to those discussions she still used her written notes about issues raised during class discussions to assist her thinking and writing. She also said that she enjoyed partaking in a group brainstorm activity when there were no assessment constraints.

Negative statements were far outweighed by statements expressing the value of class discussions, such as the following:

> *I take the information that the lecture has verbally presented. I think about this information and further my readings. The ability to take this information and clarify it through discussion. This clarification process is generally more helpful if done with my peers. Here each concept is redefined in a number of ways from many different perspectives. This allows me every chance to identify with the type of communication the information is given in. I am never really sure what comment will trigger off my understanding.*

Nine of the 10 interviewees spoke favourably about the beneficial aspects of discussions for their own learning. Indeed, four of the 10 interviewees said that class discussion was the most important feature that helped them to learn, and a further four said that class discussion was the second most important procedure facilitating their learning. The range of issues raised about class discussions during interviews is shown in Table 3. The range of issues is quite wide and many are described in ways that are close to descriptions available in contemporary literature on leaning. For example, in the group clustered under *Learning Process: Examine* there are a number of statements that focus on a process of reflection. There are also a group of statements indicating that, collectively, these students recognise the role of affective and motivational elements in facilitation of learning in a class discussion. Among the student descriptions there were some well-developed models of knowledge structure, as indicated in the following description by one student of the effect of the introduction of new material during a discussion

...if it can connect somehow to what I'm thinking then I'll connect it. If it doesn't well then it's...it's sort of...I guess it's always there. I guess it stays there as well but it's not...um...mm.....mm...no it's...yeah it gets incorporated into my thinking, into my knowledge or whatever it is that...It must compare with my beliefs, my morals, my ethics, whatever you want to call them um.... So, it may be incorporated and discarded later er...into my belief system. But...I guess the knowledge is always there... Some of your knowledge will agree with your belief system and some of it doesn't, but you've got to have, I feel I've got to have both sides of the arguments.

Table 3. Topics noted about class discussions.

Topic	Example	Number of students
Climate		1
Physical	*Placing the chairs in a circle is often helpful for the exchange of ideas.*	1
Emotional	*I have an emotional reaction to being contradicted.*	
Social interaction		
Peers	*Because [peers] are on a similar level ...well you pick things up*	3
Informal group	*You have discussions when start talking to your friends or when you are walking out the door*	3
Bonding	*Members at the beginning of the study period in some ways form a bond and a pact that they will treat each other within certain boundaries*	1
Qualities of peers	*[With] mature aged students...I can open up more...because they have more of a clue as to what I'm trying to say.*	1
Motivation		
Interest	*I may actually just tune out and let them get on with it*	1
Value	*If I like something I will continue to do it.*	3
Confidence	*It gives me more confidence that I got what I needed out of the article.*	2
Efficacy	*I know I'm not a dunce*	1
Affect		
Feeling, emotion	*My emotional state has a great deal of effect on my willingness to learn and participate*	3
Comfort	*I think I feel more comfortable with myself...if I come and talk to peers about it and they say the same thing*	4
Learning style		

Question and feedback	*My learning style is through questioning and getting feedback and re-questioning and getting feedback*	1
Listening	*I listen and different thoughts go around in my head...and I just sort of take it all in*	3
Talking	*I've always been a person who learns through talking about things*	2
Visualising	*It was a mental picture or some sort of graphical representation that I could almost see*	3
Learning process:		
Acquisition		
Bounce off	*Being able to bounce off thoughts from our peers*	1
Pick up	*You might, or you might not, pick up things that you've missed.*	
Learning process:		8
Examine		
Exploration	*I have the opportunity to examine my ideas and interpretations*	3
Clarification	*I jot down points that I want clarified or I want answers to*	5
Comparison	*[Seeing] what is different about my idea and the other person's idea*	5
Many angles	*[I ask] why did they look at it from that angle*	4
Challenge	*I actually kind of argue with the ideas in my head.*	5
Questioning	*Made me realize you have to look deeper into the information...and question some of the things*	3
Monitoring	*[I'm] gauging how they react to the different suggestions*	5
Learning process:		
Transform		
Big picture	*So I can get the big picture of what they're trying to get out of it*	1
Translate	*I enjoy putting my views forward and that translating helps me to learn better*	1
Reorganise	*I might find a gap and the new piece might fit in and fill part of that gap*	6
Confirm	*I still...sort out the information into what is relevant to me in my viewpoint*	1
Reinforce	*If they've picked up the same points that I have it reinforces it in my head*	1
Expand	*It expands your learning from how you've possibly always done your learning*	5

Generation of new	*And see whether that forms a new pattern that I hadn't had before*	1
Problematic nature		
Pressure	*I don't want to be badgered to participate*	2
Stealing ideas	*I don't like to share with people the fact that I've thought of it because I don't want them to steal it.*	1
Off task	*I feel like my time is being wasted if...they're completely getting off the topic*	1
Compromising	*You have to compromise and I just felt that was frustrating*	1
Doing all the work	*I just found that it would always seem to fall back on me to be the one to who would speak in front of the class*	1

The collection of statements represented by the examples in Table 3 provides evidence that participants have a rich base of knowledge that could be used to develop future discussions about a number of important features of learning. For example, the quotation discussing knowledge that 'fits' (see Learning process: Transform: Reorganise) might be used to stimulate consideration of the existence of contrasting views or conceptions about a topic that might be the subject of a class lesson developed by one of these student teachers. Such a discussion could draw upon a body of research indicating that quite strong, but conflicting, models of a phenomenon can be held in memory by students, albeit to the chagrin of their teachers .

The data in Table 3 are, however, group data and a final objective in this project was for us to see if we could represent differences in complexity of individual student's knowledge. The final part of this section sets out the results of our application of coding for levels of complexity.

Phase 2: Knowledge complexity

The sections of transcripts of two students that focussed on class discussions were analysed using the coding system described earlier. The results of the analysis of complexity for these students are shown in Table 4 and 5. The interview accounts generated by these two students were different in both content and in the complexity of relationships. Table 4 lists the topics raised by the two students. In this display the relationship between major statements, is indicated with indenting. Major statements are not indented and are indicated by the _symbol. Minor statements are indented and are preceded by the * symbol and statements embedded within these are further indented.

Consideration of the statements in Table 4 shows a reasonably high degree of overlap in the content of the two participants' verbal accounts. For both students, class discussions contributed new ideas and different perspectives, assisted their appreciation of issues of dealing with compatible and conflicting ideas, and raised matters of confidence about their own understanding.

Despite this similarity in what was discussed, there was a difference in the degree of complexity of the two sets of statements. Student B expressed several major propositions about ways in which class discussions helped her learning but developed only two of these

to any extent. Her discussion focussed on understanding and how discussion could change that understanding. She also made clear statements about her self-as-learner. Student A had fewer major statements but developed each of these to a greater extent than did Student B. She also described how discussions could lead to change in understanding and described how discussion had an impact on her affective state, which ultimately impacted on the way that she approached an assignment. In the final section of her discussion she described her 'model' of how agreement between her current beliefs and new information could be handled.

Table 5 includes the results of the coding of complexity of the statements made by these two students. In this table the difference in their profiles has been represented in a quantitative manner. Student A had a higher percentage of more complex statements. Although student B produced more statements overall, most of these statements provided lower level details and involved simple nomination of a relationship rather than expression of a more complex explanation of the relationship

As indicated in Table 4 student B identified more major statements about ways in which discussion could assist learning. However, only about half of these were rated as more complex Level 2/3 statements. For student A, the majority of her major and minor statements expressed more complex relationships. Even though Student A nominated fewer ways in which discussion could help her learning she had well-developed networks of knowledge associated with each of these nominated ways. This extra development of Student A's knowledge about class discussions, relative to Student B's, is also apparent when the structure of the argument made in the transcript is set out in Table 4.

Table 4. Content of the students' descriptions of how class discussions help learning

Student A	Student B
¨ Bouncing off thoughts · Picking up information - Good to know how other feel and why - Makes me feel more comfortable - It's not just me: I'm not a dunce - It's something in the reading, like the language · It helps me reinforce points when they(peers) pick up similar ideas	¨ I listen · I'm more a listener than a talker ¨ Helpful to hear other people ¨ I have my own beliefs ¨ Helps expand my ideas ¨ Helps me understand ¨ Gives me a chance to clarify, to question ¨ Helps me get another point of view · I'm open to other views, · My understanding is not the

· Gives me confidence - My skills are OK · Reduces fear of doing the assignment - Makes me more comfortable about doing the essay - Affects my approach to the assignment - I'm not so stressed out	best ¨ I put new information into the right tins · Process it, take it on board · If I agree, I accept it, If not I brush it off · This might change my view, or might confirm it · Cause me to think, Why does he think like that? · Might agree with my beliefs, my previous experience
¨ Introduces new ideas · I have to think · Provides reinforcing of ideas · Makes me decide whether I'll connect the information - If it fits I'll connect it - Gets incorporated into my thinking - If not it's still there - I compare it with my beliefs Some knowledge agrees, some doesn't - Must have both sides	¨ Talking about it · Helps understanding what they mean · By saying it in other ways · I'm narrow in my view · So I saw it in other ways · See a good way to think of it.

Table 5. Results of complexity analysis

		Student A		Student B	
		n	%	n	%
Level 0	Repetition	2	4	6	9
Level 1	Qualification	8	17	6	9
Level 1	Detail	5	11	19	30
Level 1	Example	4	8	8	13
Level 1	Relation only stated	4	8	14	22
Level 2	Complex relation	23	49	11	17
Level 3	Higher-order relation	1	2		
	Total statements	47	64		
Major statements	Level 2/3	2	100	11	54.5
Minor statements	Level 2/3	26	84.6	11	45.5

Conclusions

Like the students surveyed by Lawson and Askell-Williams (2001), the students in this study expressed a wide range of views on what helps them to learn in their university classes. They focussed on their own habits of mind, their cognitive and metacognitive actions, their motivational states and their practical experiences. They also identified a set of teacher qualities and a varied set of specific teaching procedures that influenced their learning in a positive way. As in the Lawson and Askell-Williams study, class discussions was by far the students' most frequent response to the question,"What helps me to learn in my university classes?"

The findings suggest that, as a group, these students have a high degree of affinity (perhaps unknowingly) with the social constructivist position . The students see situation, interaction, detailed analysis, and explicit teaching as having a major impact on the knowledge that they construct. They also make explicit the key role of the 'hot', affective and emotional, features of their learning, noted by Dillon . They express doubts about their self-efficacy and show that feelings are strongly involved in their engagement in discussions.

The findings set out in Table 2 draw attention to the students' strength of belief in the value of class discussion. The strength of their views suggests that we, as teachers, should consider how effectively we take into account such a strong belief in our classrooms. It has particular relevance for our use of lectures. Shulman explained that, even though educators now know that class discussion is necessary, the dominant form of pedagogy continues to be the lecture. This is because lecturing is simple: it reduces much of the technical and economical complexity of teaching. Lecturing also maintains control, for when the teacher is lecturing, the teacher knows what is going to be said. If students are invited to speak, the complexity rises and the unpredictability increases. However, short-term expediency is gained at the long-term expense of students' cognitive gains. Of course, there is no reason why discussion between lecturer and students, or among, students, should not be embedded within lectures.

Our probing of a sample of students to seek more detailed knowledge of class discussions found that the students made explicit a set of knowledge that covers much of what has been discussed in research on class discussion. The students viewed discussions as much more than conversations and identified discussions where ideas were defined and clarified, where ideas were linked, and where explanations were developed and modified. Our participants' accounts picked up themes identified in Tobin et al's (1994) analysis of how class discussions can impact on beliefs and in Dillon's (1994) description of the development of understanding of subject matter. The interview transcripts also contained clear examples of what Pontecorvo (1987) referred to as openness to the ideas of other students. Furthermore, we suggest that in Student A's discussion of knowledge that "fits/doesn't" fit we see something akin to the mental models that Nuthall (1997) described as a possible benefit of class discussion.

There are also some silences that deserve attention. In the student interviews, although the teacher was important as an organiser of the social-emotional atmosphere, there was relatively little attention given to the role of the teacher as a participant in the discussion. In the students' defence it may be that their lack of concern with this component of the teacher's role was associated with the focus in these interviews being on the learning side of the teaching-learning transaction.

We were also concerned that most interviewees expressed difficulty when asked to expand on their views about learning, though the findings described above suggest that they underestimated their knowledge in this domain. However, one of our interviewees found this task quite daunting.

> *I don't know what really helps me to learn...I don't know how that helps me to learn, it just does. It's just something I've never questioned, it just helps me...it's just the way I've learned to survive while I'm doing these things. But I don't know how.*

We are concerned about this student's situation. We are also concerned that some of the students did not appear to be aware, until they were pressed for explanations, that they could generate explicit knowledge about class discussions and learning. Our results do not yet allow us to confirm or reject the position espoused by Woolfolk-Hoy and Tschannen-Moran (1999) that was quoted in the introduction to this paper. Although our students did make explicit a wide range of knowledge about how class discussions help them to learn, we cannot be confident that we yet know the extent to which this qualifies as detailed knowledge about mechanisms of learning. We need further research with such students to discover if their knowledge has been organised or developed in ways that could generate effective responses to some of the complex situations that will arise in their own classrooms.

One of our key research objectives was to pursue the issue of the complexity of students' knowledge. The procedure we have developed has allowed us to make numerical statements about complexity in a way that is congruent with a descriptive analysis such as that in Table 4. The results in Table 5 suggest that it will be profitable to pursue a numerical analysis because it can reveal differences in the profile of the students' understandings. On the basis of our discussion in the introduction to this paper we assume that most teachers, on key issues, would prefer students to end up with a profile closer to that of Student A.

Has this analysis changed our degree of comfort with our web statements about what students will gain from our courses? If our analysis of participants' knowledge of class discussions is a good estimate of their other knowledge in the domain of teaching and learning we feel a little more confident about the state of knowledge of learning in these final year students. Participants have a familiarity with many of the topics that previous research has identified as being important components of class discussions. However, at this time we are less certain that this knowledge has been developed in a manner that has the degree of profundity that will enable our students to have a major impact on the learning of their own students. Our intention is to extend our analysis of the complexity of students' knowledge beyond the small sample described in this paper with a view to providing further insight into the quality of knowledge about learning that our students possess.

References