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Moving beyond dichotomies and hierarchies to recognise the complex, dynamic and transactional nature of child-care students' and university access students' knowledge about learning.

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MOVING BEYOND DICHOTOMIES AND HIERARCHIES TO RECOGNISE THE COMPLEX, DYNAMIC AND TRANSACTIONAL NATURE OF CHILD-CARE STUDENTS' AND UNIVERSITY ACCESS STUDENTS' KNOWLEDGE ABOUT LEARNING.

Abstract

Constructivist perspectives propose that learners build new knowledge upon the foundations of their existing knowledge. Learners bring their existing knowledge to new learning in topic domains such as mathematics and science. Learners also possess knowledge about learning itself. Theoretical frameworks that represent students' cognitive schema about learning, such as surface versus deep approaches to learning, mastery versus performance goals or hierarchies of conceptions of learning, have provided influential and parsimonious heuristics for classifying students' cognitions about learning. Meanwhile, proponents of situated cognition have emphasised the ubiquitous influence of situations upon students' acquisition and representation of knowledge.

In this paper we propose that a tension exists between theories that tend to ascribe a disposition, or type, to any individual (such as a "deep" learner, or "mastery" oriented student) and the variable influence of contexts upon students' cognitions about learning. If learning, and knowledge about learning, really is acquired in situation and applied in context, then we would predict differences in the manifestations of students' knowledge according to changes in context.

To investigate our proposition, we conducted focussed interviews with child-care students and university access students about their knowledge about learning. We employed NUD*IST software and common-theme matrices to interrogate participants' responses. Our analysis suggests that students' knowledge about learning is extensive and dynamic across context and time, even, and especially, within the same course of instruction. By the students' accounts, poles of contemporary theoretical dichotomies (such as surface-deep, or mastery-performance) seem to operate in transaction according to contextual imperatives such as deadlines, interests, self-efficacy, task requirements and relevance. In addition, students appear to seek balanced transactions between knowledge that has been theoretically conceptualised in different ways, such as effort—ability self-theories and surface—deep approaches to learning.

The students' accounts lead us to propose that dichotomous or stepwise hierarchical characterisations of students' knowledge may be useful for generating precise interventions for specific instructional situations. However, such characterisations are liable to misrepresent, in particular, to under-represent, the complexity and multi-dimensional nature of students' knowledge about learning. This seems especially to be the case if such characterisations are generalised beyond specific situations to suggest more rigid types, or dispositions, of individual learners that conform to a single dimension such as an approach, conception or self-theory.

Contemporary perspectives about students' knowledge about learning

The quality of students' learning depends not only upon the thinking processes that they use, but also upon the complexity of the knowledge that they hold, both in subject domains and also in their knowledge about learning (Winne & Marx, 1980; 1982). Indeed, learners' knowledge about learning mediates learners' effective engagement with subject-matter. Therefore, if the educational

community is to be fully informed about the factors that influence the success of educational programs, then they must have information about the knowledge about learning that students bring to educational settings.

The field of investigations into learners' mental models about learning is diverse, including investigations into students' depth of processing, approaches to learning, conceptions of learning, epistemologies, achievement goals, self-theories, and intentions. Such theories have given rise to influential and parsimonious heuristics for classifying learners' knowledge, for example, surface versus deep approaches to learning, mastery versus performance goals and hierarchies of transmissionist to constructivist conceptions of learning.

For example, Saljö (1979) was an early contributor to a tradition of research that identifies hierarchies of learners' and teachers' *conceptions* of "What is learning?" Conceptions have been categorised into dichotomies, and then further differentiated into hierarchies that range from transmission—reception categories that view learning as reproducing, to constructivist categories that represent learning as seeking meaning and change as a person (Marshall, Summers, & Woolnough, 1999; Marton, Dall'Alba, & Beaty, 1993).

A related field of investigation is concerned with people's *epistemologies*, such as Perry's (1970) interviews with college students' and identification of forms of intellectual and ethical development.

A third field of investigation related to knowledge of learning is *approaches to studying*, represented by the work of Biggs (1979; Biggs, Kember, & Leung, 2001) and Entwistle (Entwistle, Hanley, & Hounsell, 1979; Entwistle, Skinner, Entwistle, & Orr, 2000). Biggs proposed an interaction between motives (extrinsic, intrinsic and achievement) and deep versus surface study strategies, resulting in classification scheme of learners as "deep" or "surface" with a possible third category of "achieving" (Biggs, 2001; Biggs et al., 2001).

Closely aligned with deep—surface approaches is achievement goal theory, which proposes that people can approach tasks with either (a) a goal of mastering the situation/task/new learning with a view to personal fulfilment, achievement and growth, or (b) a performance goal, which causes them to attempt an outcome that compares favourably to others, and causes them to look good in others' view (Ames & Archer, 1988; Ames, 1992; Elliot, McGregor, & Gable, 1999; Maehr & Midgley, 1991; Molden & Dweck, 2000; Pintrich, 2000a; Pintrich, 2000b; Schunk, 1989; Schunk, 1990; Schunk & Ertmer, 1999). Mastery goals have been linked to deep level learning strategies that contribute to quality learning over time. In contrast, performance goals are considered to predicate superficial, rote or memorisation learning, which has short-term, but not long-term utility.

A complementary theoretical approach to understanding people's cognitions is provided by attribution theory (Graham, 1991; 1984; Weiner, 1985). Attribution theory posits that explanations of outcomes of events can be classified according to three causal dimensions: locus (internal to external); stability (temporally stable to unstable); and controllability (controllable to uncontrollable). Attribution theory is commonly illustrated using the attributions of ability or effort for successes and/or failures. People can adopt attributions for successes or failures based upon the effects of their own efforts, or they can attribute success or failure to external causes such as luck, other people or task difficulty (Dweck, 1999). Attributions affect motivation, performance and emotions, impacting upon the expectancy of future success or failure (Schunk, 1991).

Meanwhile, proponents of situated cognition (Lave, 1988; Lave & Wenger, 1991; Wenger, 1998) have emphasised the ubiquitous influence of contexts upon learners' acquisition and representation

of knowledge. The possibility of dynamic variation in learners' knowledge and subsequent learning actions was raised in an early paper by Laurillard (1979) who argued against dichotomised learning styles of holism and serialism:

Two important conclusions have emerged: (a) that students cannot be characterised in terms of a dichotomised description of learning; (b) this is because they are responsive to the environment and their response to learning is determined by their interpretation of that environment. (p. 408)

Furthermore, Volet (1997) made the case that students' responses to the environment are not just cognitive, and that the dynamic role of motivational and affective variables must also be incorporated into models of academic learning. Similarly, in our own research about teaching and learning with students from a variety of learning institutions (Askill-Williams, 2001; Askill-Williams & Lawson, 2003; Askill-Williams & Lawson, 2004) we began to formulate the proposition that if learning, and knowledge about learning, really is acquired in situation and applied in context, then we would predict a dynamic interplay—a transaction— between functionally available knowledge about learning and each specific learning context.

This points to what we believe is an ongoing and unresolved tension that is repeated throughout the educational psychology literature on conceptions, approaches, goals, epistemologies and self-theories. This is the tension between theories that reduce learners' cognitive schema about learning (and studying) to parsimonious and accessible dichotomies and/or hierarchies, while at the same time make reference to the substantial influence of contexts upon students' thought processes. We question whether a reduced dichotomous/hierarchical representation of students' mental models can be theoretically comprehensive and practically functional in the face of situational influences.

From our earlier work we began to suspect that it is possible for a learner to concurrently hold, and choose to exercise different (sometimes quite opposite), epistemologies, conceptions, approaches, goals, or self-theories, according to quite specific situational variations. In attempting to resolve the tension between stable personal trait-like characterisations and situationally variable states, we began to develop the view that people's interactions with learning environments do not appear to be dominated by one or two overarching positions on a dichotomous representation such as an approach to studying or conception of learning. Rather, students' mental models about learning appear to be considerably more complex, differentiated, and to have a more multidimensional flavour. Existing theoretical models did not seem to deal comprehensively with the complexity that we found in our interview data. Furthermore, recent work by other authors had begun to differentiate dichotomies such as memorising versus understanding (Kember, 1996; Watkins & Biggs, 2001) into more finely grained categories such as memorising for understanding.

Thus, our purpose in the remainder of this paper is to report our investigations of the knowledge that samples of child-care students and university access students hold about learning. We will consider the impact of situational variations upon students' mental models of learning and within-student complexity and variability of mental models about learning.

The Research Questions

- What do child-care students and university access students know about teaching and learning?
- How can students' knowledge be represented in an accessible form to a wider audience?

- To what extent do current theories contribute to our understanding of students' knowledge about learning?

METHOD

Participants

Our first participant cohort, the child-care group, included 18 students taking a pre-qualification, Certificate Level III in Community Services, child-care, run by a Technical and Further Education College in South Australia. Twelve of the 18 students volunteered to be interviewed. The child-care cohort was selected to represent a group of adult students who were at a beginning level of post-compulsory education. Box 1 contains a description of the child-care course. Entry to the child-care course was on the basis of application and interview.

The university access students were selected to represent a group of non-traditional university students whose entry to university was not based upon grades received in their secondary schooling. There were six students in the access cohort, four of whom volunteered for interview. The access course is embedded within the access and equity principles of its host university. Box 2 contains an outline of the access course.

The child-care students and access students had engaged in various unskilled and semi-skilled employment, such as waiter, shop-assistant and labourer. Their prior education ranged from limited secondary education to the minimum school leaving age of 15 years, to completion of Year 12, with the exception of one child-care student who was concurrently enrolled part-time in an undergraduate psychology degree. Their ages ranged from 18 years to mid-thirties.

The majority of participants were born in Australia, and all stemmed from British or European heritage. In reporting this study we substitute pseudonyms for all participants' names.

Box 1: The Child-Care course

The Certificate III in Community Services (Children's Services) course is designed for people interested in working in

- Long day care child care centres
- Occasional care centres
- Family day care
- Out of School hours care programs
- Vacation Care programs

The course can lead to further study and career pathways in the Diploma in Community Services, which may then lead on to Bachelor degree studies.

The Community Services Training Package has been developed as part of the National Training Framework. It is a nationally recognised course which aims to provide skills, attitudes and knowledge that are required in the children's service industry. The course is competency based, which means that students will be required to demonstrate skills, attitudes and knowledge to industry determined standards.

The course consists of

- Field placement in the campus child-care centre of 15 hours per week
- Classroom based training on one day per week
- Flexible delivery training on two days per week

Due to high demand for positions within the course, the following criteria are used to select applicants

- Educational level
- Experience in community service settings, particularly in children's services
- Desirable personal traits and attributes
- Career goals

Box 2: The Access Course

The one-year Access Course allows people to experience university study in a non-threatening environment then introduces them to some major fields of study. In the following year they may apply for admission to degree courses and their application will be assessed on the basis of the academic potential demonstrated in the Access Course. There are no prerequisites or entry requirements, but where applications exceed available places preference is given to those who have been educationally disadvantaged.

Part 1 comprises the single topic University Life and **Part 2** the topics entitled Developing the Skills of Academic Literacy and Learning to Use Quantitative Methods.

In **Part 3**, students choose one or more university topics in specific areas such as the social sciences, biology, law, mathematics or the humanities. Each topic involves attending an evening session on campus once a week.

Procedure

Interviews. We reviewed the extant educational psychology literature to identify major concepts in current theory about student learning and recommendations about how students should undertake learning tasks. From that review we formulated 18 questions to provide the basis for semi-structured interviews. The 18 questions covered the following areas related to learning: The nature of the teaching and learning environment (lectures, group-work, situated practice); the nature of teaching and learning (constructivist and transmission—reception paradigms); the nature of the learner (cognition, metacognition, motivation, self-regulation), and the nature of the subject matter (content and purpose). These questions cover a set of concepts that are central to current thinking about learning and studying. The 18 questions are listed in Appendix A.

Interviews were conducted at the students' TAFE and university during a break in lessons, or at the students' usual location for private study, such as their desk at their home. Each interview lasted from 20 to 90 minutes, canvassing the 18 questions and any other issues that participants raised. Interviews were audio-taped and transcribed verbatim.

Data analysis. Interview transcripts were repeatedly read and coded using NUD*IST (QSR, 1997) data analysis software. Each transcript was coded to one or more of ten deductive categories (Miles & Huberman, 1994). The deductive categories emerged from our review of the literature that prompted the 18 interview questions (learning environment, the learner, teaching and learning, subject matter). Figure 1 contains the ten deductive coding categories. As a check on the reliability of the coding process, an independent rater was trained to code to the ten deductive categories. Percentage inter-rater agreement ranged from 81.6 per cent to 100 per cent across the ten categories.

Next, we used the searching capabilities of NUD*IST to combine all participants' statements from each of the 10 deductive categories into thematic spreadsheets. The spreadsheets contained major and minor themes in the first two columns, and thereafter, a column for summaries of each participant's statements organised according to the themes in the first two columns. The spreadsheets enabled us to search for patterns in the data.

RESULTS AND DISCUSSION

The purposes of the present section are, first, to represent in an accessible form the knowledge about learning that emerged from interviews with the child-care and access students; second, to employ current theoretical perspectives to draw out some common themes that appear salient to the group as a whole; and third, at a higher conceptual level, to suggest the overarching theme of *transactions* and *balance* between constructs that often appear as dichotomies in the educational psychology literature.

We organise the following discussion according to selected constructs in contemporary educational psychology, including performance and mastery goals (Pintrich, 2000a; Pintrich, 2000b) and surface and deep approaches to learning (Biggs, 1979; Biggs, 1987; Entwistle et al., 1979); effort (incremental) and ability (fixed) self-theories of intelligence (Dweck, 1986; Dweck, 1999); and theory versus practice (Lave, 1988; Lave & Wenger, 1991; Wenger, 1998).

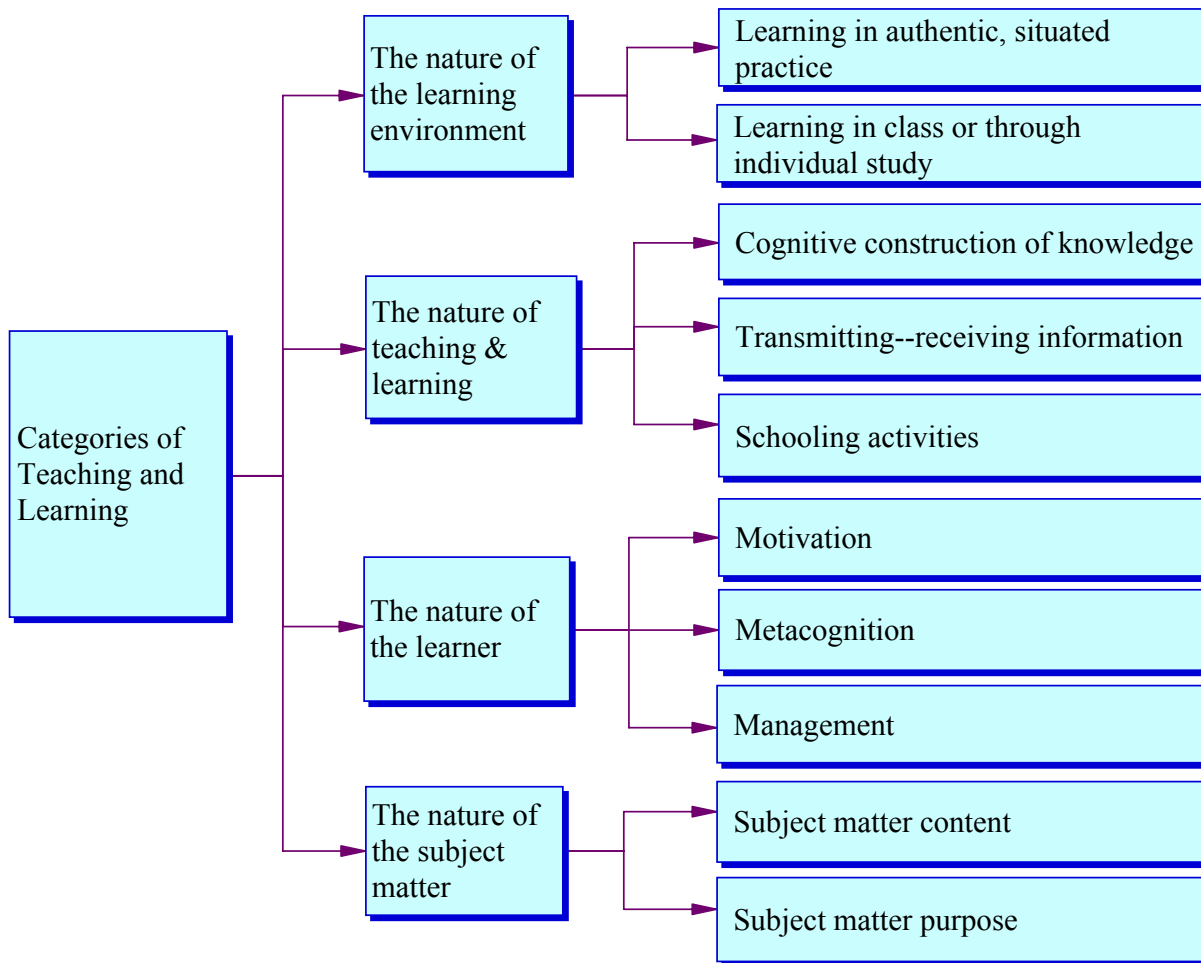


Figure 1: Categories of teaching and learning

Performance versus Mastery Goals and Surface versus Deep Approaches to Learning

Table 1 is a collation of the statements that the child-care students made about what they do to learn. From Table 1, it can be seen that the major theme of *Strategies for constructing knowledge* is divided into themes of, discuss; ask questions; do reading and writing; try to understand; draw from prior experience; gain authentic, situated practice; feelings about being wrong when learning; make connections between bits of knowledge; appreciate the role of the teacher in assisting understanding; decide what is important to learn; and that roles can reverse, as sometimes students are teachers too.

Note that in the first line of Table 1, all participants in the child-care cohort had something to say about the value of *discussions* for constructing knowledge. For example, Mary spoke about how brainstorming expanded her own way of thinking, and Ken spoke about one-on-one communication between student and lecturer. In the second theme in Table 1 *questions*, Bella described how she “keeps asking questions until it sinks in” and Grace asks herself “Why are they (the children) doing that?” In the theme *readings*, Arma described how reading other books helps her to “get thinking heavier” and Jen explained how reading helps her to “go into it properly.” In the theme *thinking for understanding*, Arma has a conversation in her head and Grace tries to make sense of what is going on. Scanning through Table 1, it can be seen that the theme *authentic practice* contains entries from all child-care participants, such as where Bella explains that doing things helps her to learn, Mary puts “2 and 2 together,” and Ken pictures the child-care centre and asks himself, “What is my

experience?” In the last line of Table 1, Cait suggests that once you have the knowledge you can “become a teacher to others.”

Although there are clearly individual differences in the responses of the participants in the child-care group, taken as a whole, the responses in Table 1 demonstrate a range of strategies directed towards constructing knowledge. These strategies can be classified as *deep* and as being directed towards *mastering* a knowledge base about caring for children. It is interesting, therefore, to compare the contents of Table 1 with participants’ comments about what they do to pass the written competency exercises in their competency assessment folders. These comments are collated in Table 2. For example, Bella reads the exercises, Jay has trouble with the wording and Jess and Lara talk about being bored. These comments suggest a more surface approach to the assessment tasks, an approach that does not see assessment as an opportunity for increasing mastery of the content. In these child-care students’ accounts, within a single course of study, achievement goals, choice of learning approaches, and consequent learning strategies, are not all weighted to one pole or another of dichotomies such as performance or mastery goals, or deep or surface approaches. Both poles of such dichotomies are represented.

Table 1: Child-care students: statements about strategies for constructing knowledge

Themes	Arma	Bella	Jay	Juli	Mary	Jess	Bec	Lara	Ken	Jen	Grace	Cait
discussions	Discuss what's happening... help each other out; give our opinions... get them thinking a bit more.	Get more involved in class, like when they have discussions	As we were talking about yesterday, there's a difference between asked & being told	So a whole group of us are arranging what we want to cook	Yesterday I was in a brainstorm, everybody has their own ideas... you combine it with your own ideas... expand your own sort of way of thinking. Makes you think. It's beneficial.	One of the girls was talking just now, she's way behind on her assignments	I suppose if we keep passing things then we're on the right track. Then I guess if we're not then we talk to the lecturers	Listening to the different thoughts or opinions of other people who are talking... gathering the information that they have. They could have different experiences	One on one interaction.. Between a lecturer and student. have that communication	Discussions; pick knowledge of group opinions; contribute my knowledge to discussions; checking my own knowledge	You talk about your experiences; everyone has an experience they want to tell	The teacher will talk about their own experiences, which is fantastic, you talk about your own experiences as well. Everyone gets a chance to be involved. See things from a different point of view
student asks questions	am I really sure about this; ask questions if I'm not sure; I ask other people: go back and think again: I was right the first time	keep asking different questions until it sinks in		talk to director; how can we replace that stuff (food additives)?				ask somebody; get a clue			think, "Why are my answers different to book answers?" Analyse the children, "Why are they doing that?" Interact with lecturer-ask questions	write a list of questions; ask the lecturer; ask other students
readings	read other books: helps me to get thinking heavier; read the section: think that's what they do: now, would I do the same thing or different			read first; that helps to understand; when I read it's going into my head	go back and read through it again- pick up a lot more	give me a book & I'll go & sit & study; I'm happy			read through the question a couple of times; make sure I've fully understood it; the book is a generalisation; every centre is different	read and discuss; read and go into it properly;		read through it again; get it clear in my head
writing	I like writing assignments: it gets me thinking; writing is therapeutic in some way			read about it, do the activities (in competency book); helps me to understand it more; easier to remember it if I write; when I write I'm reading as well; do rough copy, add things in		[writing] I don't plan, it just flows		write down stuff				
thinking for understanding	I think to myself; have a conversation in my head; think about what people have said in class	say oh yeah, I understand this now; make sure it goes into my head	thinking one question at a time: then-what do I know about that	thinking about it; remembering it;	put 2 + 2 together	no new thinking processes, done all this before, just surfacing	I don't usually think			think, "I knew it", think "I should have done it differently"	trying to incorporate everything & make sense of what is going on	

(Continued)	Child-care students: Strategies for constructing knowledge											
Themes	Arma	Bella	Jay	Juli	Mary	Jess	Bec	Lara	Ken	Jen	Grace	Cait
prior experience	think in my own real life situation: what would I do the course and common sense overlaps really	found one that made the most sense to me: from doing the mandated notification			I haven't done that yet; I've had other experiences; I'll use them	done most of it before, mother, much is second nature; sometimes I just know it; so write what comes to my head		using prior experience	have done all this with cousin's 5 kids; worked as a volunteer	follow own common sense have own children; impossible to memorise it all; don't have to memorise here; already have big ideas about everything	use my common sense; even if I'm not aware of it; make you aware of it & how it protects the child; my past experiences helps me to learn; to realise where I want to land	
authentic practice	chil-care workers help me to learn; get us involved in situations; talk about what they do and why they do it; ask us questions; show us their way of doing things	learn from the experience of having to do it; actually doing things helps me to learn	learn by experience: trial & error: Its automatic; always learning new skills because the situation arises	you see it happen, so you understand more	put 2 & 2 together; put it into practice so will be able to put it onto paper; everything that gives me experiences helps me to learn; you can't learn how to redirect a child without having to do it in the field	interact with children; see kids in a different light; watching kids;	observe staff; learning over time, picking up little bits, being flexible, observing	I've taken it in and I do it, I can see that you can do it, that it's possible	picture the centre, think What would I do in this situation?; what is my experience?; easier to answer questions; it's a visual thing; I take myself through it, think back; remember the steps; picture the layout of the room	students problem solve during the day	being in a centre is a learning experience in itself	cos you're doing things-you're just constantly learning it; it's easier; I feel like I'm learning more
being wrong				OK to get it wrong, cos I'm learning	scared of making a mistake; self-conscious; don't want to do the wrong thing; step on toes	learn from your mistakes					need to be able to feel that it's OK to make mistakes - won't be ridiculed	
make connections	think what way am I going to do it: sometimes two different ways; bring it all together and make my decision									some people learn the basics; I learn between the lines		can get conflicting information from Teachers - I do what I think is right
teachers assist understanding		teachers help us with what we don't understand	the lecturer said it; it really made sense to me									
what's important to learn					Course pinpoints what to look out for: how to react, redirect, give them the best; meet their needs, emotional, developmental, nutrition					read and discuss most important parts; what is and isn't important		
students are teachers												someone tells or shows you something; you learn from them; you take on what they've told you; you become a teacher to others after that

Table 2: Child-care students: Statements about completing assignments

Student	Theme: completing written assignments
Arma	I'm like...read my assignments out to my parents and then I feel like that it sounds okay, what more could I put in there and spelling if they can pick up any mistakes
Bella	I read the exercises; copy out the answers. The answers are in the book
Jay	I have the knowledge but may be struggling to answer the question-the wording-I hate it when the questions are worded so stupid
Juli	when I read it's going into my head; highlight most important parts; that will help me with assignments
Mary	recently when I've had two or three assignments due at once and um...I'd tend to do like the easier ones first and.....then um...just sort of I keep putting off um...and procrastinating um...just not wanting to do the last one until I really have to. Um...I just hate doing it.
Jess	sometimes I don't know how to do the activity; trying to find the information; sitting, listening, noting, being bored
Bec	the teacher writes it on the board; you copy it into your book
Lara	copying from a blackboard doesn't work for me - boring - lose enthusiasm
Ken	it's just a matter of going through the book and finding the right chapter; sit there and gather information; take bits from each paragraph; sum it up; put it into your own words; try go through it [the book] properly and really just get into it. Just read it and get real idea from that. Well go through it properly is just do it as it is in book. I had to resubmit an assignment because I didn't write down the ratios of adult child ratios for the childcare centre.I asked a friend. She says look I've done it, I've got a pass for it, here you go. So I was able to write it down and resubmit it the same day.
Cait	I take notes on everything, in case I miss or forget something; go over my notes

For example, Mary espoused views that seem to represent both deep and surface approaches in her attempts to master the complexity of child-care and her need to pass the competencies for certification. But her comments do indicate that she thinks that the reading she does for her course informs her practice in the child care centre. There is a transaction between the two approaches. Each approach might be apparent in one component of her course, but it does not exist in isolation from the other: Both form part of her mental model of her intentions, plans and actions for learning (Bereiter &

Scardamalia, 1989; Kerr, 1981). For example, from Table 1, in the theme *what's important to learn*, Mary suggests that the class-based work of the course “pinpoints what to look out for” in the centre.

Furthermore, even though students might appear to adopt performance goals or surface approaches towards their written competency assessments, this did not mean that they were unaware of the value of the knowledge that was required for those assessments, as evidenced by Mary’s reflection:

Mary (child-care): I could do better: If I did all my (theory) work I’d have a better understanding; I’d be able to do the child-care centre better, that’s what the theory is there for; they tie together.

Contexts change quite often during a week of instruction. On some days the child-care students are dealing with children in the child-care centre. On other days students sit in a classroom listening to lectures, contributing to class discussions, answering teacher questions and completing written assignments for homework. The daily juxtaposition of on-the-job experience in the child-care centre, learning in class, and individual study would suggest that differential goals, approaches and strategies could vary over quite short spaces of time.

By way of illustration of how a student could concurrently hold a performance goal and a mastery goal, during her interview Jay (child-care) jumped up, grabbed a doll, and performed an animated role-play of how to establish empathy with a distressed child—she was clearly engrossed with the subject matter and her capabilities to master it. In that same interview, (that is, within a few minutes) Jay also described her struggle with procrastinating over assignments and leaving them until the last minute (as did other child-care students). Thus, students’ goals and strategies that are conceptualised and factored in the literature as quite distinct or dichotomous appear in our students’ accounts to be intermixed in a dynamic manner within the same course of instruction. The important point to draw from this is that the data just noted is difficult to reconcile with the dominant use by the student of only one of the poles of a dichotomised approach, or a single goal orientation. Rather, these students may draw upon more than one type of approach or goal orientation in a short period of time, depending upon the demands and affordances of quite specific learning situations.

The students’ reports suggested a dynamic transaction between different types of knowledge about learning and the demands of the learning situation within a short time period. This suggests that the students were sensitive to variations in context, so that what might be conceptualised as a “usual” or apparently undifferentiated period of learning was in fact substantially, and subtly, differentiated in the range of demands being made upon the students’ knowledge about learning across quite short periods of time.

The nature of the educational experiences that the child-care students were receiving included a combination of class-based theory and authentic, situated practice, where the students were placed as trainee workers in a child-care centre. One possible hypothesis is that the authentic, situated practice contributes an imperative to master the subject matter,

while competency assessments and exams provide an imperative to adopt performance goals. Thus students are faced with having to *balance* both demands in quite short periods of time. If a student does not display evidence of mastery goals or deep approaches and strategies in a particular academic environment, it does not imply that the student lacks such goals or strategies for all learning endeavours, or for all learning associated with that topic or program. This interpretation does not discount the importance of performance goals, but instead suggests that performance goals and mastery goals are both valuable in that they have applicability to different contexts. As Biggs and others have pointed out, it is unrealistic to expect mastery goals in non-conducive contexts, or to lament the lack of mastery approaches in students for whom no contextual imperative for mastery exists. Note the shift in emphasis here. In our analysis, rather than the performance or mastery goal being attributed to the achievement motivation of the student, goals are seen as an outcome of a transaction between the student and situation. Rather than theoretically dichotomous approaches and goals operating at opposite poles, our analysis suggests that students' motivational knowledge is involved in transactions within the demands of learning situations.

Entity versus incremental self-theories of intelligence

Building upon our proposition that dichotomous constructs appearing in the educational psychology literature seem to work in transaction in the present study, perhaps the most telling evidence supporting an interpretation of an interaction between entity and incremental self-theories is provided by the access and child-care students' recollections of their personal histories in formal academic environments. Many of these students indicated that their previous years of compulsory schooling had been substantially marked by a lack of academic success, suggesting both limited ability and limited effort (by their own and other people's assessments).

For example, Analise (access) told of her previous understandings about her own ability and application of effort, summed up by her father's oft repeated taunt, "You're a bugger of a child." Analise said that she wasn't a bugger of a child any more: she was discovering that she had ability *and* could apply the necessary effort. Ray (access) told of how school never interested him, how he did poorly and how he left at the first opportunity, his 15th birthday. Now, he has decided that life has more to offer than a succession of itinerant, physically demanding jobs. Although English is his second language, and although he claimed he has never written a page, let alone a whole essay, Ray's understanding is that because he wants to learn he has as much ability as anyone else, and he is prepared to "do what it takes."

Here the key to people's understandings about potential success appears not to be that they operate within either a relatively stable framework of incremental intelligence, or a relatively stable framework of entity, or fixed intelligence (Dweck, 1999). Rather, our participants' accounts suggest three modifications to a dualistic self-theory. First, there appear to be not one, but many possible mini-self-theories that apply to different situations. Second, there occurs a transaction and balance between entity and incremental theories that can change over situation and over time. And third, there occurs a

transaction and balance between students' self-theories and many other variables such as interest, relevance and value of the subject matter. By our participants' accounts, when they want to learn for their own reasons, there appears to be no reason why they should not possess both sufficient ability and make the necessary effort. We gained a distinct sense from participants' responses, such as Analise's and Ray's, that perceptions of effort seem to influence perceptions of ability and, vice versa, so that perceived ability seems to work as a stimulus for application of effort. In addition, participants' retrospective accounts of their changing motivations, and changing interpretations of their ability interacting with their willingness to apply effort, lends support to the importance of recognising the potential for dynamic change in people's knowledge about learning (Bond, 2000; Volet, 1997; Volet & Lawrence, 1988).

Indeed, Dweck (1999) made reference to the influence of variables such as interest upon a person's willingness to apply effort. For example, she recounted the story of Charles and Bob whose decision to major in a difficult computer science course, "would rest, they decided, on how interested they were in it and how hard they were willing to work" (Dweck, 1999, p. 13). In this case, it seems that interest has the potential to modify willingness to apply effort, and therefore could be considered to be a mediating variable to a person's self-theory. This argument can be further illustrated by considering the following 'entity' item in an entity-incremental attitude scale

Schoolwork is like chores—it has to be done, but you don't want to take much time doing it if you can help it. (Dweck, 1999, p. 34)

If schoolwork is like chores, then it lacks interest, and possibly other motivational qualities such as apparent value for future employment. Therefore schoolwork, as a defined situation for an individual, is unlikely to elicit a willingness to apply effort. In this case, unwillingness to apply effort could well be ascribed to characteristics of the task rather than to a self-theory (Ames & Archer, 1988; Ames, 1990). It is not difficult to imagine that someone like our participant Ray, in his school days, would have agreed with the above statement about schoolwork, disagreed with it when he was willingly spending considerable time and effort learning how to fix his own car (change over situation), and, as an adult, disagree with it when the value of a formal education has become more apparent (change over time).

Theory versus Practice

One explanation for the complexity of students' mental models that emerges from participants' transcripts is that the temporal combination of the theoretical and practical components of their courses interact to facilitate learning in a way that is more than a simple addition of the two parts. The child-care students told of how they may deal with an anxious child as a learning issue in a lecture session and within a few days see such a child in the child-care centre. Access students described how engaging in the practices of academia, such as reading, discussing and weighing up arguments, caused them to reconsider the way they interacted with their everyday world. Figure 2 displays Lara's (child-care) account of the integration between learning from books and learning in practice. Lara describes how "putting what they tell you into practice" is "not just sitting

getting the information” but that “taking it in and doing it” allows her to “see that you can do it.” She says that “books help you with your work” and that the course is able to “give me the information I need and the opportunity to put it into practice.” Clearly theory and practice are essentially integrated in Lara’s understanding about effective learning.

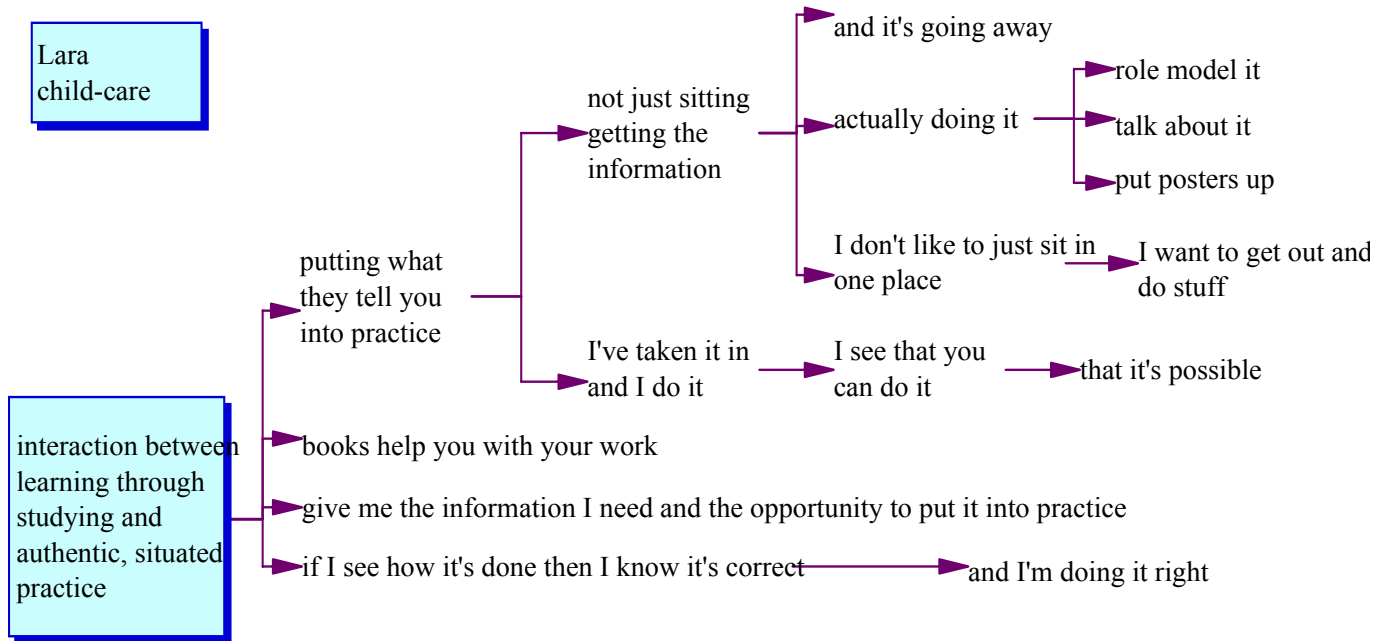


Figure 2: Lara (child-care): Statements about integrating theory with practice

A further interesting example is provided from Ray’s (access) transcript. Ray explained how his approach to solving mathematics homework problems was similar to the way he approached mathematics problems at work:

Ray: [My uncle] explains more on a level that I can understand. He tells me, look I’ll tell you this in this way ... there’s a couple of things we’ve been over, with the algebra he didn’t have no idea but we sat there and we did it together ... Yeah well by learning together, giving each other ideas and we ended up putting it together, basically. Like they say two brains are better than one.

Interviewer: Now you reckon this [maths] is all new to you, but here you’ve got a really important technique. You sat down and you had a go at it together, even though neither of you knew anything. Now, do you do that kind of learning, or have you done that kind of sit down and work it out, in other kinds of things that you’ve done in your life?

Ray: Every day.

Interviewer: So tell me about that. What’s an example of that?

Ray: Well for plastering for instance. Measuring up um ... you have ... you have to think ... you have to stop right ... you may be on a job ... Um ... you had ... you have ... they give you a design to tell you where, what you have to do. They give you a map basically what has to be rendered. New house. They tell you what you have to do. You get a ... map ... And work out on the map of the house where you want the put the render, basically.

Interviewer: Sounds like Maths to me.

Ray: Well exactly. That's right. There is a lot of geometry in the building industry which I've worked a lot. You're always measuring, always making sure things are flat and you know, it always has to be square. Same thing. Sit down. You'd look at it, you'd look at the building. You analyse basically.

Interviewer: So tell me, analyse. What's involved in analyse?

Ray: Er ... well for instance timing. Because with the plaster you can't mix too much up because of...it goes off and then you've got to work out, if there's joins in the house you've got to work out where to stop when you want to have lunch, say. Because you can't continue ... you can't just stop halfway through ... Yeah. In kitchens like I've been cooking. I've got to work out meal sizes for so many people. Then you get an order, at one table you get three of the same meal at the same table so you've got to work out how much to put in. Three times. It's everywhere. Everywhere.

A summary of the statements that the child-care students made that suggest a transaction between learning in class and learning in authentic, situated practice is provided in Table 3. It can be seen that Bella and Jay say that what happens in the child-care centre helps them to understand what is learned in class, while Mary, Jess, Lara and Cait take the lessons from class and put them into the child-care centre. Ken explains how the competency books are designed to go with the practical experience and that he can write answers in the books from his experience. However, Grace cautioned that often there is insufficient time to incorporate textbook solutions into practice.

It seems reasonable to propose that if students hold such complex knowledge about learning as represented by even small extracts from their transcripts as are contained in the examples provided herein, then it is likely that such knowledge will inform their approaches to learning, goals, self-theories and perceived links between theory and practice. Furthermore, if the range and complexity of students' knowledge about learning as contained in the collection of extracts in this paper is considered as a whole, then it becomes apparent that representing a learner as 'surface' or 'deep,' or 'mastery' or 'performance' oriented, and so on, is problematic to the extent that such characterisations under-represent the scope, connectedness and situational variability of students' mental models about learning.

Table 3: Child-care students: Statements about integrating theory with practice

Students	Statements
Arma	you see what's on paper in real life; think back to school-this is what we do; on the job and off the job is really important
Bella	child-care helps you understand what you've learnt in class; centre gives you an experience to try the things you've learnt in class; can't try things out in classroom: just taking teacher's word for it
Jay	pretty close match [between class and the child-care centre]; learn about things-it all goes into practice
Juli	because we're at the child-care centre it's easier to understand what they're saying in lessons
Mary	the child-care centre reminds me of what was in book and happened in class; conscious of what to do; do your theory- you think about it, becomes a subconscious knowledge-do it automatically; if I hadn't done theory, I wouldn't be as aware, wouldn't have remembered in the centre: wider knowledge; child-care centre and class work together, centre gives practical examples; practice, gets drilled into us as we're learning about it instead of after we've finished and half forgotten; identify with what's happening and bring it to class; in the centre we're taught what to look out for in class; if I did all my work I'd have a better understanding; I'd be able to do child-care better, that's what the theory is for; they tie together
Jess	when I put into practice what I've learnt in theory; give me the information I need and the opportunity to put it into practice
Lara	putting what they tell you into practice
Ken	the books are designed to go with the training; the assignments are based on your experience; it's a great way to do it; it's easy if I'm writing from my own experience
Jen	on paper and in real life, same stuff, situations just come up, can't run to book; learn what child-care is all about; in books; in real life; in the end theory and practice come together; real experience confirms what is in the book; go through it properly and get it [know it] for good [properly] as it is written in book; learn what child-care is all about; in books; in real life
Grace	take the lessons from a book and put them into real life; it can be difficult; not everything in child-care centre is text book scenario; don't find the time to incorporate textbook solutions into practice; you go along with it; put theory into practice; it's surprising how much you've learnt; from the classroom into the child-care centre
Cait	I guess because we've done um occupational health and safety, you know, lectures and stuff, I'm taking that from the classroom into the centre with me

ALTERNATIVE REPRESENTATIONS OF STUDENTS' MENTAL MODELS ABOUT LEARNING

It is clear that in order to design and deliver optimum teaching-learning environments, researchers, policy makers, and teachers need ways of gathering information about the knowledge about learning that students bring to teaching-learning environments. We see the need to attempt to balance the conflicting needs to reduce potentially large amounts of information, such as obtained from interviews with learners, to an accessible form, while at the same time maintaining contact with the complex, inter-related nature of learners'

knowledge about learning. Clearly it is not possible to conduct extensive interviews and analyse in-depth the responses of all learners in the way reported herein with a small sample of 16 learners, although primary school class teachers, and to a lesser extent, secondary school class teachers may be able to talk at length with their own students about the students' knowledge about learning. At the other extreme, our view is that questionnaires that factor students' responses into relatively simple dichotomous or hierarchical representations that are then used to characterise students are unlikely to adequately account for the complexity of knowledge that students hold about learning, particularly in response to contextual changes. A similar assessment was made by Hadwin et al. (2001) in relation to students' reports about self-regulated learning:

if adaptation is the hallmark of SRL, data consisting only of self-report questionnaire items and scales that aggregate responses independently of time and context may weakly reflect, and may even distort, what SRL is."
(p. 486)

In an attempt to deal with difficulties of representing students' knowledge, we are currently trialling two alternative methods, concept maps and profiles: Examples are provided below.

Concept maps

We created concept maps to display the content and organisation of each participant's transcript (while still sacrificing much detail). The process of creating the concept maps required the reading of each transcript from the beginning in order to identify major themes, which were noted using Inspiration[®] (Helfgott & Westhaver, 2000) display software. We then searched for linking statements that led from each theme to other themes. Following a transcript from beginning to end, we mapped each new idea or theme where participants' accounts took new directions; noted successive levels where more broad themes appeared to subsume less broad themes; and noted links between themes that participants suggested. An example of a concept map is provided in Figure 3, which is the concept map created from the complete contents of Cait's transcript.

The concept map of Cait's transcript presented in Figure 3, although highly stylised and reduced, does provide a way of thinking about the structure of Cait's knowledge about teaching and learning. Cait's account can be organised into five main levels. The highest level includes the entries *learning* and *child-care worker*. At the next level are statements about self-regulation, such as *it's up to me* and that Cait wants to *pass*. At the next level are sources of learning such as *hands on, doing things at the [child-care] centre, and lecturers*. Also at this level are motivations such as *interested* and that Cait would like one day to get her Diploma, (a qualification one level above the child-care certificate). At the next level are the results of actions and motivations, such as *getting information, doing well, doing my best, learning routines, having notes, and using elements (competencies)*.

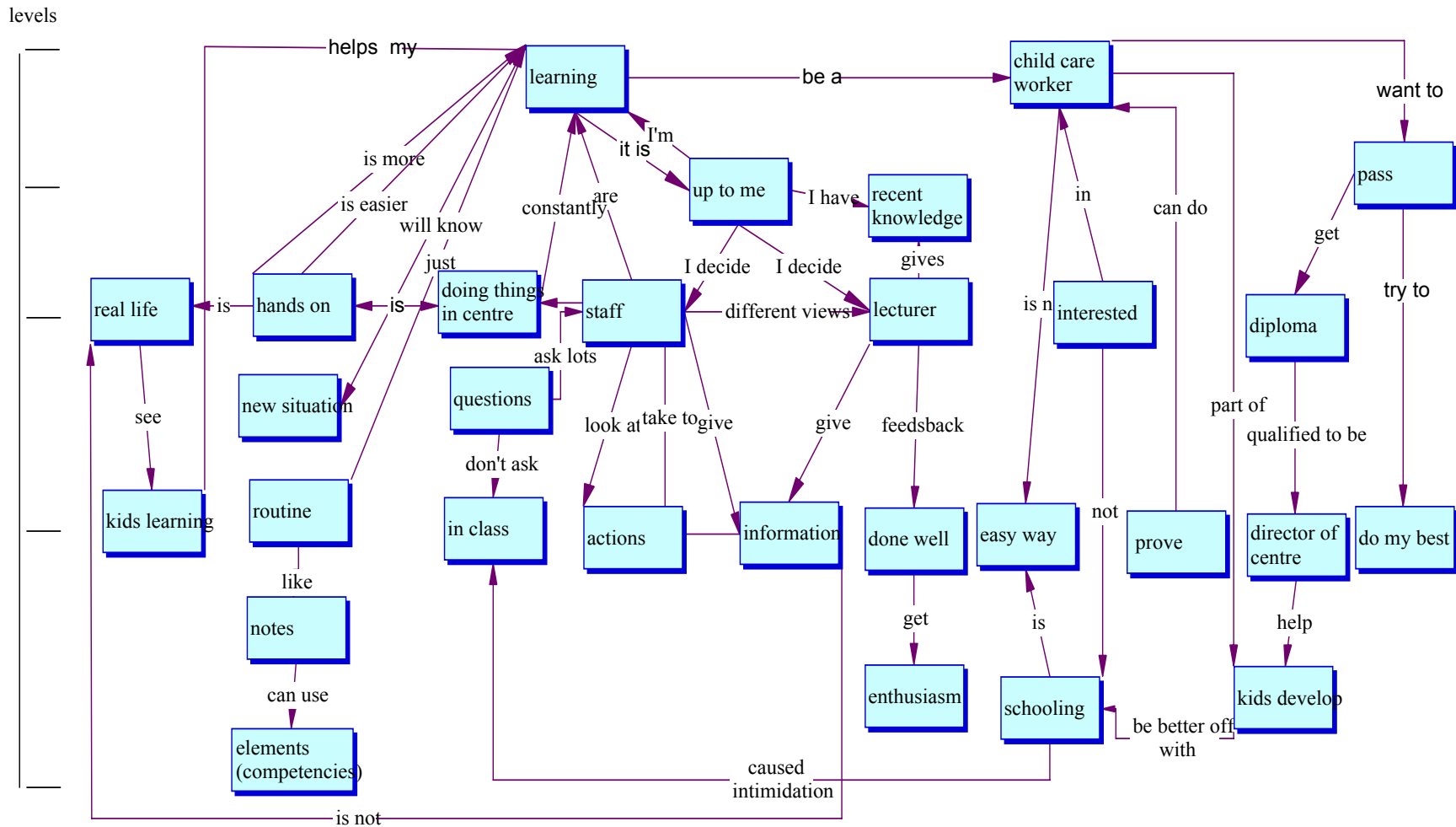


Figure 3: Cait (child-care) concept map of knowledge about teaching and learning

Finally, Cait provides details such as *enthusiasm*, *helping kids develop* and using her lecture *notes* and *competencies*. Many of the statements in the concept map at each level are linked to each other, such as Cait's recognition that her role as a *child-care worker* will be part of *kids' development*, which in turn will help kids to be *better off with schooling*. Cait's reference to schooling then caused her to make a link to her own difficulties at school which *caused intimidation* for her in class. Another series of links in Figure 3 can be observed at centre-left, where there is a connection between *learning, doing things at the child-care centre, asking questions of staff* and *looking at the actions of staff*, which is linked back to the statement *learning*, as Cait made the observation that the *staff are learning* from the students, as the students are learning from the staff.

Although the process of concept mapping the interviews is still resource intensive, the concept mapping technique does allow for representation of more of the complexity of this student's knowledge about learning and the transaction between that knowledge and situation. For example, we see a clear differentiation in Cait's reported use of questions in the child-care centre and the classroom. The technique also has potential to be used in conjunction with other more reductionist techniques in order to more comprehensively represent qualitative features of students' mental models (Martin, Mintzes, & Clavijo, 2000; McKeown & Beck, 1990; Novak, Mintzes, & Wandersee, 2000a; Novak, Mintzes, & Wandersee, 2000b; Pearsall, Skipper, & Mintzes, 1997; White & Gunstone, 1992). In the present study it has been particularly valuable in identifying, at a glance, the complexity of students' mental models.

Individual profiles

We are in the early stages of developing individual learner profiles employing a combination of NUD*IST to facilitate the categorisation of students' responses, and correspondence analysis to search for patterns in those responses. The profiles attempt to canvass learners' knowledge across multiple variables where each variable can contribute to more than one dimension of knowledge about learning.

By way of (a brief) introduction to the profiling technique, we subjected the categories and sub-categories identified in the reading and coding stage of this study to a series of correspondence analyses (Askell-Williams & Lawson, 2004). The correspondence analyses identified 29 variables in participants' transcripts that seemed worthy of investigation. Figure 4 is the graphical display of the profile of relative frequencies of the occurrence of the 29 variables in Cait's (child-care) interview transcript.

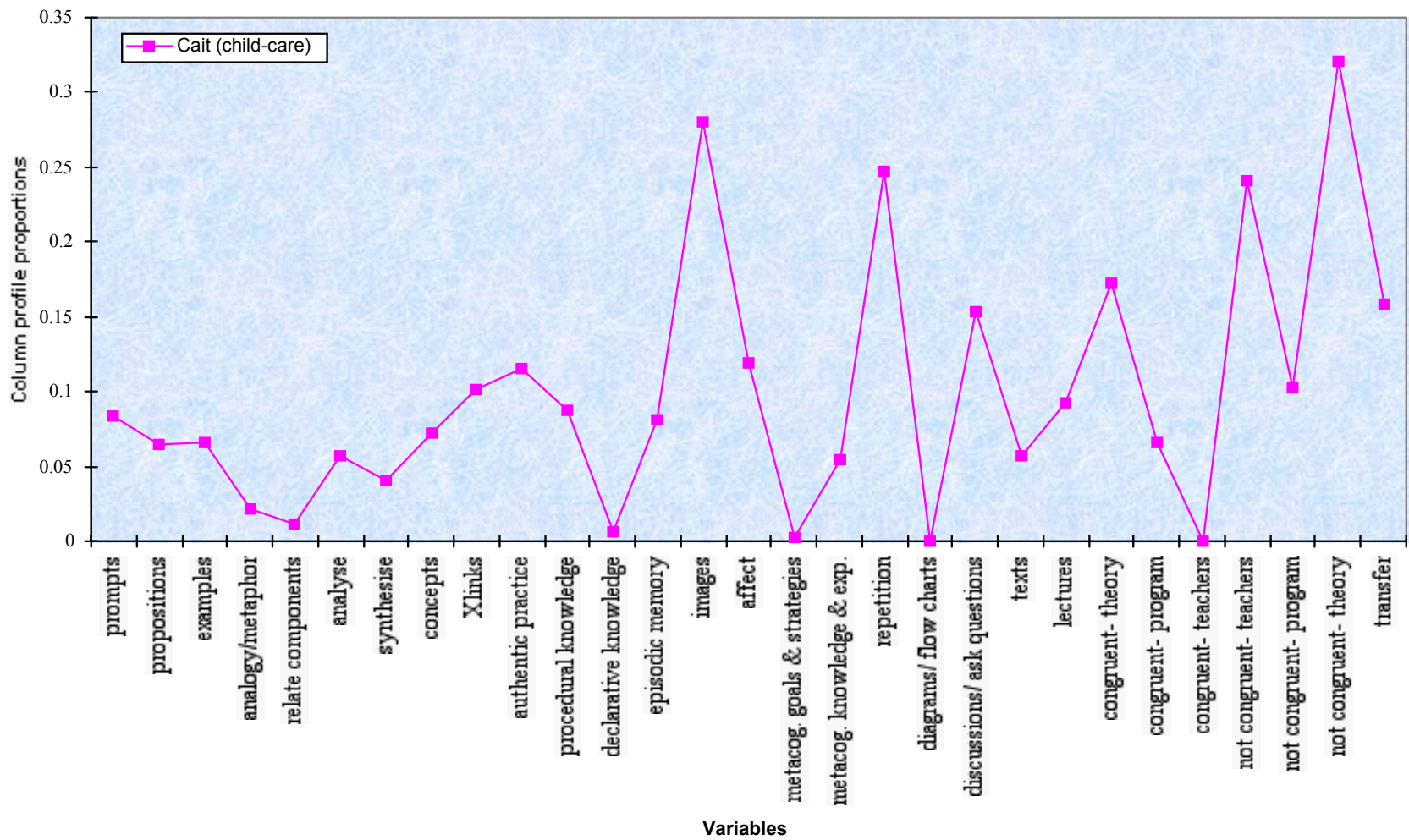


Figure 4: Cait (child-care) Profile

From Figure 4, it can be seen that Cait scores relatively strongly on *images, repetition, authentic practice, not congruent-teachers, not congruent-theory, and discussions/ask questions*. She scores relatively weakly on *relate components, declarative knowledge, metacognitive goals and strategies, diagrams/flow charts and congruent-teachers*. The potential of the profiling technique lies in its ability to highlight individual's strengths and weaknesses over a range of variables of knowledge about learning, thus providing valuable information to guide future instructional interventions. It is informative to toggle between Cait's profile, concept map and interview transcript. Cait told about how, when asking questions, she feels intimidated in class, but has no trouble in the child-care centre, which is mainly one-to-one interaction. Cait also recounts how she takes lots of notes in class. She 'goes over' her notes, but she doesn't give an account of how she might add to the value of those notes with strategies such as drawing diagrams or flow charts, making headings, creating outlines and so on. From her transcript, Cait describes herself as a "hands on" person:

Cait: I'm more of a hands-on person ... I just find it easier if I'm actually in there doing something to learn um ... yeah er ... just um ... wiping down benches and you know cleaning the kitchen or something like that. 'Cause I'm actually doing it um ... it's easier than watching a video and thinking oh yeah, that person's doing a good job, you know I'd rather get in there and be doing it rather than sitting there and watching somebody else doing it ... Yeah I feel like I'm learning more. You do, you feel, or I do, I feel like I'm learning more because I'm actually doing it, whereas the person on the video, I look at a video and think oh that person's learning more, kind of thing, 'cause they're doing it. So ... I don't know um ... I just ... you know I like actually having your hands-on approach to everything. It's sort of easier.

The use of text extracts, concept maps and profiles highlights the complexity of Cait's mental model, or models, about learning, and lends support to our case that we need to heed Nuthall's (1997) words:

the reductionist conception of research that favoured simplicity and objectivity has been abandoned for a conception of research that embraces the considerable complexity and subjectivity of much of what we need to observe, describe, and understand in classrooms.
(p. 760)

Summary and conclusion

This paper has reported a study where we conducted focussed interviews with child-care students and university access students about their knowledge about learning. Using text extracts and thematic spreadsheets we represent the broad and diverse range of knowledge held by learners and we demonstrate the use of concept mapping and profiling as alternative ways of representing learners' knowledge.

The apparent complexity of students' knowledge about learning leads us to propose, as an alternative to reductionist approaches which rely upon single dichotomous or hierarchical explanations, *transactions within and between multiple dimensions* of knowledge about learning.

Of course, a transactional perspective is not new: Dewey sought to positively reformulate dualisms to overcome the disadvantages of oppositional stances (Garrison & Archer, 2000; Prawat, 1998). Similarly, the essence of Bandura's (1997) social cognitive theory is the mutual reciprocity between the three apexes of the social-cognitive triangle. Cognition, behaviour and environment don't simply react to each other, they interact in mutually transformative ways. In Deweyian and Bandurian spirit, we propose that it is appropriate to begin to put the complexity of transactions back into some contemporary educational dichotomies and hierarchies. For example, to recognise that transmissionist methodologies can enhance the construction of knowledge; that learning about theory and practice are mutually supportive perspectives for mastering the same subject-matter; and that individual cognition reacts to and is embedded in contexts. Although other researchers have proposed transactional perspectives, the imperative of the argument that we make in this paper is that the transactional perspective emerges from an in-depth analysis of the participants' accounts of their knowledge about learning.

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Appendix 1: The 18 Interview Questions

Background theories	Questions for learners
Achievement goals	What do you want to achieve from what you are doing in this lesson/topic/course? Why do you want to achieve this?
Self-efficacy, expectancies for success and attributions for success/failure	How well do you expect to perform in this lesson/topic/course? Why do you have those expectations? Can your performance be changed and if so, how?
Psychological and social constructivism; cognition and metacognition	What thinking processes will you be using in this lesson/topic/course?
Self-regulation	In what ways are you responsible for the learning in this lesson/topic/course? In what ways is your teacher responsible for the learning in this lesson/topic/course?
Assessment & feedback	How will you know that you have learned what you are meant to?
Curriculum content	What specific things are you meant to learn from this lesson/topic/course? What broad understandings or ideas do you think you are meant to get from this lesson/topic/course?
Curriculum purpose	Why are you learning this? When, where and how will you use the learning in this lesson/topic/course?
Teaching and learning strategies	How does what you are doing help you to learn what you are meant to?
Value and Interest	Is this what you want to learn? Why, or why not, do you want to learn it?
Psychological and social constructivism. Teaching and learning strategies	Who and/or what helps you to learn? How do they/it help you to learn?

