Exploring the role of epistemic beliefs and self-questioning in student understanding of undergraduate cost accounting

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Abstract

The context of this research was an under-graduate cost accounting unit. As someone who assumed responsibility for the unit after a substantial career in industry, I was concerned that, under the extant pedagogy, students appeared not to be finding the sense in what they were seeking to learn. They appeared not to have adequate ways of thinking about the content and thus had difficulty articulating their understanding as well as having difficulty generating questions whose answers would assist their sense making. In addition, it seemed accounting was perceived by students to be objective and certain, thus they believed problems could be solved by mechanical application of appropriate accounting procedures.

Consequently, I redesigned the pedagogy of the cost accounting unit with the goals of stimulating active learning, and challenging students' beliefs that accounting techniques are applied mechanistically since accounting information is objective and certain.

The importance of students' epistemic beliefs to the success of the redesigned pedagogy was evident in the experience of early implementations of it. Hence, part of the research was a need to explore these and the impact of the pedagogy on them. The other main part was researching students' thinking while learning accounting in relation to both the process and product of learning, i.e. their thinking whilst learning and how they thought about what they had learnt.

The research took a post-positivist interpretive perspective and applied qualitative research methods. The largest data source was a body of questions (labelled self-questions) posted online that over 300 students constructed each week while wrestling with the content of the week in preparation for tutorials. These data provided a quite different window into student thinking than that available from the "think aloud" and computer-based instruction protocols more frequently used in relation to this kind of research.

This thesis is constructed upon, and contributes, thinking-centred models of knowledge and learning as explained below.

Knowledge is modelled as comprising three types of idea, each indicative of a different 'way of thinking'. A foundational idea concerns the meaning of something, whether it is the same as some other idea, how it is different to others, and its purpose or role in practice. A relational idea concerns the integration of multiple component ideas, how the idea works and, in some cases, how it can be applied procedurally or via algorithms. A modelling idea is a more

sophisticated version of a relational idea. It integrates critical thinking and judgement and is situated within the often messy and imprecise real world context in which it is applied. As such, it goes beyond the scope of traditional learning objectives or outcomes, and reflects the ways of thinking and practising in the real world. Consequently, it presents significant but constructive challenges to the conventional curricula in many domains including all professional domains. The thesis argues against framing the outcome of learning as simply the acquisition of knowledge. Instead, the outcome of learning comprises self-constructed *ways of thinking* about elements of knowledge and those elements in combination.

The model of learning is situated within an individual constructivist philosophy of learning. It comprises eight different types of thinking in which students engage, and which may be applied in each of four phases of a sense making process beginning with prior knowledge or experience.

One clear finding is that students' epistemic beliefs, even sub-optimal ones, are strongly held and this is of paramount importance in determining how they react to change and hence the success of changes in pedagogy. Compared to school age students, undergraduates have a record of past success in educational systems and thus these beliefs are likely to be held strongly.

Notwithstanding the challenges of shifting epistemic beliefs, the research provides evidence that the redesigned pedagogy led to a large proportion of students engaging in high order thinking when framing their questions and thus improving their approach to learning. It also provides evidence of changes in the epistemic beliefs of some.

The process of change in epistemic beliefs was found to include various features. It is idiosyncratically different amongst students. Change does not occur in a smooth, linear way since many students go through periods of holding different and conflicting beliefs about issues in different contexts and times. Changes in students' learning behaviours commonly occur before changes in their related beliefs, and thus before they articulate support for those behaviours. Consequently, strategies for helping students recognise and shift students' beliefs must recognise that the process is gradual and evolutionary. The research outlines implications for stimulating and supporting student change in practice, and implications for policy in respect of the barriers represented by common features of university teaching contexts that impede better learning.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by another person, except where due reference is made in the text of the thesis.

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Publications during enrolment

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Acknowledgements

During the 1980s, Monash University became a world leader in research into improving how well secondary school students learn science. Given my research interest into improving the learning of accounting, it has been my good fortune that my two key supervisors were a key part of the team that established Monash's reputation in this area at the time and have since continued to help build it.

I feel honoured by the way my primary supervisor, Dr Ian Mitchell, thought deeply about everything I wrote, seriously considered the implications, and then not only provided feedback but instigated and contributed to ongoing discourse in which ideas were developed further. I am grateful for his generosity with his time and intellectual effort, having always provided a thoughtful and constructive critique that led to improvements in my work; and for his thoroughness and attention to detail in the data.

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1 Introduction

1.1 Introduction to the thesis

This research takes place in a context in which the pedagogy was radically redesigned to promote active learning and thus is one that provides the opportunity to explore students' experiences of the redesign, particularly in relation to self-questioning, and the role of their epistemic beliefs. Exploration of these dimensions is important because pedagogical innovations in active-learning are key to improving learning outcomes (Bransford, Brown, & Cocking, 2000; Kane, 2004) and the role of students' epistemic beliefs is critical to students' receptiveness to innovation (Simpson & Nist, 2000; Vermunt & Verloop, 1999).

The pedagogy was redesigned because of my concerns, as the academic responsible for the unit, with the traditional pedagogy. In brief, the concerns were encapsulated by an apparent lack of adequate thinking: in the degree to which students could think about what they learnt and could think in their process of learning. An important part of this concern was the students' views on cost accounting; they perceived this as involving a neat set of objective algorithms that produced definitive answers whereas in the real world the domain is highly uncertain and subjective.

The next sections elaborate my background and the use of language to describe concepts important to this thesis. The section that then follows elaborates the concerns with the traditional pedagogy and the fundamental question that drove the research. As can happen with research, my original design was disrupted for reasons beyond my control and resulted in significant modifications to the kinds of data that were eventually used. Fortunately, this alternative design still enabled examination of the issues arising from the concerns I had with the original pedagogy and these concerns translated into the research aims of this thesis. Thus, the subsequent sections describe the original proposal, the disruption and its implication for the research design. The chapter concludes with an outline of the thesis as a whole.

1.2 My background

To 2003, I had worked for 20 years in corporate management in the technology sector and, prior to that, six years as a field large systems computer engineer. During these years, I had tutored my three children, a niece and a nephew in higher secondary school units, mainly maths and physics. From that experience, I was already becoming aware of the difference between surface and deep understanding, and my approach to helping my family was aimed at helping them understand at the deeper level. I was also aware of the tension between studying to do well in the exam versus to understand well.

After another episode of corporate restructuring, I was attracted to academia because I enjoyed my experience of tutoring family and my corporate career had instilled in me an orientation towards developing people. Therefore, I thought I would enjoy teaching in the Higher Education sector.

I worked three semesters as a sessional tutor in accounting in 2003 and 2004 at RMIT University and Victoria University (both located in Melbourne). I was employed as an Assistant Lecturer at Monash University in Semester 1, 2005 and tutored cost accounting as well as two other units. I was made responsible for the cost accounting unit at Monash, Clayton campus in Semester 2, 2008, responsible for the unit at both Clayton and Caulfield campuses in Semester 1, 2009, and then in Caulfield campus only from Semester 2, 2009 to Semester 1, 2014 inclusive.

In addition to being the lecturer, I conducted tutorial classes in each of these years. As a result, I became critical of the traditional approach to conducting tutorials and students' approaches to learning. Students appeared not to prepare for tutorials by attempting pre-set chapter questions, the levels of dialogue and interaction were low; consequently, tutors appeared to feel they had to justify their time by explaining answers to questions, and few students seemed motivated to learn deeply. Thus, I began "innovating" by, for example, having students work in discussion groups in class and expecting students to direct their own learning more and simply sit and receive less. During this time, I published my first accounting education paper (van Mourik, Watson, & Onsman, 2008).

I was mindful of how little I actually learnt (i.e. remembered and made sense of topics) when I completed a graduate degree in accounting in 1993-1996. At the time, I was Telstra's Federal Government Marketing Manager and my three children were in primary school. Both these experiences, workplace and children, were powerful influences on my teaching approach later at Monash University.

I completed a Graduate Certificate in Higher Education in 2005-2007. This opened my eyes to the opportunities to teach differently even in very large enrolment university units. I also felt somewhat empowered to make changes to traditional methods of teaching.

Ramsden's *Learning to Teach in Higher Education* (2003) was one of the first education books I read. It also has been the most influential because it convinced me the issues with students failing to learn deeply are related to their experience of teaching. Consequently, I largely attributed the poor approaches to study I had observed students take to problems with the teaching methods they experienced. I have tempered my view since with the realization that not all students want to learn deeply, even when they perceive the teaching approach is authentic in its quest for deep understanding. Nevertheless, my high expectations of students changed little: after all, students were studying for a degree from Monash, one of Australia's prestigious Group of Eight (G08) universities!

After completing an accounting degree, students usually gain associate membership of a professional association (CPA Australia, or Chartered Accountants of Australia & New Zealand) and undertake Professional Development (PD) programs with them before gaining certification as a professional accountant. My perception was that a significant amount of this PD is in fact rework of inadequate learning at University. Surveys of employers also provided evidence that graduates were not work-ready. In my case, when employing staff in the corporate sector, I considered a person's university degree as indicating the person may have the capacity and persistence to learn what I would need them to know. I did not take for granted the person would apply what they supposedly learnt at university.

In 2012, I commenced the redesign of the cost accounting lectures and, early in 2013, I had the opportunity to commence a Master of Education (by Research). A powerful, early influence on my thinking at the time was the Experience of Teaching and Learning Project (ESRC-TLRP, 2016). I was inspired by one of its findings that certain educators aspired to teach their students to think and practise like professionals (Entwistle, 2009; McCune & Hounsell, 2005). Thus, I aimed to teach students to begin to "think like an accountant". I proposed to use the pedagogical design[1] of this unit as my research context, and at the confirmation of my candidature in February 2014, this was accepted and the degree upgraded to Doctor of Philosophy.

In the context of learning accounting, I believe students construct their own understandings in an individual way, given their unique prior knowledge and experience. Thus my preferred

[1] I had no authority to change the curriculum, i.e. 'what was taught' and therefore the concern was only pedagogy, i.e. 'how it was taught'.

theory of learning is one of constructivism; one in which the epistemic focus is on the individual and mind (Murphy & Knight, 2016) as opposed to the mind and socio-cultural context. The key implication for my teaching is that:

> the teacher must be concerned with what goes on in the student's head. … The teacher must … build up a model of the student's conceptual structures (von Glasersfeld, 1995, p. 14).

I believe the process of construction of understanding involves activities that take place 'in the head' of the learner, but that these activities can be supported by active learning methods that take place in social settings.

1.3 The meaning of the words understanding, knowledge and idea in this context

In this thesis, the meanings of the commonly understood words 'understanding', 'knowledge', and 'idea' are conceived in particular ways; that is in terms of their association with 'thinking'. This section will elaborate these, and conclude with an introduction to some of the implications for pedagogical design.

In terms of targets of understanding, White and Gunstone (1992) specify six types of understanding[2] and speak of knowledge as something that lies behind understanding. They describe understanding "as a function of the number of elements of knowledge the person possesses about the target" (p. 12). Accordingly, a "person's understanding develops as new elements are acquired and linked with the existing patterns of associations between elements of knowledge" (p. 13). This process of acquisition and linkage results in the construction of meaning.

White and Gunstone (1992) point out that a single number and a single style of test is inadequate as a means of quantifying and assessing something as complex as understanding.

[2] The six types of target for understanding are concepts, whole disciplines, single elements of knowledge, extensive communications, situations, and people. Understanding of concepts involves understanding of a mix of elements of knowledge from as many as six different subject-specific forms: strings, propositions, images, episodes, intellectual skills, motor skills as well as one general form: cognitive strategies.

Moreover, they argue that what students come to understand depends significantly on how well the teacher understands what they teach and how they assess it.

The approach taken in this thesis is not inconsistent with the above out-takes from White and Gunstone (1992). However, the central concern of this thesis is with student *thinking* and by being motivated in that way, the thesis endeavours to add a useful perspective to their work. The view taken in this thesis is that *thinking* is fundamental to the *process* by which new knowledge is acquired and linked. Understanding is the *product* that develops as meaning is constructed and this is embodied in how the learner *thinks* about the product. Thus both the process and product of learning are *thinking-centred*.

This discussion continues with an explanation of how the thesis maintains the focus on the concern with student thinking by the ways in which the words idea, knowledge, and understanding are used. In doing so, the previous discussion of knowledge and understanding is applied in the context of this thesis and extended to include the meaning of the word idea. The discussion concludes with some implications for pedagogical design and these are elaborated further in Section 4.7.1.1.

In educational research, the word knowledge is often taken to mean something acquired, stored and retrieved from memory. Thus, the word represents something that a learner can reproduce on demand but not necessarily in a way that reflects the learner's personal construction of its meaning. As such, the meaning of the word is not associated strongly with the act of thinking. In terms of White and Gunstone (1992), this meaning of the word knowledge lacks the richness necessary for good understanding.

To heighten the focus on knowledge as something strongly associated with adequate thinking, I use the word idea. Hume and Berry (2011) make a connection between the meaning of the words idea and understanding with the statement "ideas … give a sense of enduring understandings that students need to develop" (p. 352). In accepting that proposition, the view taken in the context of this thesis is that ideas are expressions of related understandings that are of the quality desired by the pedagogy, i.e. that they "need to develop" (Hume & Berry, 2011, p. 352).

Thus, in this thesis, 'knowledge' is understood to lie behind 'understanding' (White and Gunstone, 1992) and the 'understanding' of something is embodied in having a way of thinking about that thing. In pedagogical design, the various elements of a topic are framed as 'ideas' and whilst these ideas may relate to various types of knowledge most importantly, they refer to desired *ways of thinking* about them.

Expressions of understandings about targets of the quality desired by the pedagogy depend on having adequate ways of thinking about the target. Hence, in this context, the word idea is distinguished from the word knowledge by virtue of its strong association with having ways of thinking. Knowledge is commonly conceived as a noun, but by using the word idea to emphasise the association with ways of thinking, I am conceiving knowledge as a verb. It could be argued that memorised 'knowledge' is an example of knowledge not associated with a way of thinking; i.e. not associated with an understanding. My counter-proposition is this is not knowledge at all; that to 'know' something but not understand it nor have a way of thinking about it is not to 'know' it at all.

Moreover, in this context, if a learner has an idea about something they are not only able to think of it, but also *about* it, and they have an understanding in relation *to* it. Shulman (1986) said, "Those who can, do. Those who understand, teach" (p. 14). Thus, if a teacher is to teach an idea, then they must have developed an understanding equal to, or superior to, that which the students need to develop. However, in addition, teachers must also be able to articulate their understanding, i.e. express their idea in the form of sentences which convey the richness of their understanding.

Finally, the meaning of "targets of the quality desired by the pedagogy", i.e. the "understandings that students need to develop" needs more explanation. In this thesis, the target or the understanding needed is not considered a specific destination a student is intended to reach. To do so would be to take an overly-simplistic approach to pedagogical design. Moreover the target, as White and Gunstone (1992) emphasise, should not be seen as something that can be quantified by a single number.

Instead, the target is considered better as a sufficient progression of thinking about something in a particular direction: recognising that different students will advance to different points in that direction, whilst at the same time some may advance but maybe somewhat "off-track". Targets are relative to the situation of course, e.g. the desired understanding about the functioning of the human heart in a primary school class is not the same as in a medical school. Considering the target in terms of sufficient progression of thinking means not only that a student's progress cannot be quantified by a single number nor placed on a single linear continuum: their progress may not be capable of reliable measurement at all.

The potential inability to reliably measure learning outcomes presents challenges for pedagogical design, in particular the design of assessments. Assessment design is important for many reasons, one being that assessment is often allowed to condition students' approaches to learning. However, assessment should not compromise the pedagogical designer's high aspirations for learning. Hence, I believe the understandings that students need to develop are the starting point for pedagogical design. The challenge for assessment design is how to measure understanding and key to its resolution is to accept that such measurement often must be subjective, e.g. by judging a student's understanding of something based on their explanation of it.

1.4 Introduction to the 'fundamental question'

Educational researchers have frequently advocated educational settings that engage students in active learning and problem solving, or that promote the development of students as self-regulating learners (Bransford et al., 2000; Collins, 1985, 1988; Kane, 2004; Palincsar & Brown, 1984; Papert, 1980; Pintrich, 2004; Pressley, Goodchild, Fleet, Zajchowski, & Evans, 1989; Pressley & Levin, 1983; Prince, 2004; Zimmerman, 1989, 1998). From this view, "the ideal learner is an active, self-motivated, creative, inquisitive person who asks deep questions and searches for answers to thought-provoking questions (Otero & Graesser, 2001, p. 143).

Such educational settings are also presumed to be vital to developing the attributes expected of undergraduate accounting students. This research concerns an undergraduate accounting learning situation in which the pedagogy was redesigned with the aspiration to create such a setting. More specifically, the redesign sought to address three concerns with the existing pedagogy.

The first concern was that students appeared to adopt surface learning approaches rather than deep (Marton & Säljö, 1976). In other words, most students appeared not to be finding the sense in what they were seeking to learn. They appeared not to have adequate ways of thinking about the content and thus had difficulty articulating their understanding, and had difficulty generating questions whose answers would assist their sense making.

Secondly, it seemed accounting was perceived by students to be objective and certain, thus they believed problems could be solved by mechanical application of procedures. They appeared not to be mindful that, as a system of measurement, accounting outcomes are relative. This did not appear evident in their thinking. In contrast, accounting procedures in actuality represent alternative methods of deriving information to support better decision making, and thus the application of accounting techniques involves judgement and critical thinking.

The third concern was the apparent lack of self-direction by students in their learning; the observation for example that students were content to listen to explanation of solutions in tutorials rather than doing pre-work and coming to tutorials with questions they wanted answered. Thus, learning appeared to be characterised as being passive, and facilitated by a poor level of thinking sufficient for reproduction; rather than characterised by the student taking control of their learning and this facilitated by a superior level of thinking, a level necessary if the student were to construct their own meaning.

As was stated in my research proposal document,

> the initial motivation for this proposal is to better understand how students in the unit for which I am responsible … experience the learning situation and why they do so in the way they do (van Mourik, 2014, p. 3).

That was, and remained, the fundamental question. I had observed well-intentioned, hardworking students having difficulty in learning problem solving methods in a deep rather than surface way and thus the fundamental proposition of the proposal was that well-intentioned, hardworking students are likely to need assistance in 'learning to learn' in order to learn deep problem solving methods.

Accordingly, the original proposal was developed to explore this fundamental question. This proposal is explained further in the next section.

1.5 The original proposal

The original research questions were motivated by 'finding out what was going on in the heads of students' who were experiencing difficulty in learning deep problem solving methods.

Accordingly, the original research questions were:

1. How do students experience learning situations aimed at teaching deep problem solving approaches?

2. How would changes to the teaching method assist more effective use and development of metacognition by students when learning problem-solving approaches?

The originally proposed research design involved data collected in the normal course of teaching and administering the unit and from a sample of case study participants via a series of interviews and a range of survey instruments.

Data collection was piloted in Semester 1, 2014 and a series of interviews were conducted with four students. Consequently, improvements to the data collection plans for Semester 2 were refined and preliminary findings were presented as a Three Minute Thesis summary at a Monash Excellence in Educational Research Group (MEERG) Symposium in December 2014. From the perspective of refining of the proposed research, the main findings from analysis of interview comments related to the influences of, and on, students' epistemic beliefs. In particular, they were:

1. Learning situations aimed at positively changing epistemic beliefs were inhibited by university-level, contextual factors, e.g. the brevity of the twelve week semester, which made the adoption of changed epistemic beliefs risky for students; and
2. Sub-optimal epistemic beliefs mitigated the preferred interpretation of assessment requirements leading to selection of achievement goals over mastery. In other words, it was difficult for many students to understand and/or accept the innovative assessment design due to their epistemic beliefs, and these tended not to respond by adopting deep study approaches.

However, an important part of the background to the research approach that was finally taken to explore the fundamental question is the major disruption detailed in the next section, Section 1.6, to the intended data collection. In summary, the fundamental question led to a plan for data collection that was rendered impossible at very short notice by an administrative decision in the Department of Accounting. This meant that new, existing data sources had to be found that would allow a study still driven by the initial concerns, albeit with some tweaking of the research questions.

1.6 The disruption to the proposed research design

Unfortunately, substantial changes to the proposed research design were required in late 2014 and 2015 due to a Departmental decision in July 2014 that I would no longer be responsible for the unit. This decision apparently flowed from some negative student comments made in response to a university survey of students' evaluations of units they had completed. These comments have ultimately become one of the data sets used in the thesis. This decision meant that the unit would revert to traditional methods of teaching and consequently the data could not be collected in Semester 2, 2014 as planned. In December 2014, the primary supervisor, Dr. Philip Dawson announced his intention to leave Monash.

Subsequently in February 2015, Dr Ian Mitchell agreed to become primary supervisor. The status and direction of the project and other potential sources of data relevant to the fundamental question were reviewed in Semester 1, 2015. One of these sources was a database of questions students generated as part of pre-tutorial assessment activities in the six semesters between Semester 2, 2011 and Semester 1, 2014 inclusive. The students had been asked to write questions whose answers would add significantly to their understanding of the topic. They had been provided with some scaffolds and instruction to help them do this. In rethinking how this study could proceed, the database of questions appeared to provide the primary means of making inferences about how students make sense of topic concepts and consequently, in conjunction with other data sources, allow reflection about potential improvements to the teaching method. These student questions also provided data on whether and how the students would respond to a teaching intervention that asked them to generate and post questions.

It has proved fruitful to use this bank of student questions as a data set. In 2016, after these student questions in relation to two topics had been analysed, results for each were submitted, double-blind reviewed, and accepted for presentation at different conferences. The first, at the European Accounting Association (EAA) conference in May 2016 (van Mourik, 2016b) and the second at the Accounting & Finance Association of Australia & New Zealand (AFAANZ) conference in July 2016 (van Mourik, 2016a). A presentation at the Monash Education Research Community (MERC) forum in July 2016 was also well received. Thus, presentations to these conferences provided a level of assurance of the external validity of findings based on these data.

1.7 Implications of the disruption for the structure and research aims of the thesis

The consequence of the disruption to the plan to collect data meant that the research design presented at confirmation of candidature could not be followed. Instead, the situation called for a strategy by which available data would be used to provide insights that explore the fundamental question. Moreover, the exploration required a research design based on a clear and coherent conceptual framework and one that would result in contributions to the various relevant literatures. Fortunately, this proved possible.

The fundamental question introduced in Section 1.4 is "to better understand how students in the unit for which I am responsible … experience the learning situation and why they do so in the way they do". The pedagogy associated with the learning situation experienced by students had been redesigned primarily to address three concerns with the traditional teaching method: surface vs deep learning approaches, misunderstanding of accounting, and lack of self-direction as described also in Section 1.4. As will be shown in the description of the teaching method in Section 3.6 of the Context Chapter, student self-questioning was a key element of the redesigned pedagogy. This thesis examines data relating to the redesigned pedagogy in relation to the three concerns. Thus, a research aim is associated with each concern, and respectively these are:

1. To explore how redesigned pedagogy might promote thinking in the process of sense making;
2. To explore the role of epistemic beliefs in relation to accounting reports and techniques and pedagogy redesigned to develop beliefs about these; and
3. To explore how redesigned pedagogy might promote self-directed learning.

Consequently, four research questions ultimately emerged to guide the research. These are….

RQ1: What is the evidence of epistemic beliefs and their development in the context of the redesigned pedagogy?

RQ2: What mental processes are associated with self-questions asked by cost accounting students, and how do these processes vary with the production of different knowledge structures?

RQ3: How do students perceive activities requiring them to generate questions?

RQ4: What are the implications of the research for the redesigned pedagogy and pedagogy in higher education contexts more broadly?

Thus, this thesis examines the role of epistemic beliefs and self-questioning in students' understanding of cost accounting in the context of the redesigned learning situation and the implications for future pedagogical improvement.

1.8 Thesis outline

As introduced in the previous section, this thesis examines the role of epistemic beliefs and self-questioning in students' understanding of cost accounting in the context of the redesigned learning situation and the implications for future pedagogical improvement.

Therefore, the thesis is structured as follows:

Chapter 2 contains reviews of the two main bodies of literature: epistemic beliefs and self-questioning including relevant implications for practice.

Chapter 3 provides descriptions of various elements of important context, including the higher education context of accounting, accounting students in Australian universities, the Monash University context of accounting, the cost accounting discipline, and the learning situation.

Chapter 4 contains the methodology. This includes the aims of the study, descriptions of the research approach, myself as researcher, the student participants, and explanations regarding data collection and analyses. It also provides information related to ethics approvals, trustworthiness of findings, and explains the limitations of the research.

Chapters 5 and 6 present data. More specifically, Chapter 5 presents data and inferences related to the sense making of students whilst studying cost accounting, mainly related to self-questioning.

Chapter 6 presents data and inferences about students' perceptions of, and behavioural responses to, the teaching approach and the exploration of their epistemic beliefs. This chapter is focused on two particular aspects of the teaching approach: the use of self-questioning by students in preparation for tutorials and the active-learning approach to the conduct of lectures.

Chapter 7 presents a discussion of the findings and explorations of the answers to each of the research questions.

Chapter 8 synthesises the Chapter 7 discussions and provides a conclusion. Following that, the bibliography and a range of appendices are presented.

2 Literature review

Chapter 2 contains reviews of the two main bodies of literature: epistemic beliefs and self-questioning. The first section reviews the epistemic beliefs literature and includes the literature related to conceptions of learning, reviews the implications for practice regarding both, and introduces a research question. The next section introduces self-questioning and the subsequent sections, reviews some relevant theoretical perspectives, empirical research, and implications for practices. Each of the latter three sections also introduce a research question.

2.1 Conceptions of learning and epistemic beliefs

As outlined in the Introduction, Section 1.2, I had three concerns with the traditional teaching method in cost accounting: surface vs deep learning approaches, misunderstanding of accounting, and lack of self-direction. A key factor in all three was the student's epistemic beliefs. A very common example of this is a typical student's conception of cost accounting as being a set of rules and procedures rather than a set of problem solving tools. Therefore, this section will review the relevant literature and end by introducing the first research question.

This section of the literature review covers three broad areas. The first relates to conceptions of learning: in general and then in particular, in regard to learning accounting. The second takes a broader perspective than conceptions of learning by reviewing the literature pertaining to epistemic beliefs. The third sub-section reviews the implications for instruction and the final sub-section introduces the first research question.

2.1.1 Conceptions of learning

This section reviews the conceptions of learning literature, firstly in respect to the general literature and then in regard to learning accounting in particular.

2.1.1.1 General literature

The term, 'conception of learning', refers to a view of what learning means to an individual and encompasses both the 'what' and the 'how'; i.e. a person's view of the object of learning as well as the process by which it is learnt (Byrne & Flood, 2004; Marton, Dall'Alba, & Beaty, 1993).

In the main, frameworks describing conceptions of learning evolve from five levels identified by Säljö (1979) and a sixth added by Marton et al. (1993). The sixth had previously been found in research by Van Rossum and Taylor (1987) and was characterised as "a conscious process, fuelled by personal interests and directed at obtaining harmony and happiness or changing society" (p. 19). Together, they form a six level hierarchical framework in which each conception includes all of the lower level conceptions.

The framework follows:

1. Increasing one's knowledge
2. Memorizing and reproducing
3. Applying; the acquisition of facts, procedures, etc., which can be retained and/or used in practice
4. Understanding; the abstraction of meaning
5. Seeing something in a different way; an interpretative process aimed at the understanding of reality
6. Changing as a person

The distinction between the lower and higher level conceptions can be summarised as a difference in views of learning, for example, the difference between reproductive and constructive views of learning (for example, Marton et al., 1993; Van Rossum, Deijkers, & Hamer, 1985), or the difference between quantitative and more qualitative and integrative views (for example, Chalmers & Fuller, 1996).

Evidence suggests that students' conceptions of learning are associated with students' approaches to learning (Dart & Boulton-Lewis, 1998; Richardson, 2013), and hence learning outcomes (Biggs & Tang, 2011). Van Rossum and Taylor (1987) found more sophisticated conceptions are more likely held by older students than younger students. Conceptions of learning do not appear to be qualitatively different between genders[3] (Baxter Magolda, 1992; Richardson, 2000).

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[3] However, Baxter Magolda did find qualitative differences between genders in patterns of reasoning and attributed that to differential experiences of learning. Other research, for example in the area sometimes labelled 'girls in science', found gender based differences in areas such as the extent to which students preferred content to be located in and linked to real world contexts and issues (which girls preferred, e.g. Kelly (1981)), but these are rarely differences in actual conceptions of learning.

More specifically, students can be helped to develop their conceptions through programmes that deliberately set out to challenge the students' conceptions (Marton et al., 1993) as well as by relating them to actual course materials (Martin & Ramsden, 1987).

It is generally accepted that there are parallels between these conceptions of learning and the stages of intellectual development of Perry (1970) discussed in the next section. This may explain why the body of literature concerning conceptions of learning is relatively small but nevertheless it is highly influential, especially in Europe and Australia.

A review of the relationship of conceptions to culture will proceed in combination with a discussion of culture and epistemic beliefs in a later sub-section of this chapter.

2.1.1.2 Conceptions of learning accounting

Research in conceptions of learning accounting is justified by findings that conceptions of learning are context-specific and dependent on the educational environment (Eklund-Myrskog, 1998; Marton et al., 1993). Moreover, there is a clear need for further research within specific disciplinary settings (Lucas & Meyer, 2004; Meyer & Eley, 1999).

Much of the research on conceptions of learning accounting is confounded with research into accounting as a career choice. Together, these areas of research constitute the 'perceptions of accounting' literature, for example, as reviewed by Lucas and Mladenovic (2014). The career choice factors strand of the literature consistently finds that intrinsic factors, i.e. conceptions of accounting and the learning of it, have much less influence on accounting students' choice of career and degree major than do the extrinsic factors, i.e. financial and job-related factors (Wells, 2015).

In their review, Lucas and Mladenovic (2014) found that students tend to have unrealistic perceptions of accounting as well as poor conceptions of what it means to learn accounting, (Ferriera & Santoso, 2008; Friedman & Lyne, 2001; Lucas, 2001; Lucas & Meyer, 2005; Lucas & Mladenovic, 2009a; McGuigan & Weil, 2011; Mladenovic, 2000). Moreover, they found that the evidence suggests that these perceptions influence students' motivation to learn, their approaches to learning and, consequently, the quality of their learning outcomes.

For example, Ferriera and Santoso (2008), in a study of 380 management accounting students in Australia, found the perceptions of accounting as 'bean-counting, number-crunching, and bookkeeping' and confirmed that these negatively affected performance. They also found that, students' performance was associated with positive perceptions of accounting at the end of the semester, but performance outcomes were nevertheless dominated by the initial negative perceptions. In other words, once the negative perceptions of accounting form, i.e. early in the course, their influence on students' approaches to study are difficult to remedy. This latter finding is supported by other research which shows that students' perceptions are deeply held and are often taken-for-granted beliefs which are difficult to uncover and change (McGuigan & Weil, 2011; Mladenovic, 2000).

Only six studies have been identified that specifically examined accounting students' conceptions of learning. Three including the earliest, Sharma (1997), took place in Australian universities. Sharma focused on second year undergraduate students, Abhayawansa, Bowden, and Pillay (2017) focused on second and third year under-graduates, and the most recent, Abhayawansa and Fonseca (2010), focused on Sri Lankan undergraduate students.

Regarding the other three, Byrne and Flood (2004) focused on undergraduate and postgraduate students in Ireland, Lord and Robertson (2006) on third-year management accounting students in New Zealand, and Moilanen (2017) on predominantly second year undergraduate management accounting students in Finland. In sum, research on conceptions of learning accounting has not been extensive.

All six studies confirm the applicability of the framework of Säljö (1979) and Marton et al. (1993) in the accounting context. They all show that most accounting students seem to possess low-level, reproductive conceptions of learning. All support Sharma's (1997) finding that accounting students' learning conceptions (low level, high level) were associated with their approaches to learning (surface, deep) and that low-level, reproductive conceptions of learning may explain why many have weak analytical and conceptual skills.

Lord and Robertson (2006) suggested that a 'locus of responsibility' concept was useful in influencing students' conceptions; and that conceptions and hence learning were enhanced when students interacting in tutorials shared a sense of distributed responsibility for learning. This would seem to suggest that change of student's conceptions involves deconstruction and reconstruction, a process that is facilitated when learning takes place in a social setting.

Abhayawansa and Fonseca (2010) found the widespread low order conceptions of learning and thus the approaches to learning of Sri Lankan students in an Australian university appeared to be associated with their prior experience of many years of Sri Lankan secondary education.

More specifically, they suggest that the Sri Lankan secondary education focused on memorization and reproduction, and its collectivist culture promoted social prestige as a prime learning motivation and influence on the family's choice of course, and these factors persisted as influences on conceptions of learning in the Australian university environment.

After comparing the conceptions of learning of second and third year undergraduate students, Abhayawansa et al. (2017) found that emphasis on progressively higher levels of cognitive engagement (i.e. towards synthesis and evaluation) over the duration of a course caused development in some students' conceptions of learning. Nevertheless, they found the majority of 3rd year students retained lower order conceptions of learning (72%). Similarly, Moilanen (2017), who expected the ambiguous situations and incomplete information inherent in case studies would promote higher order conceptions of learning, found cases did not have an effect on the reproductive conceptions held by the majority of students in her study.

In summary, all studies show that most accounting students have reproductive conceptions of learning accounting, but only the studies by Lord and Robertson (2006) and Abhayawansa et al. (2017) make a claim of positively influencing the development of students' conceptions of learning.

Some insight to the findings of the studies into conceptions of learning accounting is provided by a study by Lucas (2000). She conducted a phenomenological study into students' ways of learning introductory accounting and identified that accounting students experienced accounting in a 'world' defined by two extremes. Students experience the first, a 'world of engagement', as being relevant and possessed of inherent meaning. The second, a 'world of detachment', is experienced as techniques to be learnt and a subject to be passed. She also found that students experiencing either world also held alternative conceptions of accounting in which they recognised accounting was blind to some important aspects of business and that they held "everyday' understandings of accounting terms that differed from what they were taught, yet these factors were not seen to be in conflict with what they were taught. Thus, regardless of the world they experienced, on these occasions students did not appreciate that accounting was a mere representation of a reality.

2.1.2 Epistemic beliefs

Following Kitchener's (2002) terminological differentiations of when to use the words "epistemic" and "epistemological", the term 'epistemic beliefs' is taken here to refer to beliefs about the nature of knowledge and the process of knowing[4] (Muis, Trevors, & Chevrier, 2016). Epistemic beliefs is part of the field of epistemic cognition (Greene, Sandoval, & Bråten, 2016), which broadly encompasses the processes involved in the definition, acquisition, and use of knowledge. More specifically, epistemic cognition is the interplay between beliefs, knowledge construction and knowledge judgments (Muis et al., 2016). In contemporary literature, the term was conceived to become inclusive of what were previously disparate fields. These include personal epistemology (Hofer & Pintrich, 1997, 2002), epistemological resources (Hammer & Elby, 2002), epistemic cognition (Chinn, Buckland, & Samarapungavan, 2011; Greene, Azevedo, & Torney-Purta, 2008; Hofer & Bendixen, 2012; Kitchener, 2002), and epistemological beliefs (Schommer-Aikins, 2004; Schommer, 1990).

The study of epistemic beliefs is important because of its relationship to learning. Despite the issues with measurement discussed later, a relationship has been found between epistemic beliefs and learning and reasoning (Sandoval, Greene, & Bråten, 2016) and academic achievement (Greene, Cartiff, & Duke, 2018). In particular, Greene et al. (2018) found epistemic beliefs to be more strongly related to conceptual understanding and argumentation than procedural or declarative knowledge performance. They also highlight the importance of teaching students the ways knowledge develops and is justified in academic domains.

Moreover, researchers have sought to clarify the relationships of epistemic beliefs to self-regulation (Greene, Muis, & Pieschl, 2010; Muis, 2007; Muis, Chevrier, & Singh, 2018), metacognition (Barzilai & Zohar, 2014; Bromme, Pieschl, & Stahl, 2010; Hofer, 2004a), the need for cognition (Kardash & Scholes, 1996), cognitive processing (Kardash & Howell, 2000), and conceptual change (Andre & Windschitl, 2003). This section will provide a review of the epistemic beliefs literature in general and then a review of the literature in the context of accounting.

2.1.2.1 General literature

As part of the broad field of epistemic cognition, the literature on epistemic beliefs has developed from three conceptual perspectives. The first, and oldest, stems from the work of Perry (1970). From this developmental perspective, epistemic beliefs are conceived as being

[4] In contrast, 'epistemological beliefs' refer to beliefs about theories relating to the origin and justification of knowledge.

unidimensional and changeable in a systematic way, reflective of movement through stages of maturity or intellectual development (Richardson, 2013). Five of the more prominent schemes are outlined below.

Perry's study (1970) involved Harvard undergraduates, most of whom were male. His scheme contains nine developmental positions that summarise into four stages of cognitive development. The first stage is dualism; opinions are either correct or not. In the second, multiplicity, multiple theories or opinions are recognised but a belief that one is correct is retained. In the third stage, contextual relativism, it is recognised that some opinions may be more defensible than others and none are 'correct' but the ability to resolve these dilemmas is lacking. Finally, in the fourth stage, commitment within contextual relativism, dilemmas are resolved based on the applicable context and value systems.

An alternative scheme developed by Baxter Magolda (1992) includes four qualitatively different ways of knowing. An *absolute* way of knowing assumes that knowledge is either right or wrong. A *transitional* way of knowing accepts that knowledge is certain in some areas, but uncertain in others. Here, it is assumed in areas where knowledge is uncertain that eventually it will become certain. An *independent* way of knowing acknowledges that knowledge is mostly uncertain, that experts are not necessarily the sole source of knowledge, and there tends to be an 'anything goes' attitude. A *contextual* way of knowing also assumes that knowledge is uncertain but knowledge is judged on the basis of evidence in context.

King and Kitchener (1994) developed a seven-stage epistemological scheme that showed a variation in abilities to make reflective judgements about ill-defined problems. The scheme encompasses three levels: pre-reflective, quasi-reflective, and reflective. They describe these abilities as 'epistemic cognition', defined as "the process an individual invokes to monitor the epistemic nature of problems and the truth value of alternative solutions" (Kitchener, 1983, p. 225).

Kuhn (1991), in a study that sought to understand how and why individuals reasoned, defined three categories of epistemological views: absolutist, multiplist, and evaluative. The absolutist view of knowledge is of knowledge as certain and absolute; the multiplist view allows for equal legitimacy of all opinions and gives weight to emotions and ideas over facts; and the evaluative view denies the certainty of knowledge and believes that the relative merits of various opinions can be assessed.

From a very different perspective, i.e. the perspective of how women view themselves and their relationship to knowledge, Belenky, Clinchy, Goldberger, and Tarule (1986) identified five 'ways of knowing' of women. These 'ways' cannot be interpreted as stages of intellectual development because they lack definition in these terms. However, in the first way, silence, the authors argue women feel disconnected from knowledge and its sources. In the second, received knowledge, they listen to the voices of others. In the third, subjective knowledge, women rely on their own subjective thoughts, feelings and experiences for knowledge and truth. In the fourth, procedural knowledge, women recognise that multiple sources of knowledge exist, and that procedures are necessary for evaluating the relative merit of these sources. In the fifth way, constructed knowledge, women see all knowledge as constructed and understand it to be inherently mutable, subject to time, experience, and context.

As stated above, in each of these schemes, beliefs are unidimensional and developmental, meaning that change occurs gradually and in response largely to maturation.

A second conceptual perspective is of beliefs as cognitive resources (Hammer & Elby, 2002). From this perspective, epistemic beliefs are fine-grained and context-specific cognitive resources such as beliefs about knowledge as they apply in a particular learning task. As such, they are analogous to other kinds of resources used in the process of knowledge construction such as knowledge of learning strategies. From this perspective, instruction should help students find and activate resources they already possess but have applied only in other tasks (Hammer & Elby, 2003). Moreover, 'change' depends on epistemic climate which consists of pedagogical choices, classroom authority structures, evaluation tools, and instructional supports (Muis et al., 2016).

A third conceptual perspective conceives of epistemic beliefs as a set of multi-dimensional, independent beliefs. A widely accepted model of personal epistemology is that of Hofer and Pintrich (1997). It includes two beliefs about the nature of knowledge: certainty of knowledge and simplicity of knowledge, and two about the nature of knowing: source of knowledge and justification for knowing.

Another set of beliefs is that of (Schommer-Aikins, 2004); Schommer (1990). They concern:

1. the organization of knowledge: whether knowledge is simple and compartmentalized or complex and interwoven,
2. certainty: whether knowledge is fixed or subject to revision,

3. source: whether knowledge is handed down from authority or personally reasoned out,

4. control of learning: whether the process of knowledge acquisition is predetermined or self-guided, and

5. speed of learning: whether if learning is to occur it will be quick, or that the pace of learning depends on a range of factors such as effort and complexity.

The last two beliefs were supported by the work of Dweck and colleagues' research on students' implicit theories of intelligence (Dweck, 1999; Dweck, Chiu, & Hong, 1995; Dweck & Leggett, 1988). In that research, some students were found to conceive of intelligence as a malleable, increasable, and as a controllable quality, while others conceived it to be a fixed and uncontrollable trait. In addition to the first three, Schommer (1990) developed a self-report questionnaire to measure these beliefs, as did more recently Schraw, Bendixen, and Dunkle (2002) with their Epistemic Belief Inventory.

Variation in beliefs is of interest in this thesis but the psychometric issues are less so. The latter has been problematic, as evidenced by the following quote:

> Until researchers are able to accurately capture intra- and inter-individual EC *(epistemic cognition)* variation, claims of relations between EC and academic outcomes will warrant at best tentative status as knowledge (italics added for clarification Greene & Yu, 2014, p. 25).

Nevertheless, the nature of beliefs can be further clarified by research into psychometric issues. A particularly noteworthy example of this resulted from the work by Greene and Yu (2014), who proposed alterations in current conceptualizations and measures of beliefs about knowledge and knowing.

Firstly, regarding the nature of knowledge, Greene and Yu (2014) found the appropriateness of beliefs depend on the kinds of knowledge. For instance, declarative knowledge may well be simple and certain, whereas more complex types of knowledge may not. In their study of secondary school students and tertiary faculty, they found differences in the value placed on different kinds of knowledge, and differences across domains in the way faculty talk about 'high-level' knowledge. Secondly, regarding the nature of knowing, they found differences across domains in how faculty justified knowledge as knowledge, and their reliance on multiple sources in doing so. Again, regarding some instances of declarative knowledge, in some disciplines it may be appropriate to regard its source as coming from experts.

It now appears generally accepted that epistemic beliefs are domain[5] dependent (Hofer, 2006, 2016; Muis, Bendixen, & Haerle, 2006). Consequently, epistemic cognition operates at three levels: general beliefs about knowledge; disciplinary perspectives on beliefs, for example, that the certainty of knowledge may vary between domains; and beliefs that are specific to a discipline, for example the nature of science (Hofer, 2016).

'Change' in individual beliefs can occur, sometimes slowly and sometimes relatively swiftly through interventions and be sustained (Muis et al., 2016). A conceptual model that attempts to explain the process of change in epistemic beliefs (Bendixen & Rule, 2004) takes into account affect, metacognition, and environment and cognition. The model proposes that epistemic beliefs change through a linear, three-stage mechanism comprising epistemic doubt, epistemic volition, and resolution strategies such as reflection and social interactions. In this model, if pedagogy is effective, change is initiated because the learner encounters information that is not consistent with their current beliefs, thus creating epistemic doubt (Kienhues, Ferguson, & Stahl, 2016). Bendixen and Rule (2004) emphasise the recursive nature of change: from advanced to prior beliefs and from latter to earlier stages of the mechanism. However, and as another example of concern with psychometric issues, this model lacks empirical backing (Bråten, 2016).

The study of whether beliefs vary across cultures is also dogged by psychometric issues. This is not surprising, since they often arise from translating and using an instrument devised in North America in different contexts, often where English is not the native language. Students from different cultures interpret the same statements about knowledge and learning in different ways (Chan & Elliott, 2004; Zhang, 1999; Zhang & Watkins, 2001).

Even so, researchers have reported different conceptions in different cultures: for example, learning is conceived as a social or moral obligation in South Africa (Cliff, 1998), and similarly in China (Pratt, 1992); and as a communalist endeavour in Japan (Purdie, Hattie, & Douglas,

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[5] Domain as in discipline, not as in philosophy where it refers to areas of judgment about morality, aesthetics, taste, and values (Hofer & Bendixen 2012)

1996). Learning is conceived as reflective of socio-cultural beliefs in the University of the South Pacific (Phan, 2008) and associated with the type of student educational opportunity in China (Zhang, 1999; Zhang & Watkins, 2001). However, these findings may reflect differences in what shapes beliefs more so than reflect fundamental differences in epistemic beliefs themselves.

However, it does seem clear that with respect to the interplay between memorisation and deep understanding and the role of repetition, distinctly different conceptions of learning have been found among students in China compared to the West (Biggs & Watkins, 1996; Cooper, 2004; Marton, Dall'Alba, & Tse, 1996). The distinctions are in relation to memorization as rote learning versus memorization with understanding, and memorization as a means of improving the retention of deep understanding.

Another cultural difference may be in relation to the importance of effort in learning. More so than in anglicised countries, effort is regarded as very important in Confucian cultures (Chai, Khine, & Teo, 2006; Chan & Elliott, 2002). Other cultural differences may be likely in relation to views of authority, and thus beliefs about the source of knowledge.

Finally, some researchers (for example, Belenky et al., 1986; Goldberger, 1996a) argue cognitive development is a culturally influenced psychological process in which cognitive development as well as individual identities are influenced by issues of race, class, gender, ethnicity, physical ability, sexual orientation, and regional affiliation. Accordingly, there is ongoing debate whether relativistic (Perry, 1970), procedural (Belenky et al., 1986) and independent (Baxter Magolda, 1994) ways of knowing are valid developmental ideals (Brownlee, Purdie, & Boulton-Lewis, 2001; Goldberger, 1996b). Whilst acknowledging the superiority of such developmental ideals within the American context, Goldberger (1996a, 1996b) suggested that in certain cultures relativistic ways of knowing may not be appropriate.

For the purpose of this research, this literature will be evaluated later in Section 2.1.4 and the conceptualisation of epistemic beliefs used to guide data analysis explained in Section 2.1.5.

2.1.2.2 Epistemic beliefs in accounting

Sometimes in the literature, it is not clear whether the research takes place in terms of the unidimensional developmental perspective or multi-dimensional beliefs perspective. From an instructional perspective, whether a learner's belief reflects a malleable dimension of one's epistemology or a stage of intellectual development is of little importance: we are concerned to influence it positively. Thus, this section will review the two bodies of literature together in the context of accounting and therefore complement the review of conceptions of learning accounting in Section 2.1.1.2.

Generally, studies have shown that accounting students who conceive of knowledge as discrete and factual adopt a surface approach to learning, whilst those students who conceive of knowledge as relativistic or requiring judgement adopt a deep approach (Lucas & Meyer, 2005).

Phillips (1998) examined accounting students' beliefs about knowledge and learning and found variation in terms of the certainty of knowledge, the acquisition of knowledge, and the degree of abstraction and complexity in knowledge. He also found the sophistication of students' beliefs did not differentiate performance on multiple-choice exam questions; but the particular belief about the certainty of knowledge did differentiate performance in relation to an accounting case due to differences in ability to evaluate the relevance of facts. In his subsequent study, Phillips (2001) found differences in the belief that knowledge is complex was related to differences in performance in respect of consolidating analyses in the case activity. He suggested that, amongst other things, the better the student's beliefs and study strategies match the features of an "ideal" solution for an unstructured problem, the better the performance on the task.

In their study of introductory accounting students, Lucas and Mladenovic (2009b) found the majority did not engage with the abstract nature of accounting nor demonstrate the formal reasoning required to justify explanations. Instead, rote learning and the mimicry of accounting led to a variety of misconceptions being evident.

Even towards the end of accounting degree courses, many students continue to believe in the factual nature of accounting knowledge (Lucas & Tan, 2013) thus undermining students' and practitioners' ability to engage in the abstract, formal and moral reasoning, and critical thinking, required by accounting (Lucas & Mladenovic, 2014).

Duff and Mladenovic (2014) developed a nine-subscale instrument to measure students' expectations of learning accounting (ELAcc). Based on an earlier instrument developed by Lucas and Meyer (2005), it includes subscales relating to three epistemic beliefs about accounting. The first is 'questioning', a view of knowledge that means it is important to identify the underlying principles and assumptions. The second is the 'social/economic importance of accounting', where accounting is seen as enabling a new view of a business, economy or society. Finally, the third is ‘numbers’, a view that accounting is mainly about the study of numbers. However, it appears this instrument has been used in only one subsequent study, that being by Duff and Mladenovic (2015).

2.1.3 Implications for Instruction

This final section in the review of the literature on conceptions of learning and epistemic beliefs will focus on the implications for pedagogical design. It commences in the next sub- section by positioning the importance of this area relative to other areas of interest in student learning, then reviews the implications for instruction from the general literature, before summarising the implications from the accounting literature.

2.1.3.1 Centrality to student learning

Instruction aimed at changing epistemic beliefs is inherently difficult. As Lucas and Mladenovic (2014) say

> In part, this arises because such beliefs are intimately bound up with issues of identity and voice. To move towards a belief in knowledge as being relativistic or contextual involves an acceptance of uncertainty and subjectivity, a willingness to challenge the authority of academic staff and experts, and a commitment to evaluate evidence in context. It involves the transformation of beliefs, attitudes, opinions, and emotional reactions that constitute students’ ways of looking at the world. The change in belief systems involved may be so fundamental that the students see themselves as being different people (p. 135).

In fact, ‘see(ing) themselves as being different people’ corresponds to level 6 in the conception of learning framework of Säljö (1979) and Marton et al. (1993). At the same time, systemic issues in Australian higher education today arguably make the problem of changing epistemic beliefs of students more intractable over time, because current intakes of students include many who hold beliefs that are inconsistent with the demands of higher education, and this leads to difficulties in adapting their study behaviours (Kember, Hong, & Ho, 2013).

These systemic issues and the inherent difficulty in changing beliefs may explain the relatively low level of empirical research interest in this area. However, authors in many related areas note the importance of conceptions of learning and epistemic beliefs. For instance, Gibbs (1995) argues that the relation between conceptions of learning and approaches to learning is so strong that “it is possible to predict the quality of the learning outcomes directly from students’ conceptions of learning” (p. 23). Moreover, Bath and Smith (2009) regard epistemological beliefs as “the ‘keystone’ of being a lifelong learner” (p. 175). With one exception, Bannert, Reimann, and Sonnenberg (2014) called for research in the area of self-regulated learning (SRL) to move toward seeing regulation in terms of events rather than in terms of the traits and aptitudes relating to cognition, metacognition, motivation and emotion. The exception they noted was the traits and aptitudes relating to epistemic beliefs.

Also, with respect to SRL literature, students’ beliefs about knowledge and learning influence both motivational and strategic components of self-regulated learning (Muis, 2007; Nist & Simpson, 2000) since students’ beliefs serve as a filter through which they decipher and interpret other components of learning (Thomas & Rohwer, 1987).

In the area of goal orientations: in particular performance goals versus mastery goals, it is believed that students who endorse performance goals may resort to low-level strategies, avoid challenges and difficulties, and give up easily while reading (Qian & Pan, 2002) whilst those who endorse mastery goals experience the opposite.

However, according to Dweck and Leggett (1988), goal orientations are not only linked to belief systems: they are explained by them. For instance, students who believe that intelligence is increasable and controllable respond well, showing a mastery-oriented pattern involving the use of effective strategies. In contrast, students who believe that intelligence is fixed and uncontrollable respond poorly, showing a helpless pattern in which they avoid challenging tasks.

In the area of conceptual change, a number of studies have shown negative correlations between conceptual change and beliefs that knowledge is certain, unstable and/or given by authority (Mason & Gava, 2007; Stathopoulou & Vosniadou, 2007; Vosniadou, 2008). Accordingly, in addition to the development of students' metaconceptual awareness and intentional learning, Vosniadou (2013) highlights the development of students’ personal epistemology as an important aspect of instructional approaches for the fostering of conceptual change.

Rebello, Siegel, Witzig, Freyemuth, and McClure (2012) found that students with less sophisticated beliefs performed better in the early stages of a course than students with more sophisticated beliefs, but the students with more sophisticated beliefs demonstrated better conceptual understanding at the end. Moreover, the students with less sophisticated beliefs and low initial conceptual performance did not demonstrate gains in their overall conceptual understanding. Thus Rebello et al. (2012) highlight the need for instructional interventions that foster change in epistemic beliefs of students in order to facilitate their conceptual growth.

Furthermore, the development of a wide variety of skills, such as critical thinking and argumentation (Kuhn, 1991, 1999), moral reasoning (Bendixen, Schraw, & Dunkle, 1998), creative problem solving (Schraw, Dunkle, & Bendixen, 1995), and reading comprehension (Schommer, 1990) are all related to epistemic beliefs (Rebello et al., 2012). Thus the interests of student learning beyond the superficial are well-served by a strong focus on changing epistemic beliefs.

2.1.3.2 Implications for instruction generally

The conceptualisations of personal epistemology reviewed earlier provide a frame for discussion of instruction. From the perspective of epistemic beliefs as independent and context-dependent, the goal of instruction is help students become aware of them and their implications for goal setting, active learning, and the effort involved in learning, etc. From the perspective of epistemic beliefs as reflective of different stages of maturation, the goal of instruction is to foster development. As theory-like (Hofer & Pintrich, 1997) or as resources (Hammer & Elby, 2002), the goal of instruction in a domain or context is to teach theory or activate and engage resources (Hofer, 2001).

From the perspective of developing student epistemic beliefs by helping students become aware of them, constructivist instruction appears essential (Hofer, 2004b). For example, Muis and Duffy (2013) conducted a study in the context of a social science statistics unit comparing the effects of a constructivist teaching approach with a control group in which a traditional teaching approach was used over a period of twelve weeks. Instruction comprised questioning to stimulate critical thinking, the comparison of new material to prior knowledge, small group collaborative problem solving, and discussion and evaluation of alternative problem-solving approaches. Results showed that students in the constructivist intervention class reported more sophisticated epistemic beliefs beginning around the eighth week and the change process continued until the fifteenth week. (The authors administered the instrument three weeks after the last class). Muis and Duffy (2013) concluded that epistemic belief change does not occur quickly but can be enduring with constructivist instruction.

One of the most effective and common strategies for developing more sophisticated beliefs is to directly challenge students' existing misconceptions (Alvermann, Hynd, & Qian, 1990; Hynd, McNish, Lay, & Fowler, 1995; Hynd, McWhorter, Phares, & Suttles, 1994; Nussbaum & Novick, 1982). Directly challenging a student's conception of accounting information as being objective and certain is an example of this.

Another strategy is to focus on the beliefs themselves, for example by attempting to substitute relativist beliefs for dualist beliefs. However, in contrast, Kardash and Scholes (1996) suggest the focus should be to help students see that sometimes, reasonable perspectives require critical thinking and judgement. Role-modelling thought processes, for example by modelling active construction of meaning, and communicating that learning typically requires effort and sometimes conflict are other strategies (Schommer, 1994).

Explicit reflection on epistemic beliefs is another strategy but in their review, Brownlee et al. (2001) found only a few studies of it. Two are studies of students analysing journal entries in terms of Perry's epistemological positions (Baxter Magolda, 1986; Hettich, 1990), and the third was a study of students engaged in self-reflection and dialogue between instructor and students (Stanton, 1996).

However, beliefs are not altered simply by exposing students to constructivist learning environments (Davis, 1997; Roth & Roychoudhury, 1994). Achieving change depends on the students' willingness to face the challenge of letting go of existing misconceptions. Students may be reluctant to relinquish strategies that require little active involvement on their part and which are associated with simplistic views of knowledge (Simpson & Nist, 2000).

Finally, instructional interventions are problematic. For example, Vermunt and Verloop (1999, p. 270) caution that, when instructors and students adopt different epistemic beliefs, students may experience a ''destructive friction'' because instructors' teaching strategies are incompatible with the students' learning strategies. The result of this friction for students is either nostalgia for more familiar teaching and learning situations or disenchantment and disillusionment, leading to disengagement (Van Rossum & Hamer, 2010).

Thus from this perspective, constructivism is necessary but not sufficient. Students must be willing to change but the response to change may be catastrophic. Directly confronting misconceptions can be effective as are other approaches such as critical thinking, judgement and reflection.

From the perspective of fostering epistemological development, early efforts were similar to those designed to foster moral or ego development (Hofer, 2001). Instruction required both knowledge of the developmental trajectory and some ability to make assessments about individual students, (Hofer, 2001) so that students would hear reasoning just a stage above their current level (Vygotsky, 1962). However, the more central or connected a belief is the more resistant it is to change (Rokeach, 1968) and therefore more challenging to instructional approaches (Brownlee et al., 2001).

Instructional approaches from the perspective of fostering development resort to strategies similar to those from the perspective of increasing awareness of beliefs and their implications. For example, by equating the change in scientific metaphysical beliefs to a change in epistemological commitments, Posner, Strike, Hewson, and Gertzog (1982) promote explicit reflection by students on their epistemological beliefs.

Explicit reflections and awareness aimed at epistemological development may be facilitated by inquiry based instruction (Sandoval & Reiser, 2004), or the incorporation of ill-structured problems such as cases within the curriculum (King & Kitchener, 1994). These provide opportunities for students to examine assumptions, evaluate data, and form conclusions based upon evidence. Thus in practical terms, the implications for instruction from this perspective are similar to those from the perspective of beliefs as independent dimensions, but with the addition of inquiry-based and case-based approaches.

2.1.3.3 Implications for instruction from the accounting literature

In their research, two of the leading writers in the area of accounting education, Ursula Lucas and Rosina Mladenovic-McAlpine, are influenced by the constructive-developmental pedagogy of Baxter Magolda (1999). The pedagogy is based on three principles: validating students as knowers, situating learning in students' own experiences, and defining learning as mutually constructing meaning (Lucas & Mladenovic, 2014). The following review is structured according to these principles.

They also, along with other researchers in the area (e.g. Nick McGuigan, Sidney Weil,) advocate the importance of constructive alignment (Biggs & Tang, 2011) in accounting units in which it is intended to influence epistemic beliefs. Constructive alignment, meaning the alignment of curriculum objectives, teaching and learning activities, and assessment is however a necessary but not sufficient condition for influencing epistemic beliefs. Unit design must also promote the awareness and development of students' beliefs about the nature of accounting and accounting practice.

So far as validating students as knowers is concerned, Lucas and Mladenovic (2014) argue an accounting instructor should seek to acknowledge and engage with the students' own accounting world (Lucas, 2000), wherever it exists on the continuum between worlds of engagement and detachment. An effective way of doing this is to promote dialogue about beliefs and ask students to articulate their views of accounting (McGuigan & Weil, 2011; Mladenovic, 2000). Lucas and Mladenovic (2014) also suggest the use of questionnaires, e.g. ELAcc[6] (Duff & Mladenovic, 2014), as a means of assisting students identify their conceptions of accounting and facilitating the dialogue.

The idea of learning situated in students' own experiences is significant in that it is the essence of constructivism, but also because it is fundamental to students becoming aware of their own sense-making structures. Students will not be able to question their sense-making structures if they are not aware of them.

Lucas (2008) describes five learning activities that she found help some students identify and question their sense-making structures. The activities are situations not explicitly related to accounting which students discuss and from which some students (and on some occasions, the instructor) experience 'moments of surprise'. The effect is that students discover the need to question taken-for-granted assumptions about themselves and accounting.

In his paper, Tucker (2017) explains the value of using analogies, metaphors and similes as teaching and learning devices to help students to think and talk about accounting and the activities in which they are engaged. He also gives examples.

Encouraging and supporting students to reflect upon their own learning can be valuable in helping students become aware of and question their beliefs. McGuigan and Weil (2011) analysed students' reflective work and found transformative shifts over time in how some

[6] The Expectations of Learning Accounting (ELAcc), discussed in Section 2.1.2.2, is a nine-subscale instrument that includes three subscales relating to epistemic beliefs about accounting.

students perceived accounting. Others did not, leading the researchers to reconfirm the difficulty in many instances of changing beliefs about accounting.

Abhayawansa et al. (2017) suggest courses encompassing successive units that involve increasingly cognitively sophisticated learning and assessment activities succeed in developing some, but not most, students' conceptions of learning accounting over the course duration. As reviewed previously, Moilanen (2017) found that case studies had little effect.

Assessment design is a means of facilitating change in epistemic beliefs. For example, students may be required to enquire into, and discuss, the nature of accounting conceptions held by themselves and others (Lucas & Mladenovic, 2014). The 'outcome dependency' thus created by assessments may motivate students to allocate the cognitive resources necessary for change in epistemic beliefs about accounting (Wells, 2015).

In terms of Baxter Magolda's third principle, making both instructors and students active players in learning, Mladenovic (2000) describes a course design in which students entered a dialogue with instructors about their perceptions of accounting and how they compared and contrasted with those of the lecturers. Dialogue can be based also on reflective journals (McGuigan & Weil, 2011), or pursuant to 'moments of surprise' discovered by students (Lucas, 2008). At class level, discussion can be facilitated by the use of model questions and exemplar responses such as those used by Lucas (2000, 2001) and Lucas and Mladenovic (2009b).

Thus, the research considered in this section emphasises the importance of constructive alignment, in particular that the unit design promotes awareness and development of students' beliefs about the nature of accounting and accounting practice. Moreover, unit design must promote extensive use of dialogue to validate students as knowers, evaluate prior knowledge, and help them to identify and reflect upon their epistemic beliefs.

The description of the accounting higher education context in Section 3.2 describes the debate in the 1970's and 80's between sides advocating an emphasis on either 'procedural' or 'conceptual' content. Wyer (1984) introduced an intellectual and ethical developmental perspective to the debate that should have been of significant assistance in its resolution. Wyer's view was vigorously supported by the Accounting Education Change Commission (Francis, Mulder, & Stark, 1995a) which described her article as 'prophetic', However, the present review shows a generally weak focus since that time on intellectual development and epistemic beliefs in the context of accounting education. After evaluating the implications of the research above, perhaps an explanation for the weak focus lies in the difficulties of implementing strategies of sufficient effectiveness in tertiary accounting education contexts in the English-speaking world today, with a key difficulty being the development of accounting academics as sufficiently capable teachers.

2.1.4 Evaluation of conceptions of learning and epistemic beliefs literatures in respect of this thesis

Firstly, the review of the literature shows epistemic beliefs to be of fundamental importance to learning.

Secondly, the range of descriptions by Baxter Magolda (1992); King and Kitchener (2004); Kuhn (1991); Perry (1970) of how beliefs or individual epistemologies develop have at least two things in common. Firstly, they describe development in terms of continuums and, secondly, they imply a person thinks about the world and themselves more sophisticatedly as they develop through the continuum. This improvement in sophistication is characterised as intellectual development. These descriptions view development as involving a unidimensional epistemology. This unidimensional view may be appropriate when considering the development of infants to adolescence, but amongst mature learners, it is generally accepted that beliefs are better characterised as a system of individual beliefs, each of which develops largely independent of the others.

The models of both Hofer and Pintrich (1997) and Schommer (1990) describe epistemic beliefs in this way, the difference being that Schommer extends the scope to include two dimensions about learning. From the point of view of research into the theory of knowledge, Hofer and Pintrich's objection to the inclusion of learning dimensions is probably valid, but one that is moot in the context of educational psychology research. From the point of view of researching student learning, the greater utility associated with a broader set of dimensions all of which are relevant speaks louder than the superior philosophical purity of a smaller set.

Schommer's framework (1990) appears to have high validity, particularly in western cultural contexts. However, this thesis is not concerned with the validity of its constructs or the reliability of its measurements. Instead it takes the framework as a useful way of interpreting the data in their context, e.g. by taking a belief about source, i.e. whether knowledge is handed down from authority or personally reasoned out, and interpreting it in an accounting context as whether accounting information is objective and certain, or something that requires critical thought and judgement.

Conceptions of learning as described by Säljö (1979) and Marton et al. (1993) appear to provide valid representations of the variation with which learners in various contexts view the purpose of learning. They seem complementary to the beliefs of Schommer (1990) in that the more sophisticated the beliefs a learner has about the organization, certainty and source of knowledge (beliefs 1 to 3), the more likely they are to believe that learning is self-guided and effortful (beliefs 4 and 5), and thus have conceptions of learning higher up the scale of Marton et al. (1993), i.e. towards seeing learning ultimately as changing themselves as a person.

The literature reviewed is consistent in its portrayal of efforts to change beliefs as challenging but cannot provide empirically tested explanations of the process by which beliefs change. Whilst the model provided by Bendixen and Rule (2004) is available to researchers to test, at the same time it seems the field would benefit from more exploratory research into beliefs and their change processes and by this sort of research in a range of contexts. These explorations would enable more insightful hypotheses of the change process. In this thesis, 'epistemic beliefs' is conceptualised to be a set of independent beliefs about knowledge, knowing and learning consistent with Schommer (1990) which were outlined in Section 2.1.2.1. These beliefs are held to include conceptions of learning as reviewed in Section 2.1.1 and are understood to be domain dependent and thus in this context, include beliefs about accounting knowledge and the learning of accounting.

2.1.5 Research question 1

As described in the Introduction, the pedagogy was redesigned to address three concerns with traditional teaching methods: surface vs deep learning approaches, misunderstanding of accounting, and lack of self-direction. As reported in Section 1.6 'Disruption to the proposed research design', findings from the pilot data showed that students' epistemic beliefs were key factors related to all three concerns.

Moreover, two major innovations in the redesigned pedagogy to address the concerns were:

1. The focus on student self-generated questioning in order to achieve deep understanding, and

2. A lecture approach focused on teaching the skill of problem solving as opposed to the traditional teaching approach.

Both of these demand students shift from traditional passive ways of learning and ways of viewing accounting. Accordingly, the success of the redesign is determined in part by the degree to which the teaching method positively shifts students' epistemic beliefs.

Following the evaluation in the previous section, in this thesis, 'epistemic beliefs' is conceptualised to be a set of independent beliefs about knowledge, knowing and learning consistent with Schommer (1990), which were outlined in Section 2.1.2.1. These beliefs are understood to be domain dependent and thus in this context, include beliefs about accounting knowledge and the learning of accounting. This conception of epistemic beliefs will guide the interpretation of epistemic beliefs in the analyses of data sources in this research but these beliefs will not be mapped rigorously one-to-one to the beliefs as outlined by Schommer. Sometimes a belief interpreted from the data may encompass more than one of Schommer's beliefs. Instead the analysis will allow students' beliefs to emerge from the data and thus allow the findings to communicate more precisely what students believe.

As introduced in Section 1.7, one of the research aims is to explore the role of epistemic beliefs in relation to accounting reports and techniques and pedagogy redesigned to develop beliefs about these. Accordingly, the first research question seeks to explore epistemic beliefs and their development in the context of cost accounting. The question is stated:

RQ1: What is the evidence of epistemic beliefs and their development in the context of the redesigned pedagogy?

2.2 Introduction to self-questioning

In this review, student self-questioning is defined as "the process in which students generate, formulate and answer questions to seek knowledge or to resolve cognitive conflicts" (Stokhof, de Vries, Bastiaens, & Martens, 2017, p. 1). Students ask questions for other purposes. For instance, Graesser and Person (1994) identify three other purposes. Firstly, questions may have the purpose of monitoring the common ground between students, for example "Have you covered depreciation methods?"; secondly questions may have the purpose of coordinating social actions among students, for example, "If I gather information about straight-line, will you do the same for the reducing balance method?"; and finally questions may have the purpose of facilitating the verbal interactions between students, for example rhetorical questions. Only the first type, information seeking questions, is the subject of this review. In this review, the label self-questioning is used to refer to questions students ask themselves as they grapple with content. In the school context, these questions then are often asked of teachers, in tertiary education they may be asked of academics or peers, but are probably verbalised less than in school contexts.

This section continues with a review of the concept of self-questioning. The following three sections present firstly, some theoretical perspectives on self-questioning, a review of the empirical research into self-questioning, and a review of the implications of research for teaching. Each of these three also present a research question. Finally, a conclusion will be presented.

Self-questioning is a cognitive strategy that is important in a wide range of intellectual activities. As one important example, self-questioning is a means of guiding students in the performance of less-structured tasks. Tasks that can be decomposed into a fixed sequence of subtasks which, when performed precisely will always lead to the same result are well-structured. Less-structured tasks include reading comprehension, writing and study (Rosenshine, Meister, & Chapman, 1996). As a means of guiding students in a cognitive activity, self-questioning is not a procedure to be followed mechanically, but an activity that helps support students in the achievement of higher order outcomes. Take, for example, reading comprehension. The cognitive strategy of generating questions does not lead directly, in a fixed sequential manner, to comprehension. Rather, in order to generate questions and find answers to them, students need to think about what they are reading and make connections to other things they know, and build richer meanings for what they read (Rosenshine et al., 1996).

Self-questions often arise from an experience of cognitive disequilibrium, i.e. when a student notices a discrepancy in the process of their learning (Graesser & Olde, 2003) or from a desire to extend knowledge. Moreover:

> questions are asked when individuals are confronted with obstacles to goals, anomalous events, contradictions, discrepancies, salient contrasts, obvious gaps in knowledge, expectation violations, and decisions that require discrimination among equally attractive alternatives (Graesser & Olde, 2003, p. 525).

Compared to the research on teacher questioning, the research on students' self-questions has been relatively scant (Chin & Brown, 2002) and as the following review illustrates, most of the research in student self-questioning has taken place in the contexts of reading comprehension, science, and problem-solving. In contrast, research in the context of business disciplines has been even more scant.

The self-questioning literature in all contexts, including reading comprehension, teacher education and science learning, are discussed together in this review. In all areas, self-questioning is used to support learning in more ways than implied by the use of the noun 'comprehension' by Bloom (1956) or the verb 'understanding' as used by Anderson and Krathwohl (2001). In other words, in all of these contexts, the development of higher order outcomes such as analysis and synthesis may be the purpose of self-questioning. For example, in science education, self-questioning is an important aspect of inquiry-based science teaching (Stokhof et al., 2017). Similarly, in literacy, the nature of questioning varies with the complexity of the material, such as whether the text is expository or narrative (Eason, Goldberg, Young, Geist, & Cutting, 2012). In reading comprehension research, the importance of measuring the variety of specific cognitive processes involved is now being recognised (Cutting & Scarborough, 2013; Keenan, Betjemann, & Olson, 2008). Accordingly, in this review the word "comprehension' is interpreted broadly and no self-questioning contexts are specifically excluded.

2.3 Self-questioning - theoretical perspectives

2.3.1 Preface

In this section, four theoretical perspectives on self-questioning are reviewed: metacognition, schema theory, active learning and self-regulated learning. It concludes with the presentation of the second research question.

2.3.2 Metacognitive theory

Metacognition is knowledge about cognition and self-regulation whilst learning (Brown, 1978; Flavell, 1979; Veenman, Van Hout-Walters, & Afflerbach, 2006). It includes knowledge about ourselves as learners and what factors influence our performance, knowledge about strategies for learning, knowledge about when or why to use a strategy (Bruning, Schraw, & Ronning, 1995), and also knowledge about the nature of the domain being learnt. Hence metacognition includes personal epistemic beliefs, such as the forms knowledge takes, its sources, the norms and standards used in its justification, and its limits (Hofer & Pintrich, 1997).

Regulation of cognition involves being aware of metacognitive knowledge and using it to plan, regulate and evaluate learning. Planning learning includes selecting appropriate strategies, allocating resources, setting goals, using prior knowledge, and budgeting time. Regulating learning includes monitoring and self-testing, making predictions, checking comprehension and selecting appropriate repair strategies where necessary. Evaluating learning includes appraising the results of learning, evaluating the learning processes used, re-evaluating goals, and revising predictions (Bruning et al., 1995).

Thus, metacognitive theory distinguishes metacognitive strategies from cognitive strategies. The purpose of cognitive strategies is to make cognitive progress, whereas the purpose of metacognitive strategies is to monitor this (Flavell, 1979). From this theoretical perspective, self-questioning fulfils an important role in students' awareness, monitoring and control of their learning. An important consequence of this in terms of promoting quality learning is that a metacognitive learner has the skills to be much more informed, independent and intellectually active in their learning. Put another way, metacognition allows learners to move beyond mere reception of information and to actively construct and reconstruct their personal understandings.

2.3.3 Schema theory

Bartlett (1932) originally proposed the concept of schema but the impetus for its development as a theoretical framework emerged from the field of artificial intelligence in the 1970s and 1980s (e.g. Minsky, 1975; Schank, 1982; Schank & Abelson, 1977). The focus of schema theory is how knowledge is represented in the mind and how these representations both influence how new information is received and interpreted, and perhaps change, as a result of learning.

According to schema theory, people's knowledge and past experiences reside in memory as schemata or mental representations. What people interpret, i.e. learn, from new experiences depends on how these experiences fit into their schemata. The theory proposes four major encoding processes which result in external stimuli becoming represented in memory: selection, abstraction, interpretation, and integration (Alba & Hasher, 1983). With selection, only that part of all the information in a given situation that is related to the pre-activated schema is selected and through the abstraction process, not all the details of how it was presented are retained. For example, in relation to a written sentence, the meaning but not the format of a message may be abstracted. This could mean that the lexical form of an individual word or the syntactical form of a sentence may not be retained. How the information is then interpreted depends on its congruency with the activated schema, but these interpretations will be retained only if integrated to form a coherent global representation.

From this theoretical perspective, the lack of appropriate prior knowledge seriously impairs comprehension (Collins & Smith, 1980) as new ideas cannot be integrated with prior knowledge if the latter is essentially non-existent. However, in addition to being affected by a lack of relevant prior knowledge, comprehension may suffer from lack of activating it (Bransford et al., 1982). In that event, integration is not possible. Thus activation of prior knowledge is key, and that becomes the focus of self-questioning from this theoretical perspective (Wong, 1985).

2.3.4 Active learning

Active learning has been criticised for its lack of conceptual clarity (for example, Wong, 1985). Thus, it might be more appropriately considered a description of learning that includes some assumptions rather than a theory per se. Active learning sees learners as independent and critical thinkers who take responsibility for what they learn; it assumes students actively construct their own meanings, goals and strategies in the process of learning. In practice, active learning sees students as engaged in a variety of open-ended activities e.g. discussions, problem solving, research, etc. to ensure they have a more constructivist role than in the passive and transmissive view of learning (Kane, 2004).

From this perspective, students must generate questions that shape, focus and guide their thinking (Hunkins, 1976; Singer, 1978; Tinsley, 1973) and facilitate sense-making. Thus, self-questioning has an important role in students' processing of relevant materials (Wong, 1985). However, Wong (1985) points to a key question that requires an answer: what psychological processes are mobilized by student's self-questions so as to mediate the enhanced comprehension and retention of given materials? She goes on to argue in the context of reading comprehension, that if the psychological processes set in motion by self-questioning and self-questioning instruction and which result in the student's increased reading comprehension cannot be specified, then research is reduced to a mere functional analysis of the effects of self-questioning instruction. On the other hand, if the processes can be specified, then theory can inform the nature of self-questioning instruction.

To illustrate her argument, Wong (1985) refers to the encoding processes of selection, acquisition, construction, and integration, as delineated by Cook and Mayer (1983), and the reading strategies of underlining, summarizing, and question-answering. She hypothesises, as an example, that a reader's “underlining of key words or phrases can serve the goal of selecting those textual units for memory storage” (p. 228). She argues that this clarity leads to the matching of instruction with the specific need of students. To continue the example, learning-disabled children with deficient selective attention may be helped by the learning of underlining techniques. However, it could be that instead of underlining being a strategy that improves the psychological processes that in turn improves reading comprehension, underlining might lead to the identification of phrases to memorize.

Regarding self-questions, Wong (1985) suggests that different self-questions may elicit and mobilize different kinds of psychological processes. Further, she submits “that in self-questioning instructional research we need to conceptualize what specific cognitive processes are manipulated and mobilized by the type of self-questions used” (p. 225). As noted earlier, Rosenshine et al. (1996) argued students need to think about what they are reading and make connections to other things they know in order to generate questions and find answers to them. However, the various types of thinking involved in this process is unclear. These needs appear to remain largely unexplored in the literature.

In addition to self-regulated learning (SRL), to be discussed in the next section, the assumption of active learning is shared by other theories or instructional practices, e.g. situated learning.

2.3.5 Self-regulated Learning

As well as the assumption of active learning, self-regulated learning (SRL) models share three other assumptions (Pintrich, 2004). These are that students can potentially monitor and control aspects of their own cognition, motivation, behaviour and aspects of their environment. The second is an assumption that there are goals and standards against which learning progress can be compared. The last assumption is that self-regulatory activities mediate between the student, context and achievement.

From an information processing perspective of SRL, Winne and Hadwin (1998) provide a model in which the learner assimilates information using five types of cognitive operations. These are Searching for relevant information, Monitoring one’s own understanding, and Assembling, Rehearsing, and Translating information (SMART). From this perspective, self-questions are a form of Monitoring activity. However, similarly to the active learning perspective, SRL models do not explore the variation in how the psychological or mental processes work relative to different types of self-questions.

2.3.6 Research question 2

These four theoretical perspectives can be said to offer different but complementary perspectives on the roles of self-questioning and how and why it is worth promoting. Metacognition and schema theory focus attention on the cognitive and metacognitive processes stimulated by self-questioning.

Active learning, as Wong (1985) said, is a broad phrase that can lack precision. I suggest that literatures such as that on metacognition can help address her criticisms. However, apart from this, the construct of active learning is useful as a descriptor of conditions needed for self-questioning to be an effective approach; active learning environments cannot be constructed, I would argue, without students having some intellectual space to be active. This may include regular opportunities to take some control of their learning, often by being able to make genuine choices and decisions or to influence seriously the classroom discourse and the focus of, for example, what is discussed in tutorials.

Self-regulated learning has a substantial literature but it lacks coherence. The goal of learning being more self-regulated is clearly desirable and self-questions should have an important role in this. However, the issue of whether or not self-regulated learning should be regarded as a subset of, or isomorphous with, metacognition or whether metacognition is best seen as a subset of SRL is treated differently by different writers. One consequence is that SRL is sometimes used to describe students following a scaffolded rubric of self-questions related to monitoring their progress on completing a task. There is nothing wrong with this, but it is some distance from metacognitive reflection on one's thinking and understandings as well as changes to these, i.e. thinking that can improve how students are working on a task. My point here is that SRL has a focus on what students are doing that is somewhat different from, though not in conflict with, the other perspectives. In summary, each of these frameworks offers useful perspectives for thinking about self-questioning.

One of the three research aims of this thesis introduced in Section 1.7 is to explore how redesigned pedagogy might promote thinking in the process of sense making. Better understanding how cost accounting students' self-questions are used in the process of sense-making will allow new ways of evaluating pedagogical design and the use of new teaching interventions to improve the ways in which students learn. Thus, the second research question supports this research aim by contributing to the gap identified by Wong (1985) and shedding light upon the mental processes involved in how students need to think about what they are reading, make connections to other things they know, and build richer meanings for what they read (Rosenshine et al., 1996).

After taking account of the literature reviewed in the next section, the contribution of this research question is enriched by providing insight to how 'wonderment' questions help deep learning (Scardamalia & Bereiter, 1992) and the question was extended to consider how the mental processes vary with different types of knowledge (King, 1994b). Thus the complete research question is stated thus:

> RQ2: What mental processes are associated with self-questions asked by cost accounting students, and how do these processes vary with the production of different knowledge structures?

2.4 Self-questioning - review of empirical research

2.4.1 Preface

The following review of the empirical research in self-questioning is organised in four parts. Firstly, a review of the various ways in which self-questions are classified is presented. These classifications contribute certain ways of describing questions that are used in the subsequent sections. Secondly, the literature comparing different instructional approaches in practice and providing evidence of the benefits of self-questioning is reviewed. Thirdly, the literature discussing student variables that affect self-questions as well as barriers to the asking of self-questions is reviewed. Finally, a review of the literature relating to student perceptions of self-questioning is presented. The review concludes by advancing the third research question that drives the research in this thesis.

2.4.2 Classification schemes

In the course of analysing empirical data, researchers have classified self-questions in a wide variety of ways.

Scardamalia and Bereiter (1992) classified questions as being text-based, i.e. questions prompted by and about the text being read, or knowledge-based, i.e. questions prompted by a discrepancy or a want to know something. Typically, knowledge-based questions are higher order than text-based questions. Knowledge-based questions range from basic questions asking for information and "wonderment" questions aimed at explanation or at resolving discrepancies in knowledge.

Chin and Brown (2002) elaborated upon the scheme of Scardamalia and Bereiter (1992) by producing two subtypes of basic knowledge-based questions that seek information: factual and procedural questions. Factual questions usually require only recall of information and are often closed questions. Procedural questions seek clarification about a given procedure or ask how a task is to be carried out.

Watts, Gould, and Alsop (1997) categorised students' questions in science according to the stages of conceptual change. Firstly, consolidation questions seek to confirm understanding; secondly, exploration questions seek to expand knowledge; and thirdly, elaboration questions seek to validate knowledge and resolve any issues that arise.

Pedrosa de Jesus, Teixeira-Dias, and Watts (2003) categorised questions on a continuum ranging from confirmation questions to transformation questions. They emphasise that both kinds of questions are equally valuable and therefore whether a question is a good one or not depends on the circumstances in which it is asked.

Questions have been classified according to the level of complexity, such as the taxonomy of Bloom (1956): knowledge, comprehension, application, analysis, synthesis, and evaluation. Pizzini and Shepardson (1991) categorized questions as input, processing and output: input questions require recall; processing-level questions require making relationships; and output questions require abstraction, e.g. hypothesising, speculating, generalising etc.

Finally, in the context of foreign language reading, Day and Park (2005) classified questions according to different levels of comprehension: literal comprehension, reorganization, inference, prediction, evaluation, and personal response.

These different classifications are not in conflict in ways that call for resolution; rather they offer different, but useful, lenses for thinking about promoting and using self-questions. In this sense they are analogous to costs in accounting. Costs can be classified according to behaviour, traceability, and relevance, but this is not a conflict. Hence, there is no need to search for the "best classification."

The arguments of Pedrosa de Jesus et al. (2003) are particularly important. There is a natural inclination to argue that high order questions are always better, but there is clearly a need in learning for a range of self-questions and thus classifications such as factual and procedural questions are also important to promote and value. Looking across the higher order parts of these classifications schemes, two equally valuable foci can be distinguished. One is a focus on the content of the day: deriving relationships, looking for implications, going beyond what has been presented. The other is a focus on personal thinking and understandings: linking to existing thinking, restructuring ideas, changing beliefs (among others). While these overlap, it is helpful for educators to be thinking about both; the second focus is well aligned with constructivist perspectives on learning that emphasize the importance of learners not just receiving ideas but integrating these into their personal schemas.

2.4.3 Self-questioning in practice

Active learning environments encourage learning by engaging students in open activities and permitting a high degree of self-direction (Kane, 2004). This means students are encouraged to both talk and think, and questioning is expected to assist this. Whilst this may seem to be a relatively domain independent and worthy goal, the ways questioning is perceived and used may vary with domain. In English as second language contexts, for example, the effectiveness of self-questioning may be undermined by students' inability to process text deeply and thus formulate strategic questions (Miciano, 2002).

This section proceeds firstly by reviewing literature comparing un-scaffolded with scaffolded use of self-questioning, then comparing scaffolding with other strategies, then comparing various types of scaffolding, before closing with general comments about the effectiveness of self-questioning.

2.4.3.1 Scaffolded vs unscaffolded

Scaffolding is "the instructional support provided by a teacher to help students bridge the gap between current abilities and a goal" (Rosenshine et al., 1996, p. 202). It can be done in a range of ways.

In less-structured problem solving situations, Byun, Lee, and Cerreto (2014) found that teacher-generated questions were more effective in promoting metacognition than both peer-generated questions and self-generated questions that were revised with the assistance of the teacher. However, generally, as described below, self-questioning as a cognitive strategy has been found to be superior for learning to teacher-generated questions, and this superiority is enhanced when self-questioning is scaffolded compared to un-scaffolded (King, 1990). Scaffolding is particularly important for the generation of effective questions regarding more abstract concepts (Olsher & Dreyfus, 1999) and less so for clarification questions.

2.4.3.2 Scaffolded self-questions cf. other strategies

Training in generating comprehension questions has been found to be superior to the use of alternative strategies of answering teacher-generated questions, rereading, and summarizing (Davey & McBride, 1986; Nolte & Singer, 1985; Singer & Donlan, 1982; Wong, 1986) and this is the case at all levels of schooling (Wong, 1985). These findings are consistent with studies of question generation in orally presented lecture material (King, 1989) and studies in the context of students with learning disabilities (Taylor, Alber, & Walker, 2002). Scaffolded self-questions have been found to be more effective in comparison with simple discussion of the material (King, 1989), and the use of questions generated by other students (King, 1994a).

2.4.3.3 Comparison of types of scaffolding

In their meta-analysis of 26 studies conducted between 1969 and 1992, Rosenshine et al. (1996) identified five types of prompt used to assist students generate questions: signal words; generic question stems/generic questions; the main idea of the passage; question types; and story grammar categories.

Signal words, such as who, what, where, why, and how are provided to students as a list and they are taught how to use them as prompts for generating questions.

Question stems include “What are the strengths and weaknesses of. . . ?" "What would happen if. . . ?" and "Why is. . . important?” Students are provided with a sample list of these and taught to use them in order to generate specific questions. Generic questions include questions such as “How does this passage relate to what I already know about the topic?”

With the main idea of the passage, students are taught how to identify it and then use it to prompt the development of self-questions.

With question types, students are taught three types: questions whose answer can be found in a single sentence, questions whose answer requires integration of two or more sentences of text, and questions whose answers are not in the text but require students to use existing knowledge.

Students are then taught to categorise questions and generate relevant questions in each category.

Finally, with story grammar, students are taught the elements of story grammar, e.g. setting, main character, character's goal, and obstacles and taught to generate questions for each element.

Based on the calculation of effect sizes, Rosenshine et al. (1996) found that, of the five types, the most successful prompts were signal words, generic question stems/generic questions, and story grammar. They speculated this was because these prompts provided students with more direction, were more concrete, and were easier to teach and implement than the others. A study by King and Rosenshine (1993) showed that more-elaborated stems are more effective than less. Intriguingly, King (1994b) speculated that the construction of different kinds of knowledge structure might be guided by different types of guiding questions. This, and an understanding of the nature of the underlying mental processes, remains a gap in the literature and is one of the reasons the second research question presented in Section 2.3.6 was extended.

Not included in the meta analysis of Rosenshine et al. (1996) was the work of White and Gunstone (1992). They drew on the ideas of Wiederhold and Kagan (1991) to extend the idea of signal words (How, Who, Why…) by combining these with verbs such as Does, Are, Could, Would to produce stems such as 'Why does …', 'Why are …', 'How would …'. They found these stems generally scaffold much higher order questions.

Self-questioning appears to work because students are more likely to focus on the important aspects of the material they read, attempt to make sense of it and relate it to existing knowledge, and evaluate it in an iterative questioning-answering-questioning process (Nolte & Singer, 1985; Olsher & Dreyfus, 1999; Palincsar & Brown, 1984). As understanding develops in this process, students become better equipped to formulate good questions (Shodell, 1995). There is another reason why self-questioning 'appears to work': in addition to focusing on the ideas they are processing, they are simultaneously focusing on their own understandings (or lack of understandings) of these ideas, hence they are likely to do a better job of constructing integrated and coherent knowledge structures.

Scardamalia and Bereiter (1992) concluded knowledge-based questions hold greater educational potential than text-based questions because they focus on explanations and causes instead of facts, and their answers require more integration of complex and divergent information from multiple sources. Prior knowledge is an example of one of these sources, and King (1994b) found questions that accessed prior knowledge and experience are more effective. However, all types of questions can be valuable depending on the circumstances (Pedrosa de Jesus et al., 2003).

Small, cooperative group settings facilitate effective self-questioning. Some ways in which this occurs are through the provision of mutual support, shared expertise, and models for expert questioning and responding (Brown & Palincsar, 1988).

Finally, benefits appear to arise from the process of writing questions because writing appears to stimulate critical thinking and thereby academic performance (Chin & Chia, 2004).

2.4.3.4 Evidence of success in promoting student question asking

Graesser and Person (1994) assert that in most education contexts:

> It is well documented that student questions are very infrequent and unsophisticated; . . . They are normally shallow, short-answer questions that address the content and interpretation of explicit material; they are rarely high-level questions that involve inferences, multistep reasoning, the application of an idea to a new domain of knowledge, the synthesis of a new idea from multiple information sources, or the evaluation of a new claim (p. 104).

Few secondary school students spontaneously ask high-quality thinking or cognitive questions (Carr, 1988; White & Gunstone, 1992) with most questions being factual, procedural, or closed in nature, and the incidence in higher education is little better. However, that is not to say that students cannot routinely ask sophisticated questions (Watts, Alsop, Gould, & Walsh, 1997). It may be that many deficiencies in student questioning are due to a lack of relevant teaching skills and the poor classroom environments that many teachers create.

Promoting and using high quality student questions was one key goal of teachers in the thirty yearlong Project for Enhancing Effective Learning (PEEL). Teachers in that project have shown that students can be taught the necessary skills and that this improves classrooms in multiple ways. A database of over 1500 articles written by PEEL participants[7] includes 101

[7] Available at www.peelweb.org

articles on exactly this issue. They report high levels of success and convincing evidence that students can be taught and supported to ask high order questions that improve learning. In a detailed study of classes that had different levels of exposure to PEEL teaching, Mitchell (1993) analysed the classroom discourse: one measure was the proportion of discourse that involved students initiating (rather than responding to) issues of content rather than details of what to do or other management issues. These contributions were often framed as questions, but also included actions such as offering alternative explanations. However these could virtually all have been said to be contributions that resulted from a self-questioning process. In a sample of classes with no exposure to PEEL teaching this averaged 1.5% of the total time, in classes with considerable exposure to PEEL teaching it averaged 23% of the time. This fifteen-fold difference in time made profound differences to the classroom environment and hence the quality of learning.

The nature of student questions is closely tied to how deeply they are thinking about the content. Deep comprehenders do not necessarily ask more questions, but they do generate a higher proportion of good questions (Graesser & Olde, 2003). The next section continues this focus on who asks questions and the barriers some students face.

2.4.4 Barriers to question asking

One barrier is that students may be unaware of their knowledge deficits or have difficulty identifying them (Baker, 1979; Glenberg, Wilkinson, & Epstein, 1982; Graesser & McMahen, 1993; Graesser & Person, 1994; Markman, 1979; Pressley, Ghatala, Woloshyn, & Pirie, 1990). This is especially the case if they have low levels of domain knowledge (Brown, Bransford, Ferrara, & Campione, 1983; Chi, Bassok, Lewis, Reimann, & Glaser, 1989; Miyake & Norman, 1979; Olsher & Dreyfus, 1999) or have metacognitive deficiencies (Wong, 1985).

Social factors present another barrier to self-questioning (Graesser & McMahen, 1993; Van der Meij, 1987, 1988, 1994). A student may fear appearing ignorant or losing status if they were to ask an apparently bad question (Dillon, 1988; Graesser & Person, 1994) and may be reluctant to interrupt the teacher or change the topic of conversation. They may also fear negative repercussions from classmates and the teacher (Reinsvold & Cochran, 2012; Rop, 2003). Good, Slavins, Hobson Harel, and Emerson (1987) found that as grade level increases, students ask fewer questions that relate to the immediate task and which draw attention to themselves. Good et al. (1987) surmised this probably occurs because, as students become older, they do not want to call attention to themselves. Systemic conditions, such as structures of the school, relations between adults and students, and socialization into institutional and situational authority roles, may also inhibit student questioning (Dillon, 1988). PEEL teachers recognized these issues and the consequential need to develop what they labelled a sense of "shared intellectual control" where students perceived that their questions and other contributions were sought, valued and used by the teacher. It was one of twelve strategic principles of teaching for quality learning that were recurring themes in what PEEL teachers reported as successful approaches to generating quality learning (Loughran, Mitchell, & Mitchell, 2003). Of the 101 articles referred to earlier, 54 include evidence of the teacher deliberately enacting this aspect of practice.

A third barrier lies in the lack of questioning skills. Critical thinking skills help, leading to questions being asked out of curiosity and thus more profound thought (Seker & Komur, 2008). Many teachers are poor role models for good questions (Graesser & Person, 1994). Students whose perception of learning is the receipt of expert information will not be oriented toward asking questions (King & Kitchener, 2004). Conversely, questioning is aided by an ability and inclination to reflect on learning progress (Tanner, 2012). In fact, the ability to ask themselves questions that help direct their learning has been called the "hallmark of self-directed, reflective learners" (Chin & Brown, 2002, p. 522). Thus, metacognitive deficiencies can also impede the articulation of questions (Chin & Osborne, 2008; Wong, 1985).

Regarding personal attributes, the quality and quantity of students' questions may be influenced by their age, experiences, nature of the topics, and reward structure (Biddulph & Osborne, 1982). Students can vary in their level of curiosity, and thus vary in how easy they find it to ask questions. This variation may depend on the students' predispositions to risk-taking, their learning styles, and their ability to tolerate uncertainty (Pedrosa de Jesus et al., 2003).

Finally, another barrier relates to the teacher's circumstances. Teachers may feel pressure to cover the curriculum (Stokhof et al., 2017), and thus prefer direct instruction in order to cover content quickly enough; sometimes 'coverage' as they perceive the need rather than what it actually is. Sometimes teachers discourage spontaneous student questioning to prevent disruption to lesson plans (Rop, 2002). As evidence suggesting teachers mitigate the threat to lesson plans from student questioning, Reinsvold and Cochran (2012) found that the time teachers talk was twice the time students talk and teachers' questions were primarily closed and task-oriented.

On the other hand, teachers may promote student questioning by encouraging students to pursue questions of personal interest (e.g. Zeegers, 2002), but the questions may not necessarily address curriculum goals (Stokhof et al., 2017). Organising quality guidance in relation to questions, and ensuring the questions ultimately serve a useful learning purpose are other challenges faced by teachers (Keys, 1988). Teachers who do not have confidence in their own understanding may avoid or repress students' questions (Woodward, 1992) and teachers who experienced didactic learning approaches as students are less likely to facilitate student self-questioning (Woodward, 1992). However, too much control of the level of student questioning discourages student engagement (Good et al., 1987; Wood & Wood, 1988).

These are all real and significant barriers to good question asking, however it is important to note that all bar the fifth (teacher circumstances) are barriers that skilled teaching can do much to overcome. Put another way, if educators want good question asking for the sake of better learning they need to develop and use strategies to achieve it.

2.4.5 Student perceptions of self-questioning

Students can feel either positive or negative about self-questioning (Pedrosa de Jesus, Neri De Souza, Teixiera-Dias, & Watts, 2005). Their questions can invoke feelings, and these feelings can, in turn, generate and shape further questions (Pedrosa de Jesus et al., 2005). While some students might enjoy asking questions and see the benefit for them of how questions guide and organise their thinking, others may feel timid and embarrassed when asked to generate a question (Chin & Osborne, 2008). Students may perceive self-questioning as opportunities to assuage boredom by engaging in intellectual activity, and as such, find it preferable to mundane tasks such as memorising or completing busy work (Rop, 2003). However, they also may feel social pressure to refrain from asking too many questions because of the attitudes and behaviours of classmates, or become frustrated when the educator does not value their questions.

Once again, there are clear implications for teaching here. An educator who explicitly values and skilfully uses student questions will directly address the affective issues in the second (social factors) and fourth (personal attributes) barriers discussed above. Moreover, by debriefing on why particular questions were useful both for the group and the individual question asker, an educator can tackle the cognitive and affective issues in the first (unaware of knowledge deficits) and third (lack of questioning skills) barriers.

As an active learning strategy, self-questioning makes greater intellectual demands on the student as well as develop their metacognition. Thus, students can understand the value of self-questioning but not enjoy it and even prefer more passive strategies (Gourgey, 2001; Sternberg, 2001). Debriefing on this issue also can build student understanding of, and therefore support for, the extra intellectual effort required.

2.4.6 Research question 3

This literature review shows that research in self- questioning has been substantial. At the same time, it shows research into the affective side of self-questioning is surprisingly scant. This is an area of research need, particularly given that the effectiveness of active learning is significantly shaped by the interplay of the affective dimension with the cognitive (Pintrich & Zusho, 2007). The interplay thus is also a key factor in the exploration of self-questioning in cost accounting as taught in the learning situation of this research context. Accordingly, the research aims of this thesis introduced in Section 1.7 are supported by the third research question. The research question is:

RQ3: How do students perceive activities requiring them to generate questions?

The next section, the final part of the literature review pertaining to student questioning, concerns the implications of the research for practice.

2.5 Self-questioning - review of implications of research for teaching

2.5.1 Preface

The following review of the implications of research for teaching is in three parts. Firstly, the implications for scaffolding and instruction, secondly the implications for the learning environment, and finally the implications of self-questioning for pedagogical design improvement are reviewed. The section concludes with a statement of the fourth research question that drives the present study.

2.5.2 The implications for scaffolding and instruction

Answers that contribute significantly to students' learning depend on being able to generate and formulate good questions for eliciting them (Shodell, 1995) and the needs students have for assistance in their efforts to develop questions provide cues about the teaching strategies to be used (Olsher & Dreyfus, 1999). Support to address students' needs in relation to self-questioning can be provided directly via scaffolding or indirectly via the design of teaching and learning activities.

Either way, however, there must be commitment by the educator to, and ownership of, self-questioning as a cognitive strategy. This means finding ways to mitigate the barriers attached to the educator's circumstances discussed in Section 2.4.4. This is problematic as evidenced by the following experience in England. There, despite many years of 'commitment' to the explicit teaching of comprehension strategies, Parker and Hurry (2007) found in their study of 51 London classrooms that direct teacher questioning was the most frequent and dominant strategy used; that questions generally lead to predictable answers; and that students maintained a passive role in formulating questions.

The following discussion of implications are organised according to their implications, firstly, for the provision of scaffolding, and then for the design of activities.

2.5.2.1 Scaffolding question asking

Language can obscure meaning. The extensive use of labelling in instruction can shield interpretations from the student's attention and, even though the labels are used in the student's conversation, their meaning is not understood. For example, by emphasising the learning of definitions of terms, teachers may not actually help their students interpret the meaning of them (Glen & Dotger, 2009) and thus may not have sufficient understanding to ask worthwhile questions. This may lead to greater usage of closed questions (Reinsvold & Cochran, 2012).

Thought-provoking question stems can help students generate questions that prompt them to compare and contrast, infer cause and effect, note strengths and weaknesses, evaluate ideas, and explain and justify (King, 1994b). However, as is the case with the other types of prompt: generic questions, the main idea of the passage, question types, and story grammar, there is a dilemma relating to providing scaffolding assistance that, like all dilemmas, can only be managed. Too much support may result in the student doing little processing themselves and therefore not develop internal structures (Rosenshine et al., 1996). This risk of over-prompting, however, must be weighed against the opposite, a lack of sufficiently elaborated guidance (King & Rosenshine, 1993).

Similarly, care must be taken in both the design and implementation of scaffolds if they are to achieve their purpose. Choi, Land, and Turgeon (2005) used an online peer-questioning scaffolding framework to facilitate reflective thinking and metacognition and made participation in group discussion 50% of the final grade They reported that more questions were asked but that the quality did not improve with the majority being categorised as clarification/elaboration instead of the more intellectually-thoughtful categories of counter-argumentative or context-oriented questions. The authors speculated that either the scaffolds were ineffective or students required more training in their use. However, an alternative explanation is that the quality of questions asked was not valued in the assessment.

Thus, scaffolding is critical if students are to be assisted with the development of useful self-questions. However, scaffolding can have undesirable consequences: increased activity that brings no benefit (for example, Choi et al., 2005). Moreover, the mechanical use of them – questions asked for the sake of having to generate them - may actually stifle higher order thinking.

2.5.2.2 Indirect support via activity design.

In addition to support for questioning in the form of scaffolding, support can be provided indirectly via the design of teaching and learning activity. One type of activity where the design may stimulate student questioning is open inquiry (for example, Stokhof et al., 2017). Others especially relevant to the higher education sector are problem-based learning (Hmelo-Silver, 2004) and the use of case studies (for example, Desiraju & Gopinath, 2001).

Another broad type of activity that will stimulate questioning is to provide students with different resources that present conflicting accounts or perspectives of the same event or phenomenon and ask them to decide how to interrogate these to sort out the differences. A PEEL history teacher, for example presented students with different sets of information about the RMS Lusitania, sunk by German U-boats in 1915 that had different implications for whether or not the German attack could be justified. There are many similar episodes in history.

It is not difficult to design activities in the messy real world of accounting that use this approach. For example, two income statements may be presented that show significantly different reported profit (or loss) for the same business due to different choices of depreciation policy and students asked to comment on the health of the business; alternatively, students may be presented with multiple estimates of a product's cost (due to use of different methods and assumptions) and asked to justify a recommendation about which estimate to rely on.

2.5.3 The implications for the learning environment

Teachers are still asking the majority of the questions (Osborne & Dillon, 2008). Thus again, there is a need to maintain an appropriate balance. Too much teacher control of questioning results in passive students (Good et al., 1987; Wood & Wood, 1988). To avoid passivity, students' "internal dialogue (needs to be) driven by self-questioning" (Gourgey, 2001, p. 31).

A question-rich environment (Watts, Alsop, et al., 1997) can be fostered by giving praise to those who invent questions, by avoiding repressions (White, 1977) and by teachers asking students to write questions about things they find confusing (White & Gunstone, 1992). This could lead to the compilation of a learning journal (e.g. Kulas, 1995). The question-rich environment would also be fostered by the teacher pausing at convenient intervals during the lesson to give students time to generate questions they wish to ask, and then stimulate discussion by using the questions as 'thought provokers' (Maskill & Pedrosa de Jesus, 1997a, 1997b).

Fostering students' question-posing capabilities through the use of real-world problems and contexts is an effective strategy for improving problem-solving ability (Chin & Chia, 2004; Dori & Herscovitz, 1999). In addition to the first theme of teacher modelling and the use of appropriate stimuli, question prompts and taxonomies discussed in the previous section, Chin and Osborne (2008) identified two other themes in their review of ways of encouraging student questions. The second is structuring tasks through the use of physical supports, time and targeted activities. Examples include structured learning journals, 'question boards' to display students' questions, and the inclusion of specific times for questions within a lesson. The third is providing social supports, for example, peer-learning approaches that develop the use of question-asking and answering to structure group interaction at a high cognitive level.

Creation of a question-rich environment requires conditions of trust and depends significantly on teacher confidence. This is confidence not just in the subject content but also in the capacity to exercise relaxed authority and control within the classroom (Watts, Alsop, et al., 1997). Teacher anxiety concerning their own subject knowledge inhibits not only the quality of teacher questions but also of student questions (Biddulph & Carr, 1992). Research also suggests that some teachers would accept the risk of students asking 'difficult' questions if they felt more secure in their employment (Woodward, 1992).

As the final word, Dillon (1988) summarised the pedagogy of student questions thus:

"1. Provide for student questions: make systematic room for them, invite them in, wait patiently for them.

2. Welcome the question.

3. Sustain the asking" (p. 24).

2.5.4 The implications for pedagogical design improvement

Student self-questioning can assist teachers improve their teaching (Chin & Brown, 2002). This section is structured around the different ways the outcomes of self-questioning can inform pedagogical design.

2.5.4.1 Diagnostic of students' conceptions

Questions provide insight to the quality of students' understanding (Watts, Gould, et al., 1997; White & Gunstone, 1992; Woodward, 1992) and reveal the confusion students have about various concepts (Maskill & Pedrosa de Jesus, 1997b; Watts & Alsop, 1995). These issues may then be anticipated to arise again in future and thus changes made to the pedagogical design to address them.

2.5.4.2 Diagnostic of thinking processes, ways of thinking about content

Questions indicate the ideas that students have been thinking about and how students have been trying to make connections to other things they know (Chin & Brown, 2002). They provide insight into students' reasoning (Donaldson, 1978) and additional things they want to know (Elstgeest, 1985). This information is also an input to the design of teaching and learning activities.

2.5.4.3 Diagnostic of teacher's conceptions and thinking

As well as being indicative of students' learning, questions can also prompt teachers to examine their own thinking (Watts, Alsop, et al., 1997). Thus, teachers may clarify their own understanding, correct misconceptions, and discover better ways to communicate and facilitate learning. This experience therefore is an important source of professional development.

2.5.4.4 Evaluation purposes

The capability to pose questions is a potential method of student evaluation, particularly in respect of higher-order thinking (Dori & Herscovitz, 1999). This focus on learning process is in dramatic contrast to the traditional form of evaluation based on answers, i.e. outcomes.

2.5.5 Research question 4

The types of questions that students ask can reveal their depth of thinking (Chin & Brown, 2002) but students can exhibit depth of thinking in different ways (Chin & Brown, 2000). Consequently, teachers ought not to have expectations that when students are learning well, that they will ask particular questions. Rather, good learning is likely to be exhibited by a mix of questions that reflect the perspectives and prior experience of the student as well as their current thinking. Accordingly, care must be taken to avoid overly-prescriptive descriptions of what good self-questioning should look like.

There is overlap between student questioning and student participation in broader discussions. This is inevitable given the highly interconnected aspects of the two. However, the research reviewed here suggests that self-questioning can include aspects of quality learning that, variously, are highly reflective, metacognitive and independent. Perhaps more importantly, the implications for educators achieving classroom change in this area are much more specific: educators must be concerned with the need to stimulate and support both high quality questioning and high quality involvement in discussion more generally.

Student self-questioning was a key component of the redesigned pedagogy used in this research context to address the three key concerns described in Section 1.4 of the Introduction. The implications from the self-questioning literature for teaching were reviewed in Section 2.5. As outlined in Section 1.6, students' epistemic beliefs were found to be a significant influence on the effectiveness of the redesign and the implications from the epistemic beliefs literature for teaching were reviewed in Section 2.1.3.

Accordingly, in support of the research aims of this thesis introduced in Section 1.7, the fourth and final research question explores the implications of this research for the redesigned pedagogy and pedagogy generally. It is expressed thus:

> RQ4: What are the implications of the research for the redesigned pedagogy and pedagogy in higher education contexts more broadly?

2.6 Self-questioning - conclusion

The review emphasises the need for educator training in relation to the use of self-questioning and the need for student scaffolding and task design so that both low and high order questioning is stimulated; it emphasises the need for learning environments that are safe and supportive with educators skilled in using student questions to meet curriculum agendas; and it emphasises the potential of self-questioning to inform pedagogical design.

The types of questioning that have been a focus of the studies reviewed here can be placed into three, somewhat overlapping groups. Firstly, good questioning can help students organise their learning and how they respond to tasks. Procedural (Chin & Brown, 2002) questions and the use of signal words to prompt them (Rosenshine et al., 1996) are relevant here. Secondly, it can help students monitor their learning: process new information and integrate it with prior understandings, reflect on their learning identifying weaknesses, extending and reconstructing understandings as needed. Both confirmation and transformation questions (Pedrosa de Jesus et al., 2003) are relevant here, as are wonderment questions (Scardamalia & Bereiter, 1992). Signal words, generic questions and question stem prompts (King, 1994b) are effective means of scaffolding the generation of these. Questions that develop metacognitive skills assist here too, particularly those scaffolded with the use of educator-generated prompts (Byun et al., 2014). Thirdly, student questioning can be important in initiating and sustaining learning environments (such as problem-based learning) where students are active partners in the learning process. Models of expert questioning (Brown & Palincsar, 1988) scaffold the generation of questions in this area.

Pedrosa de Jesus et al. (2003) are correct that there is a need for questions that would be regarded as more low level in each of these, but the literature provides multiple arguments for promoting more high order questions.

3 Context

3.1 Preface

Chapter 3 provides descriptions of various elements of context important for this research. These elements include the higher education context of accounting, accounting students in Australian universities, the Monash University context of accounting, the cost accounting discipline, and the learning situation. The learning situation elaborates the redesigned pedagogy.

3.2 Accounting in higher education

In Australia, the first professional accounting association was established in 1885 and there were eighteen of them by 1910 (Carnegie, 2009). They were based on the British model in which prospective members were required firstly to pass examinations. However, with the global ascendancy of American economic influences after World War II, by the 1960s the USA replaced Britain as the main influence over the profession and professional practices in Australia (Carnegie, 2009).

The higher education context in which accounting is taught in Australia today shows the hallmarks of historical debates that originated, in the main, in the USA. They continue to some degree today. Thus the description in this section of the higher education context in Australia comprises firstly, a description of the American context and hence its influences on the Australian context, and secondly, a description of the Australian context.

3.2.1 Accounting in the USA

By the late 19th and early 20th centuries, public accounting was a newly recognized profession and early professionals encouraged the use of higher education to increase the status of accounting to the same level as medicine, law, and other professions (Van Whye, 1994). This, it was argued, required the pursuit of an academic or liberal education, the essence of which was then, and still is, the development of general intellectual capacities (Dewey, 1914; Sangster, 2010). Moreover, a liberal education is thought to be a ‘humanizing’ education, one aimed at developing understanding of the world, formation of habits for reflection, and an appreciation of values and attitudes toward life (Hanslein, 1930).

In opposition to education as a means of increasing the status of accounting were those who encouraged higher education to serve a vocational purpose. Vocationalism reflects an educational commitment to preparation for employment and therefore a vocational education focuses on developing usable skills and applicable knowledge.

In more recent times, the vocational emphasis of accounting education has been clear (Fogarty, 2010). Accounting education, internationally, is guided by the accounting profession, in the form of standards issued by the International Accounting Education Standards Board (IAESB) operating under the auspices of the International Federation of Accountants (IFAC). Consequently, the direction of accounting education is set as a result of collaborations between academic and practitioner (i.e. professional) bodies.

More recently, in 2012 in the USA, a national strategy for the next generation of accountants was launched by the Pathways Commission on Accounting Higher Education, a joint venture between the American Accounting Association (AAA) and the American Institute of Certified Public Accountants (AICPA). In this strategy, the desire to accommodate development of the humanizing side remained apparent. For example, the Commission's (2012) report included a reference to Shulman's (2005) notion of the formative character of any professional education:

> A professional has to be prepared to *act*, to *perform*, to *practice*, … But even that isn't enough… as we look at education for the professions, professionals … have to *be* certain kinds of human beings… they have to undergo a certain kind of *formation of* character and values so they become a kind of person to whom we are prepared to entrust (Musov, 2016, p. 9 emphasis in original).

Consistent with the aspirations of the profession early in the 20^{th} Century, it was expected the development of a professional accountant would require substantial higher education, in fact '150 hours of education' (Pathways Commission, 2012). In the American context, this is understood to be equivalent to five years of university education.

The stronger emphasis on vocational rather that liberal education is evident however, in the curricular recommendations for accounting education produced in the USA in response to the Pathways Commission. The recommendations were produced by a joint task force sponsored by the Management Accounting Section (MAS) of the American Accounting Association (AAA) and the Institute of Management Accountants (IMA). The stronger emphasis on vocational education is evident in the framing of recommendations in terms of competencies: a vocationally oriented approach.

In parallel with the debate over vocational vs academic purposes of accounting education, since the late 1970s there has been debate in regard to the concern with the ever burgeoning amount of content that needed to be taught (Williams, 1990). This increase in content was driven by the proliferation of accounting standards. The debate was framed in terms of content: procedural vs conceptual content.

Some advocated university education should consist of technical procedures. Others favoured what was labelled ‘conceptual knowledge’. This referred to accounting knowledge framed by both the Conceptual Framework, which is a framework used by the profession to guide the development of accounting standards, and theories that posit the effect of accounting standards (Wilson, 1979; Zeff, 1979). In favour of conceptual knowledge, Zeff, (1980) for example, noted that accounting educators “have a positive duty to prepare students for the turmoil in standard setting” (p. 663) and therefore the content of accounting courses should pay more attention to the “economic consequences” of accounting choices. This sentiment reflected a theme voiced by Sterling (1975) when he said

> ... accounting teachers seduce the students by making them believe that accounting problems are well structured, well defined and have an easily recognizable solution. They go into practice and find that this is not true (p. 551).

Chillingly, because of its relevance today, the argument on the procedural side was summarised in 1979 by Shute as “centered on the pragmatic fact that these methods generally work - that is, students learn what is taught in the introductory courses” (p. 1).

Sophistication was added to the debate, from an educationalist perspective, when Wyer (1984) noted the issue reached questions deeper than content specification; and argued the debate ought be framed in terms of Perry’s (1970, 1981) scheme of intellectual and ethical development. However, despite being vigorously supported by the Accounting Education Change Commission (Francis et al., 1995a) this perspective did not gain traction.

Today, especially in respect to textbooks, the choice remains framed as a content issue. The following quote from the preface of a commonly used textbook typifies how the terminology of conceptual and procedural knowledge is used in today’s context. Note the absence of theory and understanding of conceptual relationships in what is referred to as conceptual knowledge (in italics):

> This book has been written with the objective of conveying an understanding of accounting *without introducing unnecessary technical terminology and procedures*. Rather, it *builds on basic concepts to provide a clear understanding* of financial statements, their uses and limitations. Accounting *terms and concepts are defined* according to the official pronouncements. Australia has adopted International Financial Reporting Standards (IFRS) for use by all reporting entities in both the private and public sectors. The accounting concepts used in the joint International Accounting Standards Board (IASB)/Financial Accounting Standards Board (FASB), The Conceptual Framework for Financial Reporting (2010), *provide the conceptual basis* of Contemporary Accounting and are used to analyse various issues in accounting … In each chapter learning objectives and *key concepts are identified* and highlighted (Bazley & Hancock, 2013, p. xvi, emphasis added).

In a criticism of accounting textbooks and courses Zeff (1989) said

> Accounting is not presented as an interesting subject that figures importantly in the calculations of managers, investors and creditors, and government policy makers but instead as a collection of rules that are to be memorized in an uncritical, almost unthinking way (p. 204, emphasis in original).

In support of the sentiment but not as a criticism of courses, Fogarty (2010) notes course "emphasis resides on definitional and procedural mastery" (p. 411) such that a "focus on *skills* is a difficult fit" (p. 411, my emphasis). In a reflection on the contribution of accounting to academia, Demski (2007) notes that accounting "textbooks are intellectually embarrassing" (2007, p. 156).

Another, more contemporary, debate relates to soft skills, e.g. writing, communication, and interpersonal intelligence (Accounting Education Change Commission, 1990). Waves of corporate scandals since the mid-1800s result in doubt over professional accounting associations' claims that their members engage in ethical conduct, serve the public interest and act in a socially responsible way. This fuels concerns with the effectiveness of accounting education in these regards.

Dimensions to the debate include whether these skills can be taught independently of the accounting domain; whether they can be taught at all to undergraduates given the maturity of their intellectual development (King & Kitchener, 1994), and whether there is time available within the curriculum (St Pierre & Rebele, 2014; Wolcott, Baril, Cunningham, Fordham, & St Pierre, 2002).

This current debate over soft skills is arguably a re-framing of the old debate over the need to emphasise a liberal education (for example, Sangster, 2010). Whilst some advocate a holistic accounting education steeped in the liberal arts (for example, Kelly, Davey, & Haigh, 1999), others such as Fogarty (2010) advocate a more practicable approach in which the desired skills are extracted from their liberal arts context and reset in accounting coursework. Fogarty (2010) suggests the way forward might be to organise content around the idea of what it means to be a professional. All of these debates spill over into the Australian context.

3.2.2 Accounting in the Australian higher education context

Accounting has been taught in Australian universities since 1902 and the first degree course comprising accounting as a core unit commenced at University of Melbourne in 1925. A survey conducted in 1955 by the American professor, William Vatter, led to the professional associations introducing tertiary education as an entry requirement. This led eventually to the substitution of the associations' own examination activity and the widespread development of accounting courses in universities and colleges of advanced education (Carnegie, 2009). This relationship between universities and the professional associations continues today.

The vocational emphasis of higher education in accounting has long been clear in Australia. For instance, a task force conducted an inquiry into accounting education in 1985. The task force comprised representatives of two professional associations and one academic body. They were the Australian Society of Accountants (now CPA Australia), the Institute of Chartered Accountants in Australia (now Chartered Accountants Australia and New Zealand) and the Accounting Association of Australia and New Zealand (AAANZ) (now the Accounting and Finance Association of Australia and New Zealand or AFAANZ). The task force published a report (Task Force, 1988).

Following the Task Force Report, the Federal Government commissioned a review of the accounting discipline in Australian higher education. It was conducted by two accounting academics: Russell Mathews (Chair), Philip Brown, and a businessperson, Margaret Jackson. Their work culminated in the release of a report: *Accounting in Higher Education: Report of the Review of the Accounting Discipline in Higher Education* in 1990 (Australia Department of Employment Education and Training, 1990).

The opening pages of the Mathews Report stated “as a result of a long period of chronic neglect, the accounting discipline in higher education is in great need of support and revitalisation” (Australia Department of Employment Education and Training, 1990, p. xix). Amongst other things, and reflective of the same debate in the USA, the Mathews committee recommended that accounting units ‘become more conceptual and less procedural’. It also recommended a fourth year of study be added to accounting education courses. However, the Australian Government’s ‘response’ to the Report was essentially to ignore it (O’Connell et al., 2005).

Generally, undergraduate business degrees with specialist studies or majors in accounting remain today as degrees spanning three years. Many of the issues observed by the Mathews committee also remain today: high student-staff ratios, staff shortages, institutional usage of accounting departments/schools’ revenues to subsidise other disciplines, significantly high student numbers, and a curriculum arguably overly restricted by the requirements of the professional accounting bodies.

The Tertiary Education Quality Standards Agency (TEQSA) on behalf of the Australian Government registers all higher education providers and ensures that providers and their courses continue to meet the Higher Education Standards Framework (Threshold Standards) 2015. It also produced a national policy document, the Australian Qualifications Framework (AQF), which includes overarching specifications for regulated qualifications in Australia.

Within the framework, the qualification level of the Bachelor Degree is level 7, at which the purpose of the qualification is to “qualify individuals who apply a broad and coherent body of knowledge in a range of contexts to undertake professional work and as a pathway for further learning” (Australian Qualifications Framework Council, 2013).

Under the Higher Education Standards Framework, Accounting Learning Standards (Australian Learning & Teaching Council, 2010) were developed by a working party comprised of members of the higher education community in conjunction with an Accounting Expert Advisory Group. This group comprised key stakeholders from academia, employers, professional bodies and students. These standards were revised under the auspices of the Australian Business Deans Council (ABDC) in 2016. For the undergraduate degree, still typically a three-year course, the standards are:

Judgement: Exercise judgement under supervision to provide possible solutions to routine accounting problems in straightforward contexts using where appropriate social, ethical, economic, regulatory, sustainability, governance and/or global perspectives

Knowledge: Integrate theoretical and technical accounting knowledge in a business context.

Critical analysis and problem solving skills: Critically apply theoretical and technical accounting knowledge and skills to provide possible solutions to routine business issues. In the Commentary of this standard, it says

> The Bachelor graduate needs to be able to use analytical tools in identifying and solving business problems and to ensure professional scepticism and ethical values are used when considering alternatives. (Australian Business Deans Council [ABDC], 2016, p. 12).

Communication: Justify and communicate accounting advice and ideas in straightforward contexts to influence specialists and non-specialists.

Teamwork: Contribute accounting expertise to a diverse team collaboratively providing possible solutions to a routine business problem in a straightforward context.

Self-Management: Reflect on performance feedback to identify and action learning opportunities and self-improvements.

Thus, the Accounting Learning Standards reflect concerns with ethical conduct, serving the public interest and acting in a socially responsible way as well as the soft skills of judgement, self-management, and teamwork. Critical analysis and problem-solving was a central theme of the redesigned pedagogy and the excerpt from the commentary provided to emphasise the high level of the standard.

In summary, consistent with the USA context, the higher education context in Australia can be seen as reflecting an uneasy tension between concerns for teaching for lifelong learning vs employment; concerns within the realm of vocationalism for balance between teaching conceptual content, technical content, and teaching for intellectual development; and concerns for teaching soft skills in a domain-centric vs domain-independent manner. As such, the context presents challenges for pedagogical design and a lack of consensual clarity about the direction of change.

3.3 Accounting students in Australian universities

There are a number of contextual factors that influence how accounting students approach their learning and perceive the teaching-learning environment in Australian universities.

A major influence on the teaching-learning environment experienced by undergraduate accounting students in Australian universities relates to the fact that by 2016, tuition fees charged to international students by tertiary institutions in conjunction with related travel and living expenses had grown to represent Australia’s third largest source of exports (Department of Foreign Affairs and Trade, 2016). It remains so today. These exports are driven, in part, by the Government’s skilled migration program, which aims to deliver migrants with high-level skills especially in areas where shortages are evident (Birrell & Healy, 2008). Consequently, international students are a substantial percentage of accounting enrolments in Australian universities.

In certain circumstances, individuals on student visas can apply for permanent residency after completing an Australian tertiary education course and this can significantly influence an international student’s choice of course and tertiary institution. A substantial percentage of students attracted in this way study accounting (Birrell & Healy, 2008, 2010). Government reforms in mid-2011 (Birrell & Perry, 2009) aimed to improve the stringency of applicant assessment by setting greater priority on assessing applicants’ English language skills and work experience. In addition, since 2011, an English standard of Level Seven on the International English Language Testing System (IELTS) has been required by the accounting accrediting agencies. However, the accountant occupational category remains one of the largest in relation to which visas have been issued because many overseas students are granted concessions, which allow them to apply for points-tested visas on favourable terms (Birrell & Healy, 2014). Consequently, rather than be attracted by the nature of the discipline, many international students have chosen accounting for reasons of Australian permanent residency.

However, many international students fail to obtain employment as professional accountants, the main reason being they lack the English communication skills required for university study and professional practice (Birrell & Healy, 2008; Parry & Jackling, 2015). Consequently, currently enrolled students may lose motivation or be overwhelmed by the demands of achieving adequate English communication skills.

Undergraduate students in Australia most commonly study accounting as a major in a business or commerce degree and therefore often can delay their choice to major in accounting until the end of first year. This provides them the opportunity to gain exposure to a variety of business disciplines to better inform their choice of major. Many students entering first year have studied accounting at secondary school level and many international students enter university at second year level having completed a prerequisite foundational or orientation year at an approved college. Consequently, there is substantial variation in prior knowledge of accounting among the accounting cohort: many students will experience accounting topics as entirely new whilst for others they ‘have done it before’.

Globally, students’ choice to study accounting as a major is driven by their first year experience, prior education, their personal characteristics and interests, the influence of parents and other people significant in their lives, employment and career opportunities, and their perception of accounting work and the profession (Laswad & Mei Tan, 2014) and this is also largely the case in the Australian context. At a single university in Victoria, Australia, Jackling and Keneley (2009) found the most influential factors were the enjoyment of topics, an interest in accounting problems, job opportunities and potential to earn a high salary. Jackling and Keneley (2009) also found that referent groups, such as parents, friends and counsellors, were influential to international students’ choice.

Consequently, students’ reasons for studying accounting vary widely, and sometimes their reasons are not conducive to a love of learning accounting. Sugahara, Boland, and Cilloni (2008) found generally that both local and international students with high creativity are unlikely to choose accounting. This attests to a common perception that accounting is mechanical and prescriptive which is unfortunate since the better accounting student is one prepared to think critically about accounting.

Undergraduates face time pressure, often combining study with part-time work, social activity and other personal interests. But in these circumstances, and despite course advice about time requirements, many seem to fail to appreciate the time required to learn meaningfully (Scully & Kerr, 2014) or manage the issues that arise (Luke, 2015). An effect is that international students have been observed to rely on the student grapevine for explanations from past students as a strategy for succeeding in the completion of studies in Australian universities (Fleet, 2013) instead of paying attention to assessment requirements and the advice of Course Coordinators.

In his study, Abeysekera (2008) found no difference between local and international students in relation to preference for traditional lectures, but that international students are more likely to prefer interactive and case-based classes. However, this result is somewhat surprising and may be explained by the fact the study involved third year undergraduate students at the University of Sydney. Given the relative difficulty of entry to this institution and the successful completion of two prior years of university study, it could be argued, compared to most international students, these students may be significantly more mature as students. On the other hand, in the particular case of Japanese students, Sugahara and Boland (2010) found that Japanese like to learn by watching due to their relatively collective approach to learning, whilst Australian students who tend to be more individualistic in their learning were more willing to learn by doing. Consequently, both local and international cohorts vary in terms of their learning preferences.

Chinese students are sometimes labelled as rote-learners but Cooper (2004) found, using the instrument of Biggs (1987b), that whilst the tendency of Chinese students to rote-learn was significantly different to non-Chinese students, Chinese students received higher scores for both surface and deep learning. Their perceptions of the educational experience have been found to be very much dependent on their perception of how concerned the teacher appears to be about their success (Wong, Cooper, & Dellaportas, 2015). A consequence is that in Australian universities, teachers are likely to make errors in their evaluations of students' learning approaches.

For the large percentage of international students in Australian universities for whom English is not their first language, English competency is the most important factor affecting their approach to learning, preference for assessment tasks, and the degree of challenge on tasks regardless of the physical location of the institution (Watty, Jackson, & Yu, 2010). This is likely to explain the findings of Chand, Cheung, and Cummings (2015), that Australian students significantly outperformed Chinese students on theory-based questions but that differences were not found for their performance on practical questions. It appears that performance on theory-based questions demanded a higher level of language ability to both understand theory and express that understanding. Consequently, students' responses to pedagogy vary according to their level of English competency.

Local students can enter university either directly into first year from year 12 of the secondary school system or into second year from a vocational training focused tier (TAFE) of the tertiary education system. Abhayawansa, Tempone, and Pillay (2012) found that the students who transferred from TAFE had significantly higher scores in deep approaches to learning in second year of university (i.e. their first year), but the difference diminished in third year. This would suggest that TAFE teaching approaches suit some students better than university approaches, and once at university, these students may become somewhat disillusioned with university learning.

Thus at one level, the learning situation experienced by accounting students in Australia is characterised by multiculturalism, a wide-range of competencies in the language of instruction, English, and the social and economic realities generally facing young people in today's world. In this situation, courses may be nominated as requiring in excess of fifty hours work per week of the teaching period, but many students invest much less, moreover their productivity may be undermined by the challenges of learning in a language that is not their first. These factors influence how effectively students approach and engage with curriculum and pedagogy.

At the individual level, variability in other factors influence students' responses to pedagogy. Motivations for enrolling in an accounting course vary, with these motivations sometimes having less to do with a desire to practice the skills taught in the course but more with the desires or expectations of others or the want to establish a new life in Australia. Students' approaches to learning and their epistemic beliefs vary as a result of experiencing learning situations in differing national and cultural systems. The key point of this review for this research is that the student cohort is far from homogeneous; there is no such thing as a 'typical' student.

3.4 Accounting at Monash University

At the time of the research (2014), the Faculty of Business and Economics offered a variety of business and commerce under-graduate courses at multiple campuses. Of most relevance to this research, are the courses offered in the Caulfield and Clayton campuses in which Cost Accounting was a core unit. These courses are those for which accounting was either a major, such as the Bachelor of Business in Caulfield and Bachelor of Commerce in Clayton, or the course was a specialist degree, such as the Bachelor of Accounting at Clayton.

Courses were accredited by professional accounting bodies since students' associate membership of those bodies depends on successful completion of a range of specified units.

As undergraduates, students were typically 18 to 20 years of age. The course entry requirements for local students differed between campuses with a higher standard of mathematics and a higher ATAR (Australian Tertiary Achievement Rank) required at Clayton compared with Caulfield. Courses at both campuses attracted a large percentage of international students. A large proportion of the international students however entered the University and the course at the beginning of second year having satisfied the university entry requirements by completing a pathway qualification at Monash College.

At the time of the data collection, the redesigned cost accounting unit noted in Chapter 1 was taught at Caulfield, whilst traditional pedagogical methods were used to teach the Clayton unit.

3.5 The content of cost accounting

Accounting is "the process of identifying, measuring and communicating economic information to permit informed judgement and decisions by users of the information" (Bazley & Hancock, 2013, p. 629). Colloquially, the term 'cost accounting' is used for a component of 'management accounting' that refers to a collection of processes by which information pertaining to costs is produced for the use of managers in a business context to permit informed decisions[8]. In this research context, the term 'cost accounting' is used in this way. It was taught in a unit titled "Cost Information for Decision Making".

Accounting has a strong orientation towards the field of economics since it is concerned with the process of identifying, measuring and communicating economic information. However, whilst contemporary accounting in the broad sense is adapting to take into account social and

[8] Predominantly in the USA, this interpretation of the term 'cost accounting' is called "managerial costing" and the term 'cost accounting' used instead to describe the measurement and reporting of costs intended for external financial reporting or regulatory purposes. In this context, cost accounting is an activity therefore that essentially is in support of financial accounting where guidelines and principles must be followed and complied with to meet regulatory, legal, or other defined standards and requirements (IMA, 2013). This interpretation is consistent with the meaning given by the International Federation of Accountants (IFAC).

environmental considerations, cost accounting's perspective of the world remains a predominantly economic one.

Cost accounting is traditionally regarded, and hence taught, in universities as a set of technical, mechanical procedures. This is intriguing because cost information produced by accounting is rarely objective and certain; most often a result of modelling uncertain futures or applying techniques that require subjective estimations[9]. Perhaps this intrigue is explained by Schön's (1987) claim of a hierarchy of knowledge in academia in which the greater one's proximity to basic science – compared with applied science and/or the technical skills of day-to-day practice - the higher one's academic status. Consequently, academic approaches to teaching cost accounting may reflect a bias towards the concepts and theory involved rather than the application of these in real world contexts.

Schön (1987) also introduced a swamp metaphor for types of problems. Metaphorically, on the high ground, problems are manageable and lend themselves to being solved through the application of algorithmic procedures. On the low ground, in the swamp, problems are messy and solutions, if they exist, are not straightforward. Real world problems, and therefore those likely to be interesting, tend to be in the swamp. Cost accounting tends to be taught as if it were dealing with problems that reside on the high ground. As alluded to above, whilst increasing

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[9] For example, in a situation in which a business manufactures a wide range of products, cost accounting techniques may be used to suggest the total cost of manufacturing a product is $200. Not very controversial, is the idea that the cost of purchasing the components of the product (say $80) contributes to the total cost of $200. Not more controversial, but more problematic, is the idea that the cost of labour involved in manufacturing it also contributes to the total. Hypothetically, if three hours of labour was required and it was performed by a casual worker who was paid $20 per hour, then labour would contribute $60 to the total cost. This labour cost is certain, having been determined objectively. However, manufacturing workers are often paid a weekly wage regardless of the amount of work they do so the calculation of time and rates is no longer objective, and the *estimate* of cost not certain. Moreover, a similar problem applies to all other manufacturing costs that are incurred in support of production, e.g. the cost of factory cleaners; management; machine operation and depreciation; factory rental etc. etc. Further, the total cost of a product does not include categories of 'cost' that arguably (a subjective judgement) should be included, e.g. declines in employee health and morale, environmental and social impacts rising from its production. It is possible to expand this example over several pages but as a final illustration of the uncertainty of the total cost, take for example, when the purpose of the cost information is to set the selling price over the future year of the product. Now all of the component costs are no longer historical, but future-oriented, therefore predicted costs. Subjectivity and uncertainty abound!

awareness of social and environmental considerations has led some to recognise that some problems accounting seeks to solve actually reside in the swampy lowland, this is less so in the case of cost accounting. Being concerned with 'costs', i.e. benefits foregone and resources used up in some way, the focus of cost accounting remains strongly economic, and hence closer towards the high ground than the swampy lowland. However, in this thesis, it is argued the ground on which cost accounting problems reside is not as high, nor as hard, as the traditional teaching of cost accounting presumes.

Given the premise that cost information produced by accounting is rarely objective and certain, the means of producing the information has innate limitations and/or requires strong assumptions. Consequently, I argue that cost accounting should not be seen merely to comprise technical, mechanical procedures, but rather to require the use of judgement and critical thought in a process aimed at producing relevant and optimally cost-effective information for the purpose of supporting decision making. This involves a sharp divergence from the traditional approach which focuses on teaching a particular accounting technique and then, almost as if it were an addendum, teaching its limitations and assumptions. It may be better to teach how critical thought and judgement can be used to identify and apply a variety of methods that minimise or accommodate the effect of limitations and assumptions. In Schön's terms, this may not result in a level of skill equivalent to "artistry", but it does recognise that accounting problems reside to some extent in an "indeterminate zone of practice" (Schön, 1987, p. 6).

A different issue is that, traditionally, cost accounting is presented to new students as if it were a new field, entirely foreign to their prior life experiences. This is understandable, since an introduction to the study of accounting at university is the first, small step into a new world of the accounting professional. However, this approach denies the fact that most, if not all, undergraduate students have prior experience analysing and dealing with cost information in some way in order to make decisions. Although they may never have considered it, many have made cost-benefit assessments, estimated the cost of things, and considered resource allocations based on costs. Although the context of these activities was personal, the knowledge and experience gleaned from them have relevance to learning to solve problems in the business context.

For example, the accounting concept of 'contribution' is fundamental to Cost-Volume-Profit Analysis. Defined as the difference between revenue and variable costs, students are likely to perceive it as belonging to the world of accounting and not connected to their own world (Lucas, 2000). Yet most students have pre-existing knowledge and experience of what it takes for one to become better off from a transaction, i.e. the idea that to become better off you must get back more than you had to put in. This idea is also the meaning of the technical accounting term ‘contribution’; it is another way of thinking about the concept. Thus, amongst other things, a teaching approach can help students develop a deep understanding of the accounting concept of contribution by extending their pre-existing understandings of becoming ‘better off’.

Cost accounting content, and the way it is presented in textbooks, has changed little in the last thirty years despite the innovation that has taken place in teaching practices. In terms of the conceptual – procedural debate discussed in Section 3.2, the cost accounting content typically taught remains predominantly procedural. Given the learnings standards expected of undergraduates (Section 3.2); there is a strong argument for change in content and textbooks.

3.6 The learning situation

This section explains the teaching-learning environment in which the unit was taught. To accomplish this, the section is organised as follows. The first section explains the concerns with the traditional pedagogy and the aspirations of the redesign. The second section presents an overview of the redesigned pedagogy and the subsequent two sections describe the lectures and tutorials. The fifth section explains the assessments and the final section provides an overview of the staff involved in teaching the unit.

3.6.1 The concerns with the traditional pedagogy and aspirations of the redesigned pedagogy

The learning situation in which the research was conducted was on the Caulfield campus of Monash University in Semester 1, 2014. It had evolved over the previous seven semesters with the goal of providing students an active-learning experience and to address the three main concerns noted in the Introduction, Section 1.4. These concerns were:

> That students appeared to adopt surface learning approaches rather than deep (Marton & Säljö, 1976). In other words, students appeared not to be seeking to find the sense in what they were learning.
>
> That it seemed accounting was perceived by students to be objective and certain, thus, they believed problems could be solved by mechanical application of procedures. In contrast, accounting procedures in actuality represent alternative methods of deriving

information to enable decision-making, and thus accounting involves judgement and critical thinking in the application of accounting techniques.

The apparent lack of self-direction by students in their learning; the observation for example that students were content to listen to explanation of solutions in tutorials rather than doing pre-work and coming to tutorials with questions they wanted to be answered.

The key differences from what I perceived to be the conventional and common approach to teaching accounting that I set out to achieve were to:

1. Reposition cost accounting as a set of tools that can be used to solve problems and assist decision making, instead of a set of mechanical and boring procedures that had to be learnt as a rite of passage. Despite making desultory, end of chapter efforts to highlight the inherent assumptions and limitations of the methods, many of the textbook writers tend to reinforce the perception of cost accounting as being mechanical and objective and as a consequence I view the typical structure of cost accounting textbooks as being an impediment to student learning;

2. Reposition cost accounting as something students already have experience of and/or already use aspects of, instead of cost accounting being positioned as part of a professional discipline remote and separate from students' prior experiences;

3. Change students' conceptions of cost accounting from being objective and certain procedures to being aids to decision making that require critical thought and judgement;

4. Integrate 'learning to think' about their learning and understandings about the application of cost accounting throughout the entire process of learning each of the cost accounting topics/tools. This meant that the teaching and learning approach would be based in active learning, and would seek to develop and promote the use of metacognition;

As a consequence of all four differences, the teaching and learning approach would contrast with the textbook approach, because the assumptions and limitations, i.e. the issues that tend to drive the need for thoughtfulness and judgement, would be integrated throughout each topic.

In summary, having subsequently become aware of the Experience of Teaching and Learning Project (ESRC-TLRP, 2016), I aimed to teach students to begin to "think like an accountant" (cf. 'thinking and practising in the biosciences' in Entwistle, 2009; McCune & Hounsell, 2005).

3.6.2 Overview of the redesigned pedagogy

Following is a summary of the key aspects of the pedagogical redesign approach implemented in 2014:

1. Having students reflect on their approach to studying the pre-requisite first year accounting (AFF1121) unit by completing a Study Process Questionnaire and then giving them feedback in terms of the possible implications for success in ACF2391;

2. Promoting the idea of learning to 'think like an accountant' in all lectures; the Assessment Skills seminar in Week 1 (which was also linked to AFF1121); and the use of Biggs & Collis's (1982) 'Structure of Observed Learning Outcomes' (SOLO) framework. SOLO provides a means of evaluating and communicating levels of understanding associated with learners' work. An example of materials used to promote the aspiration of learning to think like an accountant is provided in Appendix E;

3. Helping students to generate questions in the course of their study, e.g. through the Critical Thinking Skills seminar in Week 2 in which they were given a scaffolding tool to assist them generate clarifying/inquiry/critical questions;

4. Having students recognise existing conceptions and/or relevant experience prior to learning a topic;

5. Designing lectures as a 'conversation' with students about ways of solving a problem. Thus, they were designed as active learning classrooms and used a variety of techniques such as pre-lecture quizzes and in-lecture polls. Average lecture attendance rates were greater than 80%;

6. Framing two optional assessments around the process of learning. The first, "Lecture Engagement", was based on students' responses to the pre-lecture quiz and subsequent attendance at the lecture. The second, "Critical Thinking – Tutorial Preparation", was based on the questions students generated in preparation for tutorials after reflecting upon their understanding of suggested solutions to pre-set end-of-chapter exercises and the topic in general;

7. Framing two summative assessments. One was the final exam, and the other comprised three short tasks scheduled early, mid and late in the semester. The first task was completed during tutorials and required judgement in the use of historical data to aid cost prediction. The latter

two required "layman explanations", e.g. explanations appropriate for a non-accountant manager or recruitment interviewer, of costing systems. These also required students to write a short reflection about the quality of their answer in terms of the SOLO-based assessment criteria;

8. A flexible coursework assessment regime, in which students had choice and control over whether they participated in the two process-oriented assessments and thus whether or not they generated questions. Less than 5% of students did not participate at all in the optional assessments. More detail is provided in Section 6.8.2. A co-authored paper examining this has been published (Pretorius, van Mourik, & Barratt, 2017).

These changes represented a comprehensive redesign of the pedagogy. The main thing that did not change was the structure of the final exam, in that it remained a 3-hour, closed book, written exam. If not for the disruption discussed in Section 1.6, improving the way in which the final exam assessed critical thinking and judgement was the next item on the redesign agenda.

3.6.3 Lectures

Short pre-lecture quizzes were used for a variety of purposes such as to orient students to the lecture, intrigue them, and raise awareness of prior knowledge or relevant life experience. The lectures (~ 150 students) were interactive conversations about methods of solving a topic-related problem that used pre-lecture quiz outcomes as input to peer discussions and polls conducted during lectures.

In summary, the differences between the redesigned and traditional lecture are shown in Table 3-1.

Table 3-1 Differences: Traditional vs redesigned lectures

	Traditional	**Redesigned**
For students	‘Sit and listen’	Engage thoughtfully in collective efforts to explore various ways of solving a problem;
	Passive, learning on their own	Active learning alone and in small groups; hard ‘brain work’; prompted with / signalled by this icon: 
	Prior to lecture, read the textbook chapter	Prior to lecture, answer small multiple choice quiz that orients them to lecture
For lecturer	Describe and explain content in accounting context only	Facilitate the recognition of prior knowledge and experience and the application of new ideas in a discussion of methods of solving a problem. Connect these to accounting.
	Has total control of monologue (or dialogue if it arises); low risk	Give over significant control of lecture time and discussion to students; risky
Lecture content	Textbook is the starting point	Textbook is a reference
	Focus on declarative and procedural knowledge	Problem solving skills that require critical thought and judgement
	Lecture summarised in terms of ‘learning objectives’	Lecture summarised in terms of ‘key ideas’; ‘ways of thinking’.

An example of materials used to promote the aspiration of learning to think like an accountant is provided in Appendix E and an explanation of an example lecture aimed at enabling a lecture conversation is provided in Appendix F. Together, the content of the appendices illustrate four agendas were at play concurrently during the redesigned lectures: introducing and building meaning for the most relevant declarative knowledge; application and solving of problems in real world contexts; building recognition of the uncertainty and messiness of real world data and solutions and thus the need for critical thinking and judgement; and teaching how to learn. As often as practicable, these agendas were linked to the likely prior knowledge or experiences of students. This is in contrast with the predominant agenda of the traditional lecture which was to explain declarative and procedural knowledge in a passive learning situation.

3.6.4 Tutorials

Tutorial preparation began with a focus on particular exercises selected from the relevant end-of-chapter questions in the prescribed textbook. These exercises guided students toward the learning areas that were the priority for the course. Prior to the tutorial, students were expected to attempt these exercises, compare their answers with suggested solutions, reflect on their understanding, and generate questions to which they required answers in order to improve their understanding. These student-generated questions were the primary focus of the tutorials.

In tutorials (~20 students), with appropriate support from tutors, students worked in groups to find answers and articulate their own understandings by helping others with answers to their questions.

3.6.5 Assessments

Two specialist skill seminars were offered during tutorial times in Weeks 1 and 2. The purpose of these were to orient and equip students for the unit assessments.

Firstly, Assessment Skills seminars were conducted during tutorial times in Week 1. The workshops aimed to influence students' approaches to learning by introducing the SOLO (Structured Observable Learning Outcome) taxonomy (Biggs & Collis, 1982), applying it to the assessment of a task students had completed prior to the workshop and which was based on content from the pre-requisite unit, and explaining how SOLO would provide the framework for assessment in this unit.

Secondly, Critical Thinking Skills seminars were conducted during tutorials in Week 2. The seminars taught questioning techniques as a means of monitoring and improving one's understanding of something. Three types of question were introduced: clarifying, inquiry and critical questions, and students were provided a concrete aid they could use in subsequent weeks to assist them to generate questions in preparation for tutorials. This was reinforced by attendance at optional workshops offered by the Monash University Library in Week 6 (after students received the results of the first coursework task that was conducted in Week 4), and ongoing coaching by tutors during tutorials.

Apart from the final exam, there were three types of internal assessment (see below for details of contributions of each to a student's grade). The first internal assessment, "Coursework Tasks", involved completion of a small task during tutorials in each of Weeks 4, 7, and 10. These tasks were fundamentally different to textbook questions and past exam questions and aimed to reinforce the quality of learning expectations of the Unit and provide students with performance feedback. The first task required justified judgements. The second required layperson explanation of a job costing system. The third required layperson explanation of the comparison of three types of costing system.

The second internal assessment, "Lecture Engagement", involved a combination of completion of the pre-lecture quiz before and attendance at the lecture in each of Weeks 2 to 12. A student would earn credit if they both completed the quiz and attended the lecture.

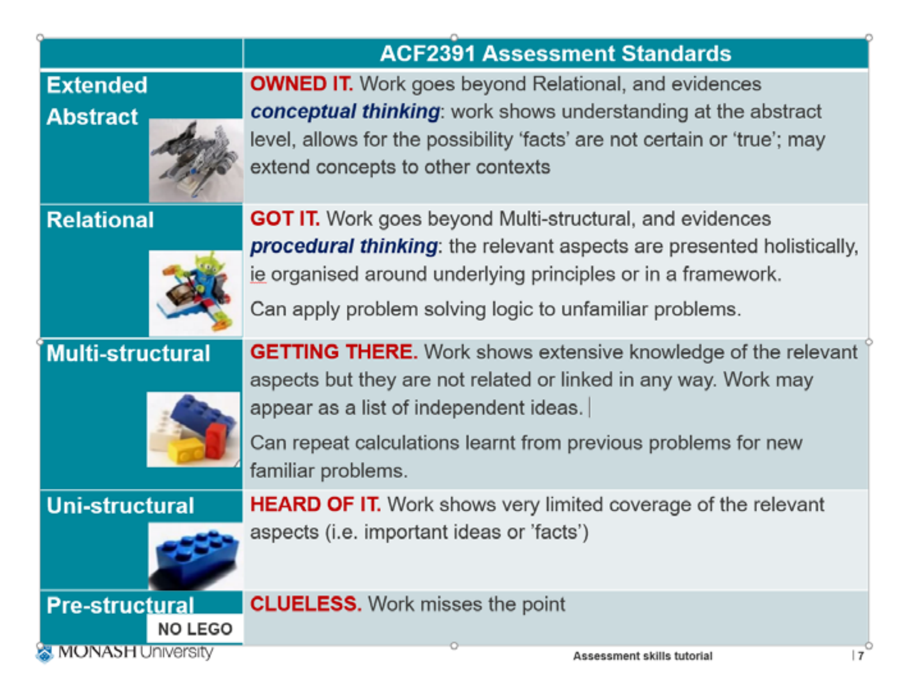
Finally, the third assessment, "Critical Thinking", focused on the tutorial preparation activity. Students were required to generate three or more questions that would, if answered, improve their understanding of topic material, and submit the one[10] whose answer they deemed would make most difference to their understanding via a Google form. The term, 'most powerful' was used to describe that question. Each week, these questions would appear on the tutorial attendance sheet and be assessed as 'satisfactory' or not by the tutor. Thus, feedback was given to students and conversations instigated as required. A detailed explanation and example of a weekly attendance sheet is provided in Appendix C. Most questions would be assessed as satisfactory unless it was suspected the question was asked only "for the sake of having a question", because ultimately whether the answer to a question is worthwhile or not is a judgement only the student can make.

Abandoning the closed book, invigilated final exam structure in favour of alternative approaches to generating the major component of the final student grade was not an option. The main reason for this is the requirement by the professional accounting bodies that accredit the unit that assessments must include a substantial one that is invigilated. Clearly then, the limitations associated with the nature of the final exam meant the exam did not motivate the

[10] In addition, all questions were posted on Moodle discussion forums and students were encouraged to volunteer answers to each other's questions.

preferred learning approaches as much as was desired. However, a number of initiatives were implemented in an attempt to optimise the motivation. Two of these are now discussed.

As well as the Coursework Tasks, the assessment standards introduced at the Assessment Skills seminar in Week 1 were applied to the final exam; see Figure 3-1. The same standards were used to communicate that the lower level standards may constitute 'knowing accounting', but 'to think like an accountant' required the top level.



	ACF2391 Assessment Standards
Extended Abstract	**OWNED IT.** Work goes beyond Relational, and evidences ***conceptual thinking***: work shows understanding at the abstract level, allows for the possibility 'facts' are not certain or 'true'; may extend concepts to other contexts
Relational	**GOT IT.** Work goes beyond Multi-structural, and evidences ***procedural thinking***: the relevant aspects are presented holistically, ie organised around underlying principles or in a framework. Can apply problem solving logic to unfamiliar problems.
Multi-structural	**GETTING THERE.** Work shows extensive knowledge of the relevant aspects but they are not related or linked in any way. Work may appear as a list of independent ideas. Can repeat calculations learnt from previous problems for new familiar problems.
Uni-structural	**HEARD OF IT.** Work shows very limited coverage of the relevant aspects (i.e. important ideas or 'facts')
Pre-structural NO LEGO	**CLUELESS.** Work misses the point

Figure 3-1 Unit assessment standards

In order to orient students to the style and structure of the final exam, three sample exams were provided to students in Week 9. These were based on previous exams but contained some modifications designed to highlight the requirement for outcomes at the relational and extended abstract levels. For instance, a question was modified to be reminiscent of the coursework task "explain to a layperson". Advice about the level of understanding required to do well in the exam was given and, for one of the sample exams, an analysis of the distribution of marks across the four levels was provided. This is shown in Table 3-2. It shows that up to 14% of the available marks were attributed to being able to 'think like an accountant', and up to 47% depended upon procedural understanding.

Table 3-2 Example of final exam advice

Dear Students,

The following table summarises the levels of understanding required to answer well the questions in this sample exam. It reinforces advice given during the semester that success in this unit requires the learning of skills and knowing “how to think” about the solution to problems.

Level of Understanding	Q1	Q2	Q3	Q4	Q5	Q6	Q7	TOTAL
Extended Abstract “Owned It”		d) 4 marks				a) 10 marks		14 marks
Relational “Got It”	d) 4 marks	c) 4 marks	a) 3 marks b) 6 marks c) 3 marks d) 3 marks	c) 2 marks	c) 4 marks	b) 8 marks	b) 6 marks a) 4 marks	47 marks
Multi-structural “Getting There”	a) 2 marks b) 1 mark c) 5 marks	b) 4 marks		a) 2 marks b) 6 marks	a) 4 marks b) 8 marks		a) 6 marks	38 marks
Uni-structural		a) 1 mark						1 mark
TOTAL	12 marks	13 marks	15 marks	10 marks	16 marks	18 marks	16 marks	100 marks

In contrast to the sample exam, the mark distribution of the final exam is shown in Table 3-3. It shows the sample exam set a slightly higher expectation than what the students experienced in practice, although in practice the reward for extended abstract level of understanding was about 28% greater. The reason why the actual exam set a slightly lower expectation was to manage the failure rate.

Table 3-3 Final exam comparison to sample exam

Level of Understanding	Sample exam	Final exam
Extended Abstract	14%	18%
Relational	47%	34%
Multi-structural	38%	47%
Uni-structural	1%	1%

Whilst the Final Exam and Coursework Tasks were focused on learning outcomes, the Lecture Engagement and Critical Thinking assessments were focused on the learning process. A flexible assessment regime existed in which a student’s result for the Unit would depend only on the Final Exam and Coursework Tasks (weighed 80% and 20%) respectively, or all four assessments (exam weight 60%, coursework 15%, Lecture Engagement 10%, and Critical Thinking 15%), whichever resulted in the higher score. Students were not required to make and disclose a strategic choice at any time. The intent was to give students greater choice and control over their learning, and to motivate them to "try out" the process-oriented activities in an authentic way. In other words, students would suffer no direct disadvantage or penalty if they chose to ignore the process-oriented assessments.

3.6.6 Teaching staff

The teaching staff comprised firstly myself as Chief Examiner and Unit Coordinator responsible for designing the pedagogy, and setting and grading assessments; and as Lecturer responsible for the conduct of large one-on-many teaching events. The staff also comprised four other regular staff members who, in addition to myself, acted as tutors responsible for the conduct of small class events. Tutorial classes typically comprised 20 students. The number of classes taken by each tutor is shown in Table 3-4.

Table 3-4 Tutoring staff[11]

Tutors	**# classes**
Greg	2
Monica	7
Bill	2
Bill/Jack (block teaching)	2
Jack	2
Diana	2
Total	17

There were two concerns associated with teaching staff. The first, a tutor, Bill, new to the unit in the semester in which the research data was collected, was outspoken amongst his students in his negativity to the teaching approach. Secondly, another tutor, Jack, experienced in the unit, continued to be positive and supportive but began to put too much emphasis on being critical of the crafting of students' questions, rather than emphasising the value of them being answered. What this meant was that just under 36% of the students were experiencing tutor

[11] Other than mine, names have been anonymised.

behaviours that were inconsistent with or in conflict with my pedagogical goals. This significant variation in the consistency of the tutorial teaching with my goals is important when considering the data reported in later chapters.

4 Methodology

4.1 Preface

Chapter 4 contains the methodology. It includes the aims of the study and descriptions of the research approach, myself as researcher, and the student participants. Next, processes of data collection and analyses are explained. Finally, it provides information related to the ethics considerations, discusses the trustworthiness of findings, and explains the limitations of the research.

4.2 Aims of the study

This thesis examines the role of epistemic beliefs and self-questioning in undergraduate students' understanding of cost accounting and the implications thereof for future pedagogical design.

As explained in Section 1.4, the fundamental question is "to better understand how students in the unit for which I am responsible … experience the learning situation and why they do so in the way they do". The pedagogy associated with the learning situation experienced by students had been redesigned to address three concerns with the traditional teaching method: surface vs deep learning approaches, misunderstanding of accounting, and lack of self-direction was the student's epistemic beliefs. This thesis examines the redesigned pedagogy in relation to the three concerns. Thus, a research aim is associated with each concern, and respectively these are:

1. To explore how redesigned pedagogy might promote thinking in the process of sense making;

2. To explore the role of epistemic beliefs in relation to accounting reports and techniques and pedagogy redesigned to develop beliefs about these; and

3. To explore how redesigned pedagogy might promote self-directed learning.

Consequently, four research questions ultimately emerged to guide the research. These are:

RQ1: What is the evidence of epistemic beliefs and their development in the context of the redesigned pedagogy?

RQ2: What mental processes are associated with self-questions asked by cost accounting students, and how do these processes vary with the production of different knowledge structures?

RQ3: How do students perceive activities requiring them to generate questions?

RQ4: What are the implications of the research for the redesigned pedagogy and pedagogy in higher education contexts more broadly?

A detailed explanation of the pedagogical design goals and the nature of the learning situation is provided in Section 3.6.

4.3 Research approach

This description of the research process follows the recommendations of Creswell (2014) and Creswell and Poth (2018). Thus, this sub-section will, firstly, describe the interpretive framework, i.e. the philosophical view (Creswell, 2014) taken in this research, then the research design, and end with a description of the research method.

4.3.1 Interpretive framework

The nature of the research questions meant that the research approach in this thesis needed to be qualitative in its design. The research questions aim to explore evidence pertaining to epistemic beliefs, mental processes involved in active learning, and students' perceptions of a pedagogical design intended to promote active learning. Since these phenomena take place in a 'black box', they cannot be objectively observed and measured but instead must be interpreted indirectly from other data. In seeking the implications for pedagogical design, reflections concerning the fourth research question presume, to a degree, that a change in pedagogical design may result in, or cause, favourable changes in students' mental processes, epistemic beliefs and pedagogical perceptions. The investigation of the third research question involves interpretations of open-ended comments by students, but the findings are not shaped significantly by reference to the students who made the comments. These attributes are indicative of a post-positivist philosophical view (Creswell, 2014).

Post-positivism holds a deterministic philosophy in which effects are *probably* explained by causes, and therefore research seeks to collect data that may be descriptive of the causes that influence outcomes. The research then seeks to develop explanations of situations or causes and test these for validity and reliability (Creswell, 2014). The post-positivist view is distinguished from the positivist, in that the latter believes in the notion of the absolute truth of knowledge and that we can be positive about knowledge claims in relation to the behaviour and actions of humans.

In contrast to the view taken in this research however, the majority of qualitative research reflects the social constructivist philosophical view (Creswell, 2014), often also described as interpretivism (Denzin & Lincoln, 2013). Social constructivism holds that individuals develop subjective meanings of things that are multiple and varied requiring the researcher to look for the complexity of viewpoints and maintain awareness that their own backgrounds shape their interpretations. Consequently, the trustworthiness of their findings depends on how well they reflect the voice of the participants (Creswell, 2014).

Whilst the majority of data in this research is qualitative, some quantitative data is created in the process of research; for example, by counting the frequency with which particular kinds of inferences emerge from the data. The mixing of data types in this way does not mean the research is mixed methods, since mixed methods research involves much more than the collection of both types of data; it involves mixing philosophical assumptions and analytical techniques of quantitative (e.g. statistical inference) and qualitative approaches as well (Creswell, 2014).

Qualitative research ordinarily has particular characteristics. Descriptions of some of those particularly pertinent to post-positive qualitative research follow. However, as explained in Section 1.6, the original research plan was disrupted and consequently the characteristics of the research varied from what follows. These variations are also explained below. In qualitative research, data are collected directly from participants in a natural setting, rather than, for example, the use of archival data that proxy the variables of interest or data collected in artificial environments such as experimental settings. Accordingly, care is taken to attempt to interpret what the data mean rather than presume the data is an objective description of something.

Related to this is the distinctive role of the qualitative researcher. In qualitative research, researchers cannot stand apart from the research but are actually key research instruments themselves. This means they must be reflexive about their role in the research, and mindful of how their culture, backgrounds, and personal experiences may affect their interpretations.

A consequence of both these factors is that, ordinarily, an initial plan for research cannot be tightly prescribed, since some or all phases of the process may change or shift in response to the experience the researcher gains after commencing the research and subsequently collecting data. As explained in Section 1.6, an initial plan was not tightly prescribed in this research either but for a different reason. In this case, the plan was necessarily shaped by the available data.

The qualitative research process begins inductively as researchers begin organizing data into patterns, categories, and themes from the bottom up. As the analysis proceeds, deductive thinking plays an important role as researchers look back at their data from the themes to determine if more evidence can support each theme, or whether additional information must be gathered. In this case, there was no opportunity to collect additional data; I was in the unusual position of looking for data relevant to my fundamental questions/concerns and working back from that. Nevertheless, my selection of data was still driven by the nature of the study needed to address the fundamental question described in Section 1.4.

Qualitative researchers attempt to develop holistic pictures of answers to research questions, and thus prefer to access multiple data sources, such as interviews, observations, and documents when available. In contrast, positivist quantitative researchers tend to define the problem or issue in terms of a relatively simple parsimonious model, and treat the effect of other variables not represented in the model as contributions to analytical 'noise'.

Narrative, phenomenology, ethnography, case study, and grounded theory are five of the more common qualitative research designs in the social sciences (Creswell, 2013). Of these, and as explained in the next section, the case study has been selected for this research.

4.3.2 Research design

The research explores the role of epistemic beliefs and self-questioning in student understanding of undergraduate cost accounting. Self-questioning is seen as having a crucial role in students' active processing of given materials (Wong, 1985). Furthermore, the literature emphasises the critical role of epistemic beliefs in this respect (Bannert et al., 2014; Bath & Smith, 2009; Gibbs, 1995; Muis, 2007; Nist & Simpson, 2000; Rebello et al., 2012).

The research context is a learning situation in which the cost accounting pedagogy was redesigned to promote active learning, in particular, self-questioning in preparation for tutorials and a lecture approach focused on teaching the skill of solving various types of business problem. Accordingly, the research design is a single case study (Yin 2014).

Yin (2014) cites five rationales for the choice of a single-case design as being appropriate. Firstly, the research questions require selection of a case because it provides the opportunity to test a critical factor. Secondly, it may represent an extreme or unusual situation. Thirdly, it may represent a typical or common situation. Fourthly, it may be revelatory in the sense that it provides an opportunity to observe and analyse a phenomenon previously inaccessible, and finally it may provide the opportunity to study the same single case at two or more different points in time.

Of these, the choice of a single case design for the study is justified by the learning situation being typical of the active learning practices theorised by this research and the opportunity to collect data at different points in time. Consequently, the research design is likely to provide findings with high ecological validity. Ecological validity is discussed in Section 4.9.

4.3.3 Research method

The single case design has enabled findings in relation to the research questions. The research approach fitted was implemented with no disruption to the normal administration and delivery of the cost accounting unit: apart from out-of-class interviews with four students, the data were created and collected in the normal course of teaching. The data comprised three types: self-questions, responses to a broad-based survey, and student comments given in interviews.

Self-questions were generated as part of an optional assessment focused on students' preparation for tutorials. This took place in each of Weeks 2 to 12 inclusive of the twelve-week semester. Assessments were submitted electronically and collected in Google Sheets.

The broad-based survey was the Student Evaluation of Teaching and Units (SETU) survey, an evaluation required of all undergraduate subjects at Monash, and administered in this specific case, via normal university procedures. It consisted of student responses to Likert-type questions and comments in response to open-ended questions. This took place in the final weeks of the semester and prior to the exam period. Comments were redacted by the university as necessary to preserve anonymity, and then analysed in this research for themes.

Interviews with four students took place at multiple times throughout the semester and after the exam. These were recorded and transcribed.

Transcripts of interviews with the students in conjunction with comments given in response to the Student Evaluation of Teaching and Units (SETU) survey were analysed and findings triangulated to explore the answer to RQ1, the role of epistemic beliefs and RQ3, student perceptions.

Findings about RQ2, the mental processes and their relationship to knowledge structures, resulted from a multi-stage process. The process is explained in detail in Section 4.7 but summarised here. Firstly, self-questions from a small sample of students were used to infer the underlying mental processes used to make sense of a cost accounting topic. Secondly, these were then tested by reference to a large sample of questions for the same topic and, subsequently, questions asked by the same students for two other topics. Thirdly, topic content was analysed in terms of the elements that comprise it and how these elements vary in terms of knowledge structure. Fourthly, the elements were matched with mental processes inferred from analyses of self-questions directed toward those elements in order to make findings about how mental processes vary with knowledge structure. Fifthly, findings about the mental processes inferred from self-questions were modified following triangulation of the mental processes with the findings from the interview transcripts. Finally, the implications of the triangulation for the findings about how mental processes vary with knowledge structure was reviewed.

Discussion in relation to RQ4 resulted from reflection upon the discussions of RQ1, RQ2 and RQ3 as well as personal experience.

4.4 Positioning myself within the research

As is elaborated in Section 1.2, ‘My background’, I had several years’ history and experience in the unit prior to the semester in which the data relating to the redesigned pedagogy was collected. At the time of data collection, I had several roles in relation to the unit: Chief Examiner/Coordinator, Lecturer, and Tutor.

As Chief Examiner and Unit Coordinator, I was responsible for designing the pedagogy, and setting and grading assessments. As lecturer, I was responsible for the conduct of large one-on-many teaching events and as a tutor; I was responsible for the conduct of a small proportion of the total number of small class tutorials.

Data were collected in the normal course of teaching and assessment. I was not the tutor of any of the interviewees and therefore did not assess any of their in-semester assessments, including the self-questions that became a significant source of data for this thesis. Moreover, I did not mark their final exams but, as Chief Examiner, I did have a responsibility to review the exam of the one interviewee who failed it and hence the unit. Therefore, there is no basis to believe the data was biased because of my activities as researcher.

Ethics approval (see Section 4.8) was received in respect of arrangements pertaining to four students who were interviewed for research purposes as well as the research as a whole.

4.5 Participants - students

Research participants were undergraduate students, typically 18 to 20 years of age attending Caulfield campus of Monash University. Most students were enrolled in the Bachelor of Business degree and they were studying the unit as one of several compulsory accounting units required to attain a major in accounting.

In the research context in Semester 1, 2014 on Caulfield campus, of the 317 students enrolled in Week 1 of the semester, 53% were Australian citizens or had Australian residency. Fifty-eight percent disclosed the language they primarily used was English; and 8% preferred not to disclose. Sixty-seven percent qualified for entry to the University through Australian pre-university institutions, predominantly the Australian secondary school system; and 9% preferred not to disclose. Of the 75% of students who responded to the pre-lecture quiz in Week 1, 80% indicated they aspired to professional accreditation as an accountant, 3% did not, and 17% were not sure at the time.

Students enrolled in the similar unit at Clayton campus completed it as part of the accounting major in the Bachelor of Commerce degree. Compared to the entry requirements of the Bachelor of Business degree on Caulfield campus, entry requirements at Clayton were more stringent, requiring higher achievement in mathematics in particular as well as a higher ATAR (Australian Tertiary Achievement Rank).

Traditional pedagogical methods were used to teach the Clayton unit as well as all other course units studied previously and concurrently at Monash University by the research participants. As noted above, only students enrolled at the Caulfield campus were involved in this research but some would have been aware of the pedagogical difference at Clayton.

4.6 Data collection

The original data collection plan as proposed at confirmation of candidature centred primarily on interview data with a sample of students supplemented by data collected via a range of survey instruments in the normal course of teaching and administering the unit. This data collection plan was piloted in Semester 1, 2014.

However, the research plan was changed when data could not be collected on a larger scale in Semester 2, 2014 in the manner originally planned (Section 1.6). This was due to an administrative decision to assign me to a different unit and to revert the redesigned unit to a more traditional pedagogical design. In addition, in Semester 2, my primary thesis supervisor announced his resignation from the university. Consequently, and with the support of a new supervisor, a new research design that stayed true to the original motivation for the research was conceived that took advantage of relevant and available data sources (Section 1.7).

Three data sources were used and this sub-section is structured into three components, one for each of the sources: self-questions, interview transcripts, and finally the Student Evaluation of Teaching and Units (SETU) survey.

4.6.1 Self-questions

In preparation for tutorials, students were asked to reflect on their current understanding (of the given topic generally, textbook content, suggested solutions to tutorial exercises) and to generate at least three questions whose answers would improve their understanding of aspects of the topic. They were asked to nominate the question that was ‘most powerful’, i.e. the question whose answer would make the most significant difference to their own level of understanding. A weekly “tutorial preparation” assessment was framed around the generated questions and each student’s ‘most powerful’ question was submitted via Google Forms. In the remainder of this thesis these self-questions are often labelled “tute-prep” questions.

The data for all Caulfield students for all topics in Semester 1, 2014 were available for this research. These data were stored in spreadsheets for each topic. Self-question data for three topics were selected. Two of the topics were the first in the semester to concern cost accounting topics as methods of solving a problem and they were lectured in Weeks 2 and 3. The mental processes inferred from these were consistent and therefore the data for a third topic late in the semester, Week 11, was selected to test whether the nature of the mental processes related to a more advanced topic studied some eight weeks later might vary from those inferred from Weeks 2 and 3.

Stratified sampling (Yin, 2014) was used to select randomly a sample size amounting to 33% of the students for the first topic. More specifically, the spreadsheet data for the first topic were sorted in order of the students' final exam results and then every third student was selected. The same sample of students was selected for the second and third topics.

However, the final number of questions for each topic depended on the data cleansing that took place during the analytical process described in Section 4.7.1.4. Not always had a student generated a question for a topic and therefore on these occasions the student was deleted from the sample for that topic. On the few occasions when combination questions were asked by a student, these were disaggregated into multiple questions. At the end of this process, in order that the sample size of questions for topic 3 was similar to that of topics 1 and 2, the number of questions in the sample for topic 3 was 'topped up' by the selection of additional students.

After taking account of the number of students (317) enrolled in Week 1 and the data cleansing process, the final number of questions in the sample for topics 1, 2 and 3 were 88, 82, and 81 respectively.

4.6.2 Interviews

As described in the introduction to this Section 4.6, the original data collection plan centred primarily on interview data with a sample of students supplemented by data collected via a range of survey instruments in the normal course of teaching and administering the unit. Accordingly, initial interviews were arranged with four students who expressed interest via email with the objective of introducing the research and ensuring informed consent. Collection of this data was piloted in Semester 1 2014. However, as explained, interviews with a larger sample of students in subsequent semesters became impossible.

The focus of data collection during interviews was on individual student's performance on the three coursework assessment tasks described in Section 3.6 and their experience of the attempt to teach them the deep problem-solving skills necessary to perform the tasks. At the time of designing the first coursework assessment task, a template of the teaching & learning activities (TLAs) used in the lead up to the first task was developed and participants were invited prior to the subsequent interview about the TLAs to record their experiences of them 'at the time' and their current reflections of them 'in hindsight'. This information was an input to the TLA interview. Designs for subsequent interviews were planned around the remaining two tasks. The designs of the semi-structured interviews are shown at Appendix H.

However, the experience of the first interview was that data collection at such a fine level of granularity (i.e. the level of particular teaching and learning activities such as a poll question) was impracticable, and therefore similar templates were not developed and used in the subsequent interviews. Instead, more general conversation was had about the pedagogical design.

Sometimes additional interviews were arranged, for example, to explore issues that arose in an interview for which session time was unavailable. As a minimum, for each interviewee the series of semi-structured interviews comprised:

- An introductory interview. This was an opportunity to clarify the nature of the student's research participation, answer questions, and ensure informed consent.
- A "TLA interview" focused on a participant's experience of the teaching and learning activities in the lead up to the first assessment task and the participant's response to the Learning and Studying Questionnaire ((LSQ) ESRC-TLRP, 2005). The task took place in Week 4, the LSQ in Weeks 4 and 5, and the interviews took place subsequently in Weeks 5 to 7. Feedback about task performance was also given to participants in either the same interview or another scheduled a week later.
- A "mid-semester interview" focused on a participant's experience of Task 2. The task took place in Week 7 and the interviews in Weeks 9 and 10.
- An "end of semester interview" focused on Task 3, the final exam, and the participant's response to the Experiences of Teaching & Learning Questionnaire ((ETLQ), ESRC-TLRP, 2005). Task 3 took place in Week 11.

A summary is shown in Table 4-1.

Table 4-1 Student interview schedule

Interview	Timing	Focus
1	Weeks 3/4	Informed consent, introductions
2	Weeks 5-7	Early impressions of the teaching methods
3	Weeks 6/7	Review of experience of first assessment task

4	Weeks 9/10	Review of experience of second assessment task and impressions of teaching methods
5	Week after the exam	Post exam review of experience of teaching methods, and exploration of responses to LSQ and ETLQ surveys

I kept a journal in relation to each interviewee. Amongst other things, I used the journal to maintain notes about the observations and record notes in relation to necessary follow-ups and / or questions to be asked at future interviews.

All interviews were recorded and transcribed and assessment tasks collected. All data collected were digitised and stored in a case study database. The particulars of interviews conducted with each student is shown at Appendix G.

Approximately five semi-structured interviews were conducted throughout the semester with each student. Each interview examined students' perceptions of the teaching methods and assessments and had various inputs, such as students' performance on assessment tasks and responses to surveys. In total, eighteen interviews were recorded amounting to 15.7 hours.

All interviews were transcribed and stored in an NVivo® project.

4.6.3 SETU survey

The University centrally administered all aspects of the Student Evaluation of Teaching and Units (SETU) survey, including the return of data to the lecturer. Administration took place between Week 9 and the commencement of the final exam period. My role, as coordinator/lecturer/tutor was, as normally, limited to encouraging students in lectures and tutorials to participate and then acting in subsequent teaching upon the results.

Of the 310 students enrolled towards the end of the semester, 33.2% or 103 responded to the Student Evaluation of Teaching and Units (SETU) survey.

Subsequently I received the usual form of report on these data, comprising two sections. Firstly, the survey report provided an analysis and presentation of results of the responses to five survey questions. The questions were answered on a seven-point scale comprising 'strongly disagree', 'disagree', 'neutral', 'agree', 'strongly agree', 'not applicable', and 'don't know'. The survey questions are shown in Table 4-2:

Table 4-2 SETU survey questions

Number	Question
1	The unit enabled me to achieve its learning objectives
2	I found the unit to be intellectually stimulating
3	The learning resources in this unit supported my studies
4	The feedback I received in this unit was useful
5	Overall I was satisfied with the quality of this unit

Secondly, the survey provided comments in response to the two standard, voluntary, open-ended questions. They were Q11 ‘What were the best aspects of the unit?’ and Q12 ‘What aspects of this unit are most in need of improvement?’

Fifty-two (52) students, representing 16.8% of enrolled students and 50.3% of students who responded to the survey, provided comments in response to both of the open-ended questions. The format of the standard report meant it was not possible to identify which pair of comments was received from the same student. The survey comments were stored as part of an NVivo® project as well as in an Excel® workbook.

4.7 Data analysis

This section describes the methods of analyses of the three data sources: self-questions (Section 4.7.1), interview transcripts (Section 4.7.2), and the SETU survey (Section 4.7.3). Each method consisted of various activities and these are summarised in Table 4-3.

The table shows for each activity, the technology used to perform it and the outcome from it, e.g. whether the outcome was a list or chart, or the assignment of a label, etc. It also shows whether the outcome emerged from the data (D) or involved making associations with pre-identified concepts (C) (Gibbs, 2007) and the type of output. More explanation of the methods and activities is provided throughout the remainder of this Section 4.7.

The outcomes of the analyses are presented in the two data chapters 5 and 6. Chapter 5 presents data and inferences related to the sense making of students whilst studying cost accounting, mainly related to self-questioning. Chapter 6 presents data and inferences about students’ perceptions of, and behavioural responses to, the teaching approach and the exploration of their epistemic beliefs. Findings for each of the research questions are then discussed in Chapter 7.

Table 4-3 Methods of data analysis

Data	Activity	Processing	Outcome	Type of output	Concept / Data -driven
Topic content					
	Identify concepts & clusters	Microsoft Word	Create list/web diagram with codes	Categorical	D
	& their knowledge structure	Microsoft Word	Label	Analytic / theoretical	C
Self-questions					
	Infer types of thinking from sample of self-question data	Microsoft Excel	Create list of types with codes	Analytic / theoretical	D
	Classify questions in terms of target content	Microsoft Excel	Label	Categorical	C
	Classify question in terms of type of thinking	Microsoft Excel	Label	Categorical	C
	Infer phase of sense making	NVivo®	Label	Analytic / theoretical	C
	Analyse types of thinking vs knowledge structure	Microsoft Excel	Chart	Descriptive	C (Pivot table)
	Hypothesise types of thinking vs sense making phase	Microsoft Word	Table	Analytic / theoretical	C
Transcripts	Transcript analysis: infer types of thinking from interview data	NVivo®	Add to list of types	Analytic / theoretical	D

Table 4-3 Methods of data analysis (continued)

Data	Activity	Processing	Outcome	Type of output	Concept / Data -driven
Transcripts	Transcript analysis: to find quotes and classify according to type of epistemic belief	NVivo®	Beliefs & commentary	Categorical	D
SETU comments	SETU comments: classify according to type of epistemic belief	NVivo®	Beliefs & commentary	Categorical	D
Transcripts	Transcript analysis: infer themes with respect to development of beliefs (some SETU comments included)	NVivo®	Themes	Analytic / theoretical	D
Transcripts	Transcript analysis: infer factors affecting development (some SETU comments included)	NVivo®	Factors	Analytic / theoretical	D
SETU comments	Favourable/Unfavourable classified by aspect of redesigned curriculum & conclusions drawn	Microsoft Excel	Table & commentary	Categorised by aspect (descriptive)	D
	3 Favourable themes and 5 Unfavourable themes inferred	Microsoft Word	Themes	Analytic / theoretical	D
SETU closed questions	Satisfaction data re-presented as Favourable/Neutral/Unfavourable	Microsoft Excel	Charts & commentary	Descriptive	D
Cognitive behaviours	Topic level: Analysed in terms of concept where attention is directed, mix of thinking types, knowledge structures attended to	Microsoft Excel	Charts & observations	Descriptive	C (Pivot table)
Engagement / participation behaviours	Analysed from lecture and tutorial data	Microsoft Excel	Commentary	Descriptive	D

4.7.1 Self-questions

The method of analysing students' self-questions in this study, in order to infer the underlying mental processes, attempted to take account of the structure of the knowledge that the student was attempting to understand better, as well as students' prior knowledge. Thus, the section proceeds by describing the method used to describe the content of the topic and the structure of the various elements of knowledge within it (Section 4.7.1.1) and then the process of coding the topic (Section 4.7.1.1.2). Section 4.7.1.2 describes the method involving a phased sense-making framework used to take account of students' prior knowledge. Next, Section 4.7.1.3 explains the mental processes inferred from the self-question data and then Section 4.7.1.4 describes how all three of these (topic content, phased sense making process, and mental process) were used to code the self-question data.

4.7.1.1 Knowledge structure – web of ideas

In this research, I argue the process of making inferences from students' self-questions raised in the process of sense making must take some account of the object the students were studying and must recognise the likelihood of diversity in the nature of those objects. Early analyses of topic content recognised that the elements of a topic could be treated as building blocks which link to each other, which in toto encompass the important parts of a topic, and which all fit broadly within a three level hierarchy. A model based on this initial approach was refined in the course of the research, and it is described in this section. An example is discussed in Section 4.7.1.1.1.

The model used to guide the analyses of student questions in terms of objects of study sought to encompass the concerns of accounting educators discussed in Section 3.2 in relation to conceptual content, technical content, teaching for intellectual development, and the development of soft skills. Moreover, the model was developed to recognise the desire for adequate thinking, and hence is described with words 'understanding', 'knowledge', and 'idea' as introduced in Section 1.3. In summary, 'knowledge' lies behind 'understanding' (White and Gunstone, 1992) and the 'understanding' of something is embodied in having a way of thinking about that thing. To teach a topic for understanding, this thesis takes the approach of decomposing the elements of a topic in the form of constituent 'ideas'; and whilst these ideas may relate to various types of knowledge, most importantly, they refer to desired ways of thinking about them.

In line with von Glasersfeld's (1995) exhortation,

> the teacher must be concerned with what goes on in the student's head. … The teacher must … build up a model of the student's conceptual structures (p. 15),

this model is expressed from a student perspective, meaning that it is expressed in terms of the ideas or understandings students are intended to, or will typically, take out of topics rather than the knowledge specifications of the teacher or discipline expert.

The model recognises three levels of increasingly sophisticated understanding associated with ideas and illustrates how understanding of ideas at lower levels contributes to understanding of ideas at higher levels. Thus the model is named the Web of Ideas. When used in support of pedagogical design, this means on those occasions when students typically exit a learning process with a lower level of understanding than is desired by the designer, the designer is better equipped to plan teaching approaches that will achieve the desired level. Thus, the Web of Ideas supports pedagogies designed to be consistent with Shulman's characterisation of effective teaching as giving careful attention to "the management of ideas within classroom discourse" (Shulman, 1987, p. 1).

For example, accounting students often exit the process of learning a topic with an understanding, in relation to that topic, that accounting is objective and involves the mechanical application of a procedure. The desired level of understanding however, is more sophisticated than that since, in reality, accounting is subjective and uncertain. Thus, it is desired that students understand the need for critical thought and judgement when applying the procedure. The Web of Ideas illustrates this difference in level of understanding by showing ideas at two different levels. If students typically exit the learning process with a lower level of understanding than desired, i.e. in the example just given understanding accounting as objective and mechanical procedures, then the pedagogical designer can plan interventions or teaching approaches to increase the likelihood that students will develop the more sophisticated level of understanding instead.

Since understanding of an idea at higher levels is dependent on understanding of ideas at lower levels, the Web of Ideas uses the word 'cluster' to denote these. In other words, an idea may comprise a cluster of constituent ideas. An example of a cluster will be discussed in Section 4.7.1.1.1.

Although the Web of Ideas conceives of a topic in terms of the ideas and thus understandings that are likely relevant to learning it, the concern is most of all with students' ways of thinking about them. When the Web of Ideas is applied to a topic and the constituent ideas and clusters identified, they are labelled with names or short statements. This outcome is referred to as the web of ideas for that topic. However, the labels in the web of ideas for a topic do not define the ‘understandings’ nor the various ways in which students should think about the ideas.

It is not appropriate to specify a particular way of thinking for a particular idea. In pedagogical design approaches that focus on outcomes, i.e. what it is intended students can do after learning, students often respond by learning what is necessary to repeat the outcome even though they may not understand it. In terms of thinking-based approaches to pedagogical design, it must be recognized that ways of thinking ought to be personal to the individual. Consequently, design ought to avoid prescribing the required ways of thinking, in order to avoid the traps of an outcomes-based approach, in which for example, the reproduction of a definition as evidence of a student having acquired knowledge may be accepted. To prescribe the required way of thinking is to replicate the sub-optimal effects of outcome-based approaches to pedagogical design.

Since the Web of Ideas supports pedagogical design aimed at teaching a topic in such a way that students integrate the constituent ideas and achieve the desired, i.e. most appropriately sophisticated, level of understanding of the topic, the model is sympathetic to Shulman’s characterisation of effective teaching (Shulman, 1987). Written at a time of significant debate in the United States about reform of teacher education, Shulman’s paper was concerned with the development of teachers. The debate tended to focus on what teachers should know and be able to do. He argued against advocates of professional reform who based their arguments on the belief…

> that there exists a "knowledge base for teaching"- a codified or codifiable aggregation of knowledge, skill, understanding, and technology, of ethics and disposition, of collective responsibility- as well as a means for representing and communicating it (p. 4).

Shulman highlighted that the rhetoric regarding the knowledge base rarely specified the character of such knowledge. In other words, the rhetoric rarely said what teachers should know, do, understand, or profess.

He argued for an idea of teaching that emphasized comprehension and reasoning, transformation and reflection. He argued sound reasoning requires both a process of thinking about what teachers are doing and an adequate base of facts, principles, and experiences from which to reason. This meant careful attention was required to the management of ideas within classroom discourse, not only to the management of students in classrooms.

Many of his ideas about teacher education are relevant to pedagogical design in other disciplines such as accounting. For instance, ideas such as:

- teaching as the facilitation of the development of ideas within the classroom;
- not conceptualizing learning as the acquisition of a codified or codifiable body of knowledge;
- being concerned not only with what students should know and/or do but also what they understand and profess; and
- being concerned with how students think about what they are doing as well as acquiring an adequate base of facts, principles, and experiences.

The concern of this model with understandings and ideas runs counter to many contemporary pedagogical expectations and beliefs about researching learning. One is the importance attached to the specification of learning outcomes where the concern is not with how students think, but with what they can demonstrate. Another is the belief that processes and sub-processes that reside inside a ‘black box’, e.g. the mind, cannot be researched; i.e. the belief research cannot contemplate sub-processes that cannot be observed nor measured. In this thesis the concern is with the stimulation of thoughtful learning that leads to the development of ways of thinking that result in students being skilful.

Although running counter to many contemporary pedagogical expectations, the approach in this thesis has some support. For example, in his book *Creativity Crisis*, Nelson (2018) discussed some of the issues preventing the teaching of creativity in university and, in the following quote, paid particular attention to *understanding*:

> Engines that help academics write learning outcomes even discourage using the verb ‘understand’ because understanding is reckoned not to be measurable, not sufficiently demonstrable or capable of proof; it is considered too vague because you do not know what students can achieve when they understand something. Being creative – for which a single verb does not even exist – is even less measurable than understanding, which is the cornerstone of all epistemology and, you might have thought, learning.

> We cannot say that we have learned something if we do not understand it; further, understanding is not just a precondition of learning to do something but a legitimate end in itself. No one has a problem with understanding in any corner of the universe except in the rarified discourse of learning outcomes, where understanding is reckoned not to be sufficiently solid and attestable relative to describing or demonstrating or naming or calculating (p. 9).

The Web of Ideas model is elaborated in detail shortly, but in essence its three levels of Foundational, Relational and Modelling ideas describe different levels of understanding that must be taken into account in the design of pedagogy in relation to a topic. As introduced in Section 1.3, elements of topic content are expressed in terms of ideas, and in the model these ideas are categorised as one of three different idea types according to the level of understanding required. However, whilst different idea types and hence different levels of understanding will require differences in sophistication of thinking, I emphasise there is no one way in which a learner ought to think about an idea.

Despite the important difference of its focus on understanding, ideas, and ways of thinking, the Web of Ideas model may appear to resemble ones that are more familiar. One, for example, is a model using an ethnographic lens (Davies & Mangan, 2007; van Mourik & Wilkin, 2018). In another, from a cognitive science perspective, Farnham-Diggory (1994) identified five distinct knowledge types based on five distinct experimental cognitive psychology paradigms: declarative (verbal learning), procedural (skill learning), conceptual (concept attainment), analogical (one-trial learning), and logical (problem solving).

However, the Web of Ideas model used in this research to describe the structure of topic content is significantly different because of its concern with desired ways of thinking as well as students' likely ways of thinking. It consists of three levels: levels 1 and 2 have some correspondence to declarative and procedural knowledge respectively of Farnham-Diggory (1994), and level 3 to the combination of the other three (conceptual, analogical, logical). Ideas at the higher levels, 2 and 3, are seen as clusters involving ideas lower in the hierarchy, e.g. a way of thinking about an idea at level 2 will incorporate the ways of thinking of related ideas at level 1. Within the model, ideas at levels 1, 2, and 3 are labelled Foundational, Relational, and Modelling Ideas respectively.

These levels describe different types of idea. However, from a teaching and learning perspective, as opposed to say, a cognitive psychology perspective, they become more informative and insightful when taken as indicative of the different levels of thinking necessary to enable understanding of the ideas and clusters that comprise a topic.

In a particular pedagogical context, a Foundational Idea concerns the meaning of something. Depending on how well a learner has developed this idea, i.e. come to understand it and develop a way of thinking about it, the learner is able to articulate *what* that something *as a whole* is. They may also be able to articulate what that something is not, whether it is the same as something else they know of, and if it is not, then clarify *what* makes it different. They may be able to articulate the relevance (application) of that something in the real world and articulate concerns they might have with how that something is described or discussed. Thus a Foundational Idea concerns the meaning of something, whether it is the same as some other idea, how it is different to others, its purpose or role in practice. Given the commonly understood meaning of the word ‘knowledge’ (see Section 1.3), it is important to stress that the label ‘Foundational Ideas’ is not equivalent to ‘knowledge’: Foundational Ideas have strong connections with ways of thinking.

A Relational Idea concerns the relations between, and integration of, multiple Foundational Ideas and/or contributing Relational Ideas. Depending on how well a learner has developed this idea, the learner is able to articulate the idea as an integration of the ideas that comprise it. They may also be able to use their understanding of relations between components to articulate *how* something functions and, if the idea can be expressed in terms of algorithms or procedures, then they could apply these. They may be able to articulate how the relations between, and integration of, components of an idea is the same, different, or connected with other ideas they have. They may also be able to articulate *why* the idea functions, in other words they may be able to articulate the logic or rationale that underlies the idea. Thus, a Relational Idea concerns the integration of multiple component ideas, how it works and how it can be applied procedurally or via algorithms.

A Modelling Idea is a more sophisticated version of a Relational Idea. It is integrated with, or is situated within some understanding of the discipline (White & Gunstone, 1992) and the real world context in which it is applied. In accounting, it reflects the way of thinking modelled by accountants in practice, and depending on how well a learner has developed this idea, the learner is able to think critically with it and use it to make judgements. This is because they have internalised an understanding of the limitations and assumptions of accounting when applied to the messiness of the real world. Partly as a consequence, they can express technical ideas in relatively simple, layperson terms. Thus, a Modelling Idea goes beyond the scope of traditional learning objectives or outcomes, and reflects the "ways of thinking and practising" (Entwistle, 2005; McCune & Hounsell, 2005) in the real world. A Modelling Idea may reflect what Schön described as professional artistry:

> …the kinds of competence practitioners sometimes display in unique, uncertain and conflicted situations of practice. (Schön, 1987, p22).

Interestingly, Schön provides, as a specific accounting example of professional artistry, the way a practised accountant can very quickly make a significant set of judgements from the information contained in a relatively complex balance sheet.

This distinction between Relational and Modelling Ideas offers additional insight to the differences between surface and deep learning (Marton & Saljo 1976) and procedural and conceptual knowledge (Farnham-Diggory 1994). However, the distinction between Relational and Modelling Ideas is not the same as either of them.

The range of ideas for a topic that must be 'managed' may appear as a list or be shown diagrammatically. The diagram of the web shows ideas grouped by level, i.e. sophistication of required thinking, and at least partially, the relationships between ideas in the form of inter-connecting lines. However, the inter-connecting lines do not purport to show any kind of conceptual hierarchy, nor the sequence in which the ideas are taught or learnt. The diagram does not purport to provide a complete and precise specification of anything; it only serves an organising pedagogical design purpose: to assist with the identification of the ideas important to the topic, those to which students are likely to be paying attention, as well as their types of structure. This discussion of the Web of Ideas model is illustrated by way of an example presented in Section 4.7.1.1.1 below.

The contents of three cost accounting topics were analysed in this way using the advanced content knowledge and pedagogical content knowledge (Shulman, 1986) of the researcher. The list of clusters and the ideas they comprise for the three topics are shown in Appendix I, and the clusters and component ideas for each of the three topics shown graphically as 'webs of ideas' in Appendix J.

Consequently, each self-question was analysed, in part, by inferring the idea to which it was directed (Section 4.7.1.4 below).

4.7.1.1.1 An example of a web of ideas for a topic

This section aims to illustrate some of the points previously made about the Web of Ideas model by using the example of the web of ideas for the topic of Cost Estimation as shown in Appendix J.1. The topic of cost estimation concerns the use of historical data to develop equations that may be used to predict a future cost at an expected level of activity.

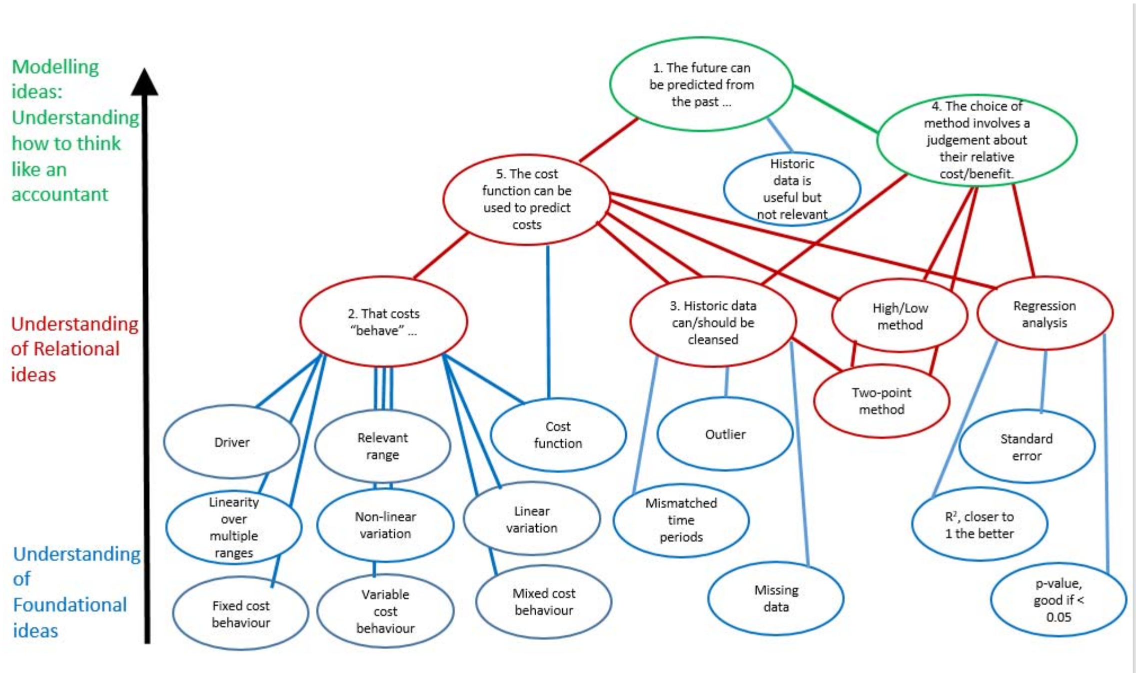


Figure 4-1 The web of ideas for the topic Cost Estimation

The lower left corner of the example shows nine ideas denoted as foundational by the use of blue ellipses. The pedagogical objectives of the topic include helping students make sense of these to the extent they develop a way of thinking about the meaning of each of them.

All nine are shown as constituents of a cluster which is a relational idea (2) shown by the use of a red ellipse. The relational idea is expressed as the idea that costs ‘behave’; meaning that the cost of something may be ‘driven’ by the level of some type of activity, although not always (i.e. a ‘fixed’ cost), and only within a relevant range of activity in which costs are treated as varying linearly in response to a change in activity (2).

A student focused on relational idea (2) might aim to make sense of the cluster as a whole, the relations between some or all of the ideas that constitute it, or how the cluster connects to other ideas the student has, etc. In doing so, the student is concerned with the integration of the component ideas and therefore making sense of the cluster as a whole. This level of understanding equips the student to determine the behaviour of costs in different situations by applying procedures and algorithms.

The example provides an illustration of clusters within clusters: that the relational idea just discussed (2) can be a constituent, together with other ideas, of another relational idea (5). Idea 5 is the idea that using predictions of level of activity, the idea of cost behaviour (Idea 2) as well as other ideas, e.g. Idea (3), a cost function (i.e. equation) can be developed and used to predict a particular level of cost. As before, a student focused on this Idea (5) might aim to make sense of the cluster as a whole, the relations between the ideas that constitute it, etc.

All of the ideas and clusters discussed in this example thus far are foundational or relational ideas. Typically, as accounting students exit the process of learning the topic of cost estimation, they exit with an understanding of these foundational and relational ideas. In other words, the highest level of understanding, i.e. the most sophisticated way of thinking, with which they exit is typically at the Relational level.

The example also illustrates a higher level of understanding that ideally would be desired by the pedagogical designer. Indicative of the ways of thinking modelled by accountants in real world practice, modelling idea (1) is the idea that the future can be predicted from the past provided the future is consistent with the past; and to the extent the future varies, uncertainty arises and judgements are therefore necessary about how predictions may be adjusted in order to increase confidence in the prediction. Accountants in real-world practice are comfortable with this idea. Idea (1) relies on idea (5) as a constituent, a foundational idea (that historic data is useful but not relevant to decision making), as well as another modelling idea (4). Idea (4) is the idea that a variety of methods exist by which cost functions (mathematical equations relating cost to volume of activity) can be estimated from historical data; and that the choice of method involves a judgement about their relative cost/benefit.

Similarly to making sense of a relational idea, a student focused on modelling idea (1) might aim to make sense of the cluster as a whole, the relations between some or all of the ideas that constitute it, or how the cluster connects to other ideas the student has, etc. However, making sense of a modelling idea is different to making sense of the others in that the student must make sense of it in the context of the discipline and real world practice; thus accommodate the subjective and uncertain nature of accounting, and accordingly be able to think critically and make judgements.

The pedagogical design challenge is how to organise teaching activities such that students' sense making of ideas in the web is facilitated in an organised and appropriate way. In this, the greatest part of the challenge is to find ways of helping students to exit the learning process with the desired ways of thinking, i.e. a level of understanding at the Modelling level.

4.7.1.1.2 Coding: Content analysis

The specification of the web of ideas and coding of the type of knowledge structure was determined through a data-driven coding process (Gibbs, 2007) reliant upon the advanced content knowledge and pedagogical content knowledge (Shulman, 1986) of the researcher/pedagogy designer.

Initially, topic content was analysed in terms of its constituent ideas and clustering of ideas. These ideas and clusters point to the various student understandings desired by the teaching approach or likely to be settled upon by students. Presented in combination diagrammatically as a 'web of ideas' the web shows the scope and priorities of the topic content intended to be managed by the teaching approach. Later, in the process of coding self-questions (Section 4.7.1.4), there were a few instances where ideas were added to the initial web of ideas.

Each idea and cluster was labelled and classified according to the level of understanding, i.e. level of thinking, required. These are listed in Table 4-4. As described in Section 4.7.1.1, they represent different types of idea, each requiring a different level of understanding.

Table 4-4 Types of idea

Type of idea	Label	Description
Foundational	F	concerns the meaning of something, whether it is the same as some other idea, how it is different to others, its purpose or role in practice.
Relational	R	concerns the integration of multiple component ideas, how it works and, in some cases, how it can be applied procedurally or via algorithms.
Modelling	M	a more sophisticated version of a relational idea. It is integrated with, or is situated within, some understanding of the discipline and the often messy and imprecise real world context in which it is applied. A modelling idea goes beyond the scope of traditional learning objectives or outcomes, and reflects the "ways of thinking and practising" (Entwistle, 2005; McCune & Hounsell, 2005) in the real world.

The content analysis was further refined in the process of analysing self-questions for a topic, for example, when a question was asked about an idea that was relevant but had been omitted from the initial specification.

The list of ideas and clusters for the three topics are shown in Appendix I, and the ideas and clusters for each of the three topics shown graphically as 'webs of ideas' in Appendix J.

4.7.1.2 Sense making process

The second framework used to guide analysis of self-questions takes account of the constructivist perspective that learning is a process by which a learner's prior knowledge is altered or supplemented. Thus, self-questions may be directed towards mental representations (ideas) as they are, or as they evolve through points in the process of making sense of the idea to be learned, or going further by expanding upon the idea or applying it to other contexts. The analytical method uses a framework to control for this based on the work of Gunstone and Mitchell (1998) who said:

> "the essence of a constructivist view of conceptual change is that it is the learner who must recognize his/her conceptions, evaluate these conceptions, decide whether to reconstruct the conceptions and, if they decide to reconstruct, to review and restructure other relevant aspects of their understanding in ways that lead to consistency" (p. 134).

Thus the framework conceives of sense-making as a process that involves consideration of pre-existing knowledge or relevant experience, some form of evaluation of that pre-existing knowledge, an interpretation of the idea being studied (the target idea) and efforts to make sense of it, and the potential extension of what is learnt to other contexts. Table 4-5 shows the four phases within the sense-making process.

Table 4-5 Phases of sense-making process

Phase / label	Description
1	Recognising existing ideas and/or relevant experience.
2	Evaluating them.
3	Deciding whether to reconstruct prior ideas / adopt the desired idea.
4	Reviewing/restructuring other relevant aspects.

The process is not necessarily linear. For example, a student studying the suggested solution to a tutorial exercise might start in phase 3, reading and seeking to comprehend the description. They may not automatically choose to accept the idea, and they may think the idea is in conflict with their personal experience or other things that they know. In that case, the student might revert to phase 1 and examine their prior knowledge or experience and how it emerged. This could lead them to affirm their existing knowledge and reject the idea under consideration, or move to phase 2 to examine what may be wrong or deficient with their prior understanding in order to better appraise how the idea under consideration might be better. Having done that, in phase 3 more effort will be taken to make sense of the idea under consideration. Armed with this new understanding, in phase 4 they may then consider the implications for other ideas they have in the same domain or similar ideas in other contexts.

Consequently, and as explained in Section 4.7.1.4, each student self-question generated in this research was analysed by inferring the phase of the sense-making process pertaining to the idea that the student was attempting to learn.

4.7.1.3 Mental processes

A detailed description of the approach to inferring the mental processes underlying the self-questions is provided in Appendix K. The presumption was that self-questions, as cognitive strategies (Rosenshine et al., 1996), arise from different ways of thinking; that different ways of thinking serve different cognitive objectives. Moreover, following developments in theory of cognitive control which see conscious control and automaticity as matters of degree (Cohen, Dunbar, & McClelland, 1990), the thought process that give rise to questions may be either conscious or not.

An initial pilot study of self-questions was conducted from which seven types of mental process were inferred. These mental processes were conceptualised as 'types of thinking'. The list of seven was then examined from the perspective of the sense making process framework (Section 4.7.1.2). From this it was found that six types of thinking were directed to the target idea under study, i.e. an idea in phase 3 of the sense making process. The seventh, was interpreted to be the same type as one of the other six but directed toward an idea in an earlier phase of the process[12]. The descriptions of the six types of thinking that emerged from the pilot was then refined and the six types validated against a larger base of questions related to the same topic and two other topics that were taught at other times during the semester. This process is explained in Section 4.7.1.4.

The list of six are shown in Table 4-6 and, to avoid repetition, their meaning will be elaborated in the data Chapter 5.

Table 4-6 Initial list of six types of thinking

Code	Type of thinking
1	Thinking aimed at entrenching/memorising
2	Thinking aimed at monitoring understanding
3	Thinking about implications, connections elsewhere at the conceptual level
4	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding
5	Thinking about, searching for, things that don't seem correct
6	Thinking in relation to perceived exceptions

[12] Later, this realisation led to an examination of the proposition that all six types of thinking might apply to objects in all four phases of the sense making process.

The consistency of coding of the data for the first topic was checked by re-analysing the data for topics 1 and 2 twelve months after the original analysis. A copy of the report is presented in Appendix L. All instances of differences were investigated and led to refinements in the criteria descriptions used to guide the assignment of codes. These are described in Section 4.7.1.4. Constantly comparing data with the codes and by writing memos about the codes and their definitions in this way is one of the reliability procedures recommended by Gibbs (2007) to ensure there is not any drift in the definition of codes, or a shift in the meaning of the codes during the process of coding.

Analysis of a second data source, interview transcripts, enabled triangulation of the results of this analysis of the mental processes associated with tute-prep questions. This supported the existence of some of the types of thinking already inferred, and added three more as detailed in Table 4-7. Data from which these three latter types were inferred are presented in Section 5.2.1.3, Section 5.2.1.6, and Section 5.2.1.9. Consequently, in total, nine types of thinking were found in the research.

Table 4-7 List of three additional types of thinking arising from interview transcripts

Code	Type of thinking
2*	Thinking about the rationale or purpose that underlies an idea
4*	Thinking about the wider implications and application of the rationale or purpose that underlies an idea
7	Thinking about generating a question for the sake of having a question

Since the nature of two of the additional types of thinking had similarity to two others previously found, yet were significantly different because of their focus on underlying logic or purpose of the target idea rather than the idea itself, codes were selected to reflect this. That is, because of its similarity to Type 2 thinking, one was coded as 2*, and similarly, the other was coded as 4*. The analysis of self-questions in terms of mental processes mentioned previously was then reviewed in the light of these additional three thinking types.

4.7.1.4 Coding: Self-questions

The coding procedure was concept-driven (Gibbs, 2007) using the codes that had been developed in the processes of content analysis and the types of thinking identified in sections

4.7.1.1 to 4.7.1.3 inclusive. Following is a high-level description of the analytical process. In the following sections, more detailed explanations of each step are presented. The process of analysis involved the following steps for each data item, (i.e. student self-question) and the outcomes were recorded in an Excel® work sheet:

1. Target idea

The question answered in this step was ‘to what desired idea (cluster and/or component idea) does the question relate?’ The appropriate content codes and type of knowledge structure (from Table 4-4) were recorded.

2. Stage of sense-making process

The question answered in this step was ‘in what phase of the sense-making process is the idea or mental representation to which the question was directed?’ The question was then coded accordingly. For example, in the study of an idea the student may have been thinking about a pre-requisite idea and thus raised a clarifying question about the pre-requisite. This question would have been coded as having been directed towards an idea in Phase 1 of the sense-making process: ‘Recognising existing ideas and/or relevant experience’.

3. Type of Thinking

The type of thinking was inferred from the question using the categories in Tables 4.6 and 4.7.

4. Once the complete sample was analysed by repeating the above three steps for each question, the work sheet was copied and the analysis reviewed to ensure consistency between coding early and late in the process. Any changes were recorded in the colour red in a second copy of the work sheet.

Next, a copy was made of the second work sheet so that in the third pass of the data, questions relating to topics other than the topic in question were deleted and multi-part questions with multiple codes disaggregated into multiple rows to simplify the subsequent production of pivot tables that would summarize the outcomes. Changes, except for the deletions, were indicated by colouring the data orange. This system of colour coding and multiple worksheets enabled subsequent review of the analyses if, and when, required.

4.7.1.4.1 Coding criteria – Target idea

In drawing an inference about the nature of the student's thinking that led to the question under analysis, it was necessary to associate the question with a particular idea or cluster within the web of ideas constructed for the topic. There was two parts to this.

The first part was to identify the sub-web, i.e. the section of the web, contemplated by the question. Since this was only the first step in inferring the particular idea or cluster targeted by the question, this part was not problematic. However, the second step was to more precisely infer the idea or cluster within the sub-web that was targeted by the question.

To resolve the second part, two judgements may have been necessary. The first was whether the question was targeting an understanding of an idea in the web or a combination of ideas, i.e. a cluster. This inference depended on the prominence of the idea(s) dealt with by the question. The inference was straight forwardly an idea if the question dealt only with a single idea and it was located at the foundational level of the web. However, if the question dealt with multiple ideas and at least two of them were equally prominent, for example the question was concerned with how multiple ideas combined to function as a bigger idea, then a cluster was inferred.

Thus if the inference was that the target was not a cluster, therefore a simple idea, then the target was coded as foundational. If the inference was a cluster, then the second judgement was whether the target was located at the relational or the modelling level of the web. This classification choice had to be inferred from the way in which the question was framed. If the question was framed in a way that suggested the student was targeting a high or sophisticated level of thinking, searching for deep meaning, or an appreciation of why an idea is what it is, then the cluster being targeted was inferred to be a modelling one. Questions indicative of critical thought or a want to understand how to make a judgement were inferred to be directed towards a cluster at the modelling level. If a question sought to understand or clarify the relations between ideas then the target cluster would be at the relational level. For example, the student may have been seeking to understand the cluster of ideas in order to be more confident they could apply a procedure or provide an explanation of relations. In effect, questions that are reflective of 'thinking like an accountant' tend to be directed toward modelling clusters, whereas questions that reflect thinking about the use of a procedure tend to be directed towards relational clusters.

4.7.1.4.2 Coding criteria – Phase of sense-making

Given an identified target, the next question was 'to which phase of the sense-making process was the question directed?' The question was coded according to Table 4-5 (Phases of the sense-making process) that was presented in Section 4.7.1.2. It is repeated here for convenience.

Table 4-5 Phases of sense-making process

Phase / label	Description
1	Recognising existing ideas and/or relevant experience
2	Evaluating them
3	Deciding whether to reconstruct prior ideas / adopt the desired idea
4	Reviewing/restructuring other relevant aspects

The analytical approach did not assume the learner would, in the course of learning an idea, necessarily progress through each phase, for example a phase(s) may have been skipped; nor do so linearly, for example a learner may, having decided to adopt a new concept (phase 3), have reverted to reconsidering their re-evaluation of a prior conception (phase 2).

A question directed to an idea in Phase 3 is one directed towards the idea desired by the teaching approach. Here the learner is open to understanding what the teaching approach intends and is seeking to make sense of it.

The sense-making process phase was inferred by making the following judgements:

- did the question simply recall understanding of a pre-existing idea or experience related to the desired idea ('Recognizing') or did it examine pre-existing ideas or experience critically and/or its relations with other ideas ('Evaluating')?
- did the question seek to understand the desired idea itself and / or its relations with other desired ideas ('Deciding') or did it look to extend the understanding beyond the scope of the topic content or apply the idea to different contexts ('Reviewing/Restructuring')?

4.7.1.4.3 Coding criteria - Type of thinking

Each self-question was analysed and the type of thinking inferred. Accordingly, each was assigned one of the codes in the following table.

Table 4-8 Complete list of thinking types

Code	Type of thinking
1	Thinking aimed at entrenching/memorising
2	Thinking aimed at monitoring understanding
2*	Thinking about the rationale or purpose that underlies an idea
3	Thinking about implications, connections elsewhere at the conceptual level
4	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding
4*	Think about the wider implications and application of the rationale or purpose that underlies an idea
5	Thinking about, searching for, things that don't seem correct
6	Thinking in relation to perceived exceptions
7	Thinking about generating a question for the sake of having a question

Codes 2 and 3 require further clarification where the target understanding is of a cluster. In the case of clusters, Code 3 is concerned with "connections elsewhere" from the cluster, whereas Code 2 is concerned with connections 'within' the cluster. To avoid confusion, the word "relations" is used to refer to connections between ideas within a cluster, and the word "connections" to refer to links external to a cluster.

As mentioned in Section 4.7.1.3, the process of inferring mental processes from student self-questions and thus coding them in terms of a type of thinking involved an exercise to ensure consistency of coding. The refinements that resulted from the exercise were as follows:

1. If a question involves connections to knowledge in a non-accounting domain (e.g. mathematics, econometrics), or application of what has been learned to a different problem solving situation (e.g. CVP or greenfield context in case of a Cost estimation question) then code Stage of Conceptual Change as 4 (Reviewing/restructuring other relevant aspects);

In relation to notes 2, 3, and 4 below, a principle on which codes 1 and 2 are discriminated is how well the question appears to be motivated in the interest of understanding as opposed to knowing/memorizing. Broadly speaking, questions not otherwise coded as Types 3, 4, 5 or 6 will be coded as 1 if they ask *about* a concept, and 2 if they explore a concept. Thus, the purposive character of Code 1 questions is to acquire information, whereas Code 2 questions is to understand better something by use of additional information.

2. Type 1 (thinking aimed at entrenching/memorizing), includes questions which inappropriately presume an absolutist (i.e. objective/definitive) answer; questions which seek to memorise a relevant fact; closed questions such as those beginning with ‘what’, ‘which’, and ‘would’ except those which contain an argument or an original proposition or which pertain to CC Stage 4;

For example, “what is purpose and advantage of calculating CMR?” is coded as 1.

3. Type 2 (thinking aimed at monitoring understanding) will typically include questions such as those beginning with ‘why’ and ‘how’ but not necessarily all of these.

For example, “Why is knowledge of an organisation's economic environment important?” is Code 1, but “Why is knowledge of an organisation's economic environment important *to the analysis of cost behaviour*?” is Code 2.

As opposed to questions linked to contexts provided by the textbook, questions linked to contexts invented by the student are coded as Type 4 (thinking about implications, connections elsewhere in terms of application of the conceptual understanding).

4. Where there is doubt between Type 1 and Type 2, aggravated for example by poor use of English, the benefit will be given to the learning process/student and thus coded Type 2;

5. Type 3 (thinking about implications, connections elsewhere at the conceptual level) generally includes questions that include phrases such as “what relationship does it have … (to another concept)”

6. Type 5 (thinking about / searching for things that don’t seem correct) generally include questions containing phrases such as "how is that correct?" and "wouldn't you be able to ...” because they suggest the student is rejecting the given explanation; and questions which appear to challenge the legitimacy of the information presented, e.g. "I question whether…”;

7. Type 6 (thinking in relation to perceived exceptions) includes questions where the student is challenging the material being studied on the basis of perceiving an exception, whereas if the student asks a question about how an exceptional situation should be handled, then it is coded Type 4 (application);

8. In questions that are lengthy because a question subsequently links to a second question that tends to elaborate the first, and each question infers different Type codes, the applicable code is interpreted from the sequence of questions as a whole.

4.7.2 Interview transcripts

For each of the four interviewees, all interview transcripts were consolidated and imported to NVivo® to facilitate coding and analysis. The data were considered, and particular quotes were earmarked and coded whenever they allowed interpretations relevant to any of the four research questions. This process was repeated and therefore codes refined and consistency of coding checked in the subsequent process of synthesising the results by grouping them in themes.

4.7.3 SETU survey

The responses to the five questions were summarised and re-presented in terms of percentages of student responses that were favourable, neutral, and unfavourable to the survey question.

The entire set of comments was transcribed verbatim to a spreadsheet. Multi-part comments were disaggregated resulting in a set of 115 comments and the data were then transferred to NVivo® where a data-driven coding approach (Gibbs, 2007) was used for analysis. In a way similar to the analysis of the interview transcript data, all of the SETU survey comments were considered and coded whenever they allowed interpretations relevant to any of the four research questions.

4.8 Ethics considerations

Approval of the research was granted by the Monash University Human Research Ethics Committee (MUHREC) on 13th April 2013. A copy of the approval certificate is included at Appendix A and a copy of the Explanatory Memorandum that was provided to students is included at Appendix B.

Some textbook images subject to copyright have been used in the discussion in Appendix O of how accounting textbooks might be structured on the basis of big ideas. Permission from the publisher, Pearson plc, was gained for the use of these and the permission licence is shown in Appendix C.

4.9 Trustworthiness

4.9.1 External and ecological validity

External validity concerns the correspondence between the research setting and external settings. High external validity supports arguments in favour of the generalizability of research findings to other settings. However, in respect to naturally occurring phenomena, findings in a research setting may be deemed to have high external validity yet the research setting may bear little resemblance to the setting in which the phenomenon of interest takes place (Gehrke, 2018).

This issue is concerned with ecological validity. According to the developmental and social psychologist Bronfenbrenner (1977):

> Ecological validity refers to the extent to which the environment experienced by the subjects in a scientific investigation has the properties it is supposed or assumed to have by the investigator (p. 156).

Three matters are critical for high ecological validity (Gehrke, 2018):

1. The research should be conducted in settings that actually occur in the ecology; and these settings should be for purposes other than research;
2. The research should minimise distortions to the setting; and
3. The research design should account for how the larger social and cultural contexts of the participants may be relevant to the ecological validity of the research and setting.

Considering these three matters, high ecological validity is claimed for this research. The research took place in a real-life, teaching and learning setting. The data collection took place in the normal course of delivering and administering a unit, and most students were unaware research was taking place even though they were informed of it at the beginning of the semester. The reality was that, except for the interviewees, students were not affected in anyway by the research. Finally, the impacts of socio cultural contexts of research participants are clearly less in a formal education setting than, for example, in counselling of sufferers of forms of mental illness. Nevertheless, concern with such issues in the present research is reflected in the extensive relevant discussions presented in the Context Chapter, and in the sensitivity to these shown in the discussion of findings and research questions.

4.9.2 Internal validity

Internal validity is enhanced through peer debriefing (Creswell, 2013). In the process of completing the research, findings have been socialised in, and feedback received from, various academic forums. These include a presentation at the Monash Excellence in Education Research Group (MEERG) Symposium in December 2014 and the Monash Education Research Community (MERC) forum in July 2016.

In addition, two papers were submitted to international conferences of accounting academics. These papers (van Mourik, 2016a, 2016b) were double-blind reviewed and accepted for presentation and discussion at the European Accounting Association (EAA) in May 2016 and the Accounting & Finance Association of Australia & New Zealand (AFAANZ) in July 2016.

Extensive examples of self-questions and the types of thinking inferred from them have been included in the data Chapter 5. Similarly, Chapter 6 presents substantial data from which student beliefs, perceptions and behaviours were inferred.

Internal validity is also enhanced through the repeated nature of the design (Creswell, 2013), i.e. of repeating the analysis of self-questions for many questions in each of three topics. This showed the applicability of the types of thinking coding scheme to multiple cost accounting topics and the consistency of finding across them.

Although I was both researcher and lecturer/examiner, the roles were clearly separated so that the validity of the collected data was protected.

As is often the case with teachers who aspire to help students learn better than they do, there is some risk that I would de-value the achievements of students and under-estimate the merits of my pedagogical design. In the course of the research, this bias has been mitigated by many in-depth conversations based on working papers involving extensive analysis and discussion of data with my primary supervisor. Conversations such as these over a lengthy period of time add to the credibility of the results (Flick, 2007; Lincoln & Guba, 1985) and have had the effect on me of taking a more balanced perspective.

4.9.3 Reliability

The six types of thinking that were initially inferred from a pilot set of data arising from one cost accounting topic were subsequently tested for comprehensiveness and sufficiency against a larger data set for that topic, and then against data sets for two other topics. This form of triangulation, based on multiple datasets in research approaches such as this one, as well as triangulation with interview data, improves reliability (Gibbs, 2007). Analysis ceased when it was believed that extension of analysis to a greater number of topics or self-questions would not alter the taxonomy.

The data analysis procedures for self-questions were based on a codebook (Gibbs, 2007) comprising descriptions of the various types of thinking, codes, and coding criteria. The coding process included consistency checks; checks between early and late stages of coding; and the maintenance of coding criteria descriptions. Similarly, the data analysis procedures for interview transcripts and survey comments have included consistency checks.

A computer system, NVivo® was used. Except for self-questions, all data sources were imported and managed from NVivo®. The convenience of navigating across data sources and nodes increased the likelihood that mis-codes were detected and the meanings of codes used consistently.

Raw data were kept separate from analyses and working papers in a case study database in order to assure reliability (Yin, 2014) and chains of evidence maintained that link findings to the analyses and back further to the data source.

Overall, a high level of trustworthiness of the findings is claimed for this research.

4.10 Limitations

The research methodology has a number of limitations.

Firstly, data were collected from a single semester in which self-questioning took place. Consequently, the implications argued to arise from RQ4 are not tested in this research; they remain informed reflections.

Secondly, the self-question data collected are in the main, single questions asked by students and thus they do not represent the complete set of questions a student would ask in the process of sense making. Moreover, the questions were generated in private study in preparation for the tutorial. Thus, the questions were normally generated at a point in time in the learning process after students had experienced the lecture, and prior to them experiencing the tutorial. Nevertheless, the data sample represents a large proportion of the cohort, and as such represents a diverse range of study approaches, student demographics, and stages of topic mastery.

Thirdly, comments provided by students in response to the SETU survey questions may not be representative of the cohort as a whole. This is because responses were voluntary, and thus the comments may be representative of only the 'vocal' segment of the cohort. However, analysis shows the distribution of favourable and unfavourable comments is in line with the distribution of favourable and unfavourable responses to the quantitative survey questions and this represents a more substantial proportion (32.3%) of the cohort.

Finally, interviews were conducted with only four students. However, the volume of data is substantial having been collected during in excess of 15 hours of interviews and they provide rich insights in relation to the research questions. These insights lead to contributions that ought to be reported.

The thesis proceeds by presenting the two data chapters: The first, Chapter 5, presents data and inferences related to the sense making of students whilst studying cost accounting, mainly related to self-questioning. Then, Chapter 6 presents data and inferences about students' perceptions of, and behavioural responses to, the pedagogical redesign as well as the exploration of their epistemic beliefs.

5 Sense-making

5.1 Preface

Along with a lecture approach that focused on teaching the skill of problem solving, a focus on student self-generated questioning in order to achieve deep understanding was a major innovation in the redesigned pedagogy. Drawing primarily on self-question data but also interview transcripts, this chapter will present data related to sense making in the context of this redesigned pedagogy.

Three frameworks were used to help analyse students' tute-prep questions. The first, a Web of Ideas comprising three levels of knowledge structure, was a means of analysing topic content (Section 4.7.1.1). The Web of Ideas articulates the ideas that are the focus of a pedagogical design, their relationships, and their levels of complexity. Thus, the web provides a means of relating tute-prep questions to the object of their enquiry. As described in Section 4.7.1.1, the researcher's advanced content knowledge and pedagogical content knowledge (Shulman, 1986) were used to analyse the content relating to three cost accounting topics. The list of ideas as well as the web of ideas for each of the three topics are shown in Appendix Sections I and J respectively.

The second framework was a means of taking account of the role of prior knowledge (described in Section 4.7.1.2). It conceptualised the sense-making process as consisting of four phases, consideration of pre-existing knowledge or relevant experience, some form of evaluation of that pre-existing knowledge, an interpretation of the idea being studied (the target idea) and efforts to make sense of it, and the potential extension of what is learnt to other contexts. Thus, the framework provides a means of distinguishing tute-prep questions that directly target the object of study (Phase 3) from other questions that pertain to other phases of the sense-making process.

The third framework emerged from the analysis of mental processes associated with tute-prep questions described in Section 4.7.1.3. These processes were conceptualised as 'types of thinking', and in total, nine types were found.

The three frameworks were used to analyse a large database of self-questions relating to three selected cost accounting topics that had been collected (as described in Section 4.6.1) in terms of thinking types, phase of sense-making, and knowledge structure (as described in Section

4.7.1.4). This analysis enabled findings in relation to research question 2, “What mental processes are associated with self-questions asked by cost accounting students, and how do these processes vary with the production of different knowledge structures?”

The following Section 5.2 describes the nine types of thinking, provides examples of questions from which each type was inferred, and thus presents findings in relation to the first part of the research question “what mental processes are associated with self-questions …”

The subsequent section, 5.2.2, explores the proposition that eight of the nine types might apply to each of the four phases of the sense-making process.

Finally, Section 5.2.3 presents results relating to the second part of Research Question 2: “… how do these processes vary with the production of different knowledge structures?”

5.2 Types of thinking

From the process described in Section 4.7.1.3, a list of nine different types of thinking were inferred to lie behind tute-prep questions. These were presented in Table 4-8 but the table is repeated here for convenience.

Table 4-8 The complete list of nine thinking types

Type	Type of thinking
1	Thinking aimed at entrenching/memorising
2	Thinking aimed at monitoring understanding
2*	Thinking about the rationale or purpose that underlies an idea
3	Thinking about implications, connections elsewhere at the conceptual level
4	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding
4*	Think about the wider implications and application of the rationale or purpose that underlies an idea
5	Thinking about, searching for, things that don’t seem correct
6	Thinking in relation to perceived exceptions
7	Thinking about generating a question for the sake of having a question

This section will proceed by describing these and then presenting examples from the data from which the different types were inferred.

The first (Type 1) is a way of thinking that does not seek deep understanding whilst the others do. It is likely to be directed at surface learning (Marton & Säljö, 1976) and/or aimed at improving the reliability of being able to reproduce accurately information that has been memorised.

Of the others, one type of thinking is in relation only to the idea at hand (Type 2), i.e. the idea about which the student is attempting to make sense and yet they do not want to think about anything more than what is being presented to them. This way of thinking is directed towards checking whether, and how well, the student understands something – from the student's own point of view.

An additional thinking type inferred from the interview transcripts is a deeper version of Type 2. This type of thinking, Type 2*, is less about the idea itself, and more about the rationale or purpose that underlies it. In the subsequent review of the coding of self-questions, only one question exemplifying this type of thinking was found.

The remaining ways of thinking differ in terms of the students' disposition towards assimilation, with Types 3 and 4 reflecting a disposition to accept, at least tentatively, the idea and a willingness to think about its wider implications and connections; and Types 5 and 6 a disposition to challenge it. More specifically, with Type 3 they are thinking about the relationship of the idea to other things they know, and with Type 4, what it means for real world practice.

A second additional thinking type was inferred from the interview transcripts. Whereas Type 2 thinking about an idea may be followed by thoughts about the application (Type 4) of that idea; Type 2* thinking about the rationale or purpose that underlies an idea may be followed by thoughts about the wider implications and/or application of that rationale or purpose. This follow-on thinking I give the label Type 4* to reflect its similarity, albeit a deeper version, to Type 4 thinking. However, in the subsequent review of the database of tute-prep questions, an example of Type 4* was not found.

With the last two (Types 5 and 6), the student's disposition is critical and shows a readiness to reject. Thus the student may be thinking about things (e.g. textbook content, explanations of answers to problems) they perceive as being in error or plainly wrong either because of conflict between new and existing ideas or because of ‘flaws’ in the student’s learning experience (Type 5) or looking for ways to disprove the idea by finding exceptions (Type 6).

The eight types of thinking discussed thus far, (i.e. all types except for Type 7 to be discussed next), are understood to be valid in the process of sense making. Their appropriateness as a learning activity depends on the context in which the learner finds themselves, thus none of these types is bad or poor, and teaching practices should not discourage any of these. A distinction is made in this thesis however, between ‘lower types’ and ‘higher types’. Lower types include Types 1 and 2 since they are directed toward the meaning of the target idea itself, whereas higher types of thinking (all others except Type 7) are directed toward a more expansive and deeper understanding of the target. The numbering of the higher types however, do not denote a hierarchy of thinking of any form.

Finally, questions reflective of Type 7 thinking are not aimed at substantive learning and thus are not the products of serious thought about the questioner’s level of understanding: they are questions generated “for the sake of having a question”. For example, a question may be generated to fulfil the requirements of an assessment activity. Any of the other eight types of thinking thus far discussed (Types 1 to 6 inclusive, 2* and 4*) could also be generated independently of serious thought and hence be poorly motivated but it is not possible to distinguish these simply by content analysis of the question.

Thus, nine types of thinking were inferred from the data but one of them (Type 7) is indistinguishable via simple content analysis of a tute-prep question. No examples of Types 4* and 7 were found in the database of tute-prep questions examined.

The next section provides a discussion of the nine types of thinking along with the presentation of supporting empirical evidence.

5.2.1 Examples of inferences about thinking

5.2.1.1 Type 1. Thinking aimed at entrenching/memorising

Closed questions, whereby the student seeks to know and remember the answer but is not looking for explanation or rationale, tend to indicate Type 1 thinking. In the following example, the student wants to know the answer but does not seek an explanation of why a particular method is more accurate:

> "Cost estimation techniques have six method [sic], which method is more accurate to determine the cost function?" (CE #135).

Similarly, there is not a simple answer to the following example. The desirable amount of operating leverage will depend on the firm's circumstances and industry, and greater is not necessarily more desirable. Thus at the student's point of progression in understanding the ideas associated with operating leverage, the student is simply seeking to remember an answer without firstly developing a deeper understanding of the idea:

> What is the maximum amount of operating leverage a firm can take on and manage? (CVP #219).

Other questions indicative of Type 1 thinking seek to clarify the correct thing to do in a procedure, without seeking an understanding of the rationale. For example:

> if the company manufacturing 100 shoes, but only sale 90 shoes and the reminder 10 shoes are not up to standard. That means the cost increase, the profit decrease. However, we use CVP formula with old increase and profit is higher than the real. Right? ([sic], CVP #144).

In that example, the student is checking how a formula should be used correctly in a particular problem context, perhaps in order to be confident they would answer a similar question correctly in the future. They are seeking to know and remember 'what to do'; not seeking to know why it is 'correct' to use the formula that way, or an appreciation of how accounting might seek to handle the complexity alluded to by the question.

Other Type 1 questions may simply seek to clarify and remember the meaning of a word or phrase. In the following example, the student is seeking to clarify the meaning of the word 'standard' by asking whether it has the same meaning as the word 'estimated':

> Does standard cost mean estimated cost? (SCA #2).

Self-questions can sometimes appear to be thoughtless in terms of helping the student learn, for example, if asked because the critical thinking assessment task requires a question to be generated (Type 7), and thoughtless because the question was inspired by study materials that reported the answer. The following question may be an example of the former:

> which one is important, the price variance or efficiency variance? (SCA #193).

In these cases, it was plausible that the self-question is indicative of a mental process but not one employed in the process of sense-making. Instead, it would be indicative of a mental process associated with something else, e.g. a poor motivation to learn, and thus the question may have been generated for the sake of having a question (Type 7) in order to fulfil an assessment requirement. I was constrained to simple content analysis of tute-prep questions and thus it was never possible to associate Type 7 with any of the questions in the database. Thus, in cases where self-questions might appear to be thoughtless, it was not safe to categorise them Type 7, and so they were categorized as Type 1 instead.

Thus, questions seeking answers to closed questions, confirmation – as distinct from explanation – of how to do something, and clarifying the meaning of terms were taken to indicate Type 1 thinking.

5.2.1.2 Type 2. Thinking aimed at the monitoring of understanding

The following questions seek deeper understanding than Type 1 of the idea being focused upon, and thus arise to overcome a deficit in understanding:

> Why is knowledge of an organisation's economic environment and operation important to the analysis of cost behaviour? (CE #92).

> older and history [sic] information is useful for us to predict the future cost, but why it is not relevant to the future cost? (CE #260).

> Why are variances categorise [sic] as favourable and unfavourable? Isn't a variance bad in accounting terms? (SCA #123).

As well as a single idea, the focus may be on a cluster of ideas, in which case the monitoring of understanding may be of the relations between the ideas that comprise a cluster. For example:

> As the CVP analysis relies on forecasts and assumptions and there are many different uncertainties to consider, how should we overcome these limitations and ensure that the analysis can be as accurate as possible? (CVP #9)

If focused on a cluster of ideas, Type 2 thinking will be inferred from a question if multiple ideas that are part of the cluster are equally prominent in how they are dealt with by the question

(Coding criteria – type of thinking in Section 4.7.1.4). For example, in relation to the previous quote, the ideas of CVP analysis, uncertainties and overcoming limitations are equally prominent. If one of the ideas is more prominent, and thus the question is concerned with its connection to other ideas, then the question would be categorised as Type 3 thinking.

Type 2 thinking may also be inferred from questions seeking explanation of correct calculative procedures, two examples follow:

> For question 16(a) the answer given that the function is TC=222.35*unit sold. But my answer is TC=12.44+222.35*unit sold. How can the t-statistic on the fixed cost indicated [sic] that the fixed cost should be zero? (CE #284).

> In question 4.33, why does it use 3200/2000 not just use 4.8 for its cost? (CVP #210).

Sometimes questions aimed at monitoring understanding contain their own answer, for example, in the following quote the student asks a question (why do we debit unfavourable variance…?) and then answers it (unfavourable variance would increase COGS):

> why do we debit unfavourable variance and credit favourable variance? is this the rule or it is because variance accounts are closed to COGS so unfavourable variance would increase COGS (as it is firstly recorded under standard cost) and favourable variance would reduce COGS meaning that the actual costs are lower than standard? (SCA #234).

Thus, questions seeking deeper explanations of the idea or relations between the ideas under focus, and questions seeking explanation of the correct calculative procedure tend to be indicative of Type 2 thinking.

5.2.1.3 Type 2 Thinking about the rationale or purpose that underlies an idea*

This type of thinking is less about the idea itself, and more about the rationale or purpose that underlies it. The first quote below, from SETU comments, shows that self-questions (i.e. ‘critical thinking’) are sometimes recognized as a means of thinking about the underlying logic:

> Critical thinking built in learning process so student know the logical reasoning behind the objectives (SETU, #8).

Moreover, the following quote from Lewis indicates that, under the redesigned pedagogy, he was thinking about 'fundamental principles':

> I've never really thought about my education that way. It's always been about understanding the course, it's never been about really understanding the fundamental principles underpinning things and that's challenging for me actually. It's a big challenge because it's just not what I'm used to (Lewis, Week 4).

Having identified the concept of a Type 2* question from the interviews, a review was conducted of the self-question data source to determine whether any of the questions ought to be re-categorised as Type 2*. One of the questions considered for re-coding from 2 to 2* was:

> As the CVP analysis relies on forecasts and assumptions and there are many different uncertainties to consider, how should we overcome these limitations and ensure that the analysis can be as accurate as possible? (CVP, #9).

Initially, the question appeared to be a Type 2* question. However, in this case, a Type 2* question would ask about the logic of CVP and its validity, or alternative logics to that of CVP. The initial appearance of this question as being Type 2* is reflective of it being directed towards a Modelling concept. Thus, the coding of the question remained Type 2.

Only the following question, initially coded Type 2, was re-coded to 2* during the review. It challenges the logic of two completely different looking graphs having the same outcome and seeks a theoretical explanation:

> In any scatter plot, information about whether a cost is variable, fixed or mixed can be revealed just by observing different characteristics of the graph. Fixed costs could be identified when a graph has no discernible [sic] pattern, however fixed costs can ALSO be observed when the pattern is linear with little or no slope. How can two completely different looking graphs have the same outcome of fixed costs and what is the theoretical explanation for this observation? (CE, #163).

5.2.1.4 Type 3. Thinking about implications, connections elsewhere at the conceptual level

Whereas Type 2 includes the monitoring of understanding of relations between multiple, similarly prominent ideas internal to the learning focus, i.e. the relations between ideas within the target cluster, Type 3 thinking is concerned with the connections of the target to other ideas.

An inference of this type requires a judgement about the student's focus based on how the student frames the question.

Questions indicative of Type 3 thinking may explore the connection to another idea from the same topic. For example, in the following question, the focus is on standard error and the question is also concerned with its connection to the regression line:

> what is [sic] the numerical output of the standard error mean and what relationship does it have to the line of regression analysis. (CE #20).

Two other examples follow. The first enquires about the relationship between two variances:

> In standard costing, direct material and direct labour price variance and efficiency variance is calculated to monitor performance. What is the relationship between price variance and efficiency variance? Do both variances have an inverse relationship, due to the nature of one being a positive figure while the other having a negative figure? Are there be other major variables that affect these? (SCA #80).

The second seeks to understand the relationships between three kinds of cost behaviour:

> How do variable, fixed and mixed costs relate to each other? (CE #205).

This type may also explore connections to ideas from another topic. In the following example, the focus is on the Cost Estimation topic idea of cost behaviour being either fixed or variable, and the question is interested in its connection to the idea of 'traceability', which is an idea from a different cost accounting topic (i.e. product costing):

> How do direct or indirect cost affect whether a cost is fixed or variable? (CE #254).

Type 3 thinking may also be inferred from questions making conceptual-level connections to other problem contexts. For example, the concern in the following question is with making a connection to businesses whose operating contexts are not repetitive:

> The use of standard costs is best suited to an entity that has repetitive activities and/or output, but what about those entities that don't have repetitive activities or output? (SCA #157).

Thus, questions indicative of Type 3 thinking explore connections of ideas to other, independent ideas.

5.2.1.5 Type 4. Thinking about implications, connections elsewhere in terms of application of the idea

Questions indicative of thinking about the application of an idea in practice take a range of starting perspectives. For example, they may query its relevance in the real world:

> Is it possible to have items with NO fixed cost and just variable cost or is that deemed to be an impossible scenario in real life? (CE #219).

Others may explore how the application of the idea might vary amongst different business or industry contexts:

> what sort of business's (if any) would operate at a high degree of operating leverage? (CVP #45).

Some questions explore how accounting choices or decisions are made in practice, for example:

> How to distinguish the Two-point method and the High-low method? What is the biggest difference of these two methods particularly when they were put into practice? (CE #230).

> What is the best way to approach developing a cost function through analysis at the account level and how do we attain the classification of costs only using this method? (CE# 160).

Others explore the real-world practicality of accounting:

> The textbook talks about disadvantages of differing estimation techniques, but just how much of a hindrance are some of the more complicated and accurate forms of cost evaluation (such as regressions) in terms of time and extra costs associated with needing to acquire and then evaluate the raw data needed to perform them within a business setting? (CE #281).

> Is it always a positive sign for a business if cost variance, price variance and efficiency variance are favourable? Could this be impacted by managers setting a higher budget,

> so when the actual cost is less than the budget cost, it looks like the managers have achieved their targets even though they have just over budgeted? (SCA #45).

Many Type 4 questions explore the implications of accounting for managers in practice. For example:

> Managers rely on cost information when making decisions. So, how can managers counteract or respond to cost information that is unreliable? What measures would they take? (CE #269).

> Operations with a high level of fixed costs are subject to excessive risks if sales volume decreases significantly. For a business in a failing industry (redundant industry), would it be prudent to remove all fixed costs of operations so everything is variable? (CVP #42).

> If a direct labor variance is calculated to be favorable for production and as a results [sic] managers grant a pay increase for workers, If this increase creates a unfavorable direct labor price variance, how do managers interpret this new figure? (SCA #1).

Thus, questions indicative of thinking about the application of an idea in practice tend to do so from the perspectives of its practicality, variation amongst businesses, or its implications for accountants and managers.

5.2.1.6 Type 4 Thinking about the wider implications and application of the rationale or purpose that underlies an idea*

It is logical to expect that Type 2* thinking (the logic or rationale underlying an idea) could be followed by the application of that thinking to another idea or its application in practice, i.e. Type 4*. The following quote from Lewis suggests this is the case. It shows that Lewis is thinking about how the underlying rationale or logic of relevant costs can be applied to the classification of costs in a problem context:

> It's probably also easier to understand the procedures involved when you think about it in more depth like that. Like when you're determining relevant cost, as you said last week. It's much harder to have the definition of relevant cost in front of you and try to classify them according to that. It's much harder to do that than it is to think about what's relevant to the actual situation, and determine your relevant cost that way (Lewis, Week 10).

In the review of coding, two questions drew consideration of whether Type 4* thinking could be inferred. The first was coded as Type 3, connections to other ideas, in this case the idea of the qualitative accounting characteristics comparability and understandability. Although the characteristics reflect the conceptual framework that underlies accounting, the question does not indicate thinking about how that framework is being applied to the idea of standard costing, and thus the coding remained Type 3:

> … how the use [sic] of standard costing and variance analysis strengthens and supports the accounting concept of comparability and understandability? (SCA, #17).

The second was coded as Type 4, thinking about the application in a case of real-world practice. Although the following question indicates thinking about the application of the cost/benefit idea, it is not applying the underlying logic or rationale of cost/benefit. Thus, the coding remained unchanged:

> The cost of obtaining relevant information must not outweigh the benefit derived from the information in a decision-making sense. How can you determine what the relative costs and benefits of obtaining information are, especially when there are non-monetary aspects involved? (Lewis, CE, #275).

5.2.1.7 Type 5. Thinking about / searching for things that don't seem correct

Questions indicative of Type 5 thinking may challenge the accuracy of statements. The following quote from Lewis attests to an awareness of this type of thinking:

> it's the first unit where you're asked to challenge things and not accept stuff without challenging it first (Lewis, Week 4).

Statements appearing in textbooks or suggested solutions may be challenged. Two examples:

> In question 2: when the suggested answer says that the several years' worth of data won't be useful for decision making, how is that correct? Wouldn't you be able to extrapolote [sic] information from the past data to see if there were trends or anything which you could learn from and then apply it to your decision making? Past data could affect what you choose as you learn from the past data right? (CE #3).

> According to the text book, "sometimes we have only two or three data points, in which case the high-low method may be our only choice", but why two-point method cannot be used? (CE #166).

Other questions may explore an apparent contradiction. For example,

> As explained in the text book when average costs are used to estimate the cost function, fixed costs are assumed to be variable. Why do accountants still use the average cost method? Isn't it contradicting? (CE #86).

The following example is of a question that shows a readiness, in certain circumstances, to reject the idea under study as useful:

> Since most retail operations have a large amount of products and services wouldn't it be too complex and time consuming to calculate and manage the CVP of each product that is sold in the store? (CVP #153).

Some questions reflect scepticism, for example:

> The textbook (Q20 part f) suggests that a favourable direct labour efficiency variance is likely to be investigated, as it could be an indication that defective or low quality units are passing through the production process. Would managers really rely on a direct labour efficiency variance to provide them with information on product quality and customer satisfaction, given that this information is more easily attained through other means, such as figures for sales returns or spoilage? (SCA #275).

Thus, in summary, questions indicative of Type 5 thinking tend to show a readiness to reject something in relation to an aspect of the idea under study, for various reasons such as it appearing inaccurate, contradictory of something else that is accepted or lacking merit in practice.

5.2.1.8 Type 6. Thinking in relation to perceived exceptions

Questions indicative of Type 6 thinking may refer sometimes to an exceptional business or industry context. In the following example, a readiness to reject the idea that the cost of utilities is fixed is contemplated on the basis that it may not apply to all businesses:

> Question 2.26 considers utilities a fixed cost despite variations due to seasonal changes. Are there any businesses whose utilities costs could be considered at least partly variable? (CE #274).

In the following example, the questioner's contemplation is that the idea under study, CVP analysis, would not apply in complex situations:

> wouldn't it be more difficult to use CVP analysis when analysing costs for multi product operations/ businesses such as restaurants because for example menu items which are likely to have many variable ratios? and because of this, it would be more difficult to perform this analysis because it must be done for each item/food? in this case, would there be an easier and accurate way of determining break even point for this type of businesses? (CVP #83).

Other forms of Type 6 questions arise when the perceived exception is an occasion when accounting assumptions don't apply. For example,

> As we know that within cost behaviour, we need to make the assumption that within the relevant range, fixed costs remain fixed and variable costs per unit remains constant, however what happens when the function moves out of the relevant range? How does this effect the assumption being made? (CVP #51).

Questions may also arise from exceptions being perceived because of a flaw in the material being studied. In the following example, the suggested answer to Q17 did not include consideration of the appropriateness of the standards:

> For question 17 in chapter 10, is it possible to consider that the unfavorable variance could be caused by the expected value to be [sic] too ambitious and that the assumptions are wrong, so then by not assessing the standard cost it might cause decision making to worsen the cause? (SCA #265).

Thus, in summary, thinking about exceptions where what is being studied may not apply tend to be reflected in questions that allude to exceptional accounting situations or business contexts.

5.2.1.9 Type 7. Thinking about generating a question for the sake of having a question

As mentioned in the discussion of Type 1 evidence, it was not possible to infer the student's motive in generating a question as simply the need to have one. Thus, if these occasions exist in the data, then they have been coded as Type 1. However, the following quotes from SETU comments and an interview transcript suggest Type 7 exists.

Firstly, students who disapproved of the requirement to generate questions may have generated them for the purpose of completing the tute-prep assessment, but they would have been unlikely to have wanted to find the answer to them:

> Critical thinking questions were a waste of time (SETU, 60.1).

Others may know the answer to their question, but be more concerned with framing a question that would be deemed satisfactory for the purpose of the assessment:

> but the way I saw those questions was that the complexity of the question is indicative of how well you understand the topic. That's the way I saw it. So my strategy to get the mark was to not ask questions about something I didn't know, but to ask a question about something that I did know because, therefore, there was no way that I could be wrong (Lewis, final interview).

The next section explores the proposition that eight of the nine types of thinking might apply to each of the four phases of the sense-making process; thus 32 scenarios in total. The exception is Type 7 because, since not asked in relation to understanding, it was not directed to any phase of the sense making process. This exploration of such an extensive range of scenarios required the use of hypothetical questions since the tute-prep questions available in this research was not sufficiently diverse. In fact, as will be shown in Sub-section 6.8.2, nearly all questions in the tute-prep question sample were directed towards the third phase, 'Deciding'.

I make a comment at this point that is discussed more fully in Section 6.8.4: collectively these examples are good evidence to support the claim that substantial numbers of students regularly engaged in forms of high order thinking. It is reasonable to suggest that aspects of the redesigned pedagogy stimulated and supported this.

5.2.2 Types of thinking and their relations to sense-making phases

As discussed in Section 4.7.1.3, initially a list of six types of thinking was inferred. These were shown in Table 4-6. It was theorised that the types of thinking were orthogonal with the phase of sense making; that any of the six could refer to ideas or mental representations not just in relation to the idea under study (Phase 3) but in any of the four phases of sense-making. This idea was tested conceptually with the formulation (by me) of twenty-four questions: six sample questions directed at mental representations in each of the four phases from which each of the six types of thinking could be inferred. These twenty-four questions are presented in Table 5-1 below.

As also noted in the introduction, Section 5.1, the list of six types of thinking was triangulated with interview transcript data. This led to the inference of three additional types of thinking, two of which are concerned with sense making.

Table 5-2 extends Table 5-1 by providing examples of hypothetical questions indicative of the two additional thinking types for each of the four phases of sense-making.

In doing this exercise, it turned out that for the great majority of cells it was possible to construct a question type that matched the column and row headings, there are a small number of cases where this could be contested and there may be one cell (thinking type 1 and sense making stage 4 that might be empty, but on balance it seems that the types of thinking are largely orthogonal with the phase of sense making.

Table 5-1 Examples of questions targeting each stage of sense-making process from which each type of thinking can be inferred

Type	Thinking aimed at entrenching / memorising 1	Thinking aimed at monitoring understanding 2	Thinking about implications, connections elsewhere at the conceptual level 3	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding 4	Thinking about / searching for things that don't seem correct 5	Thinking in relation to perceived exceptions 6
Recognising	Thinking about a previously learned idea, XXX: 'when I learnt XXX, I would answer ZZZ when asked about YYY. Is that wrong? Should I have answered VVV instead of ZZZ?'	Thinking about something previously learned (i.e. prior ways of understanding, prior ideas), e.g. 'Isn't it the case when we learnt XXXX that the presence of YYY meant ZZZ?'	Thinking about a previously understood connection between ideas, e.g. whilst reflecting on existing ideas, a student could ask, 'when I learnt XXX, I understood XXX was totally independent of YYY. That's right isn't it?'	Whilst reflecting on existing ideas, a student who thought XXX and YYY were totally independent, might ask the question 'and a consequence of that when I answered this type of exam question was that I would do ZZZ. That's right isn't it?'	Whilst reflecting on existing ideas, a student might think 'I never did understand why the professor said "BBBB" at the time because it seemed to be the opposite of what we actually did. He was probably wrong'. This thinking can be inferred from the question 'He always said "BBBB" but what he meant was "CCCC", Right?'	Whilst reflecting on existing ideas, a student might think 'we knew what we had to know about (that) to do well in the exam but (that) never applied to (this). Thinking in that way could lead to the question '(That) never applied to (this), right?'

Type	Thinking aimed at entrenching / memorising 1	Thinking aimed at monitoring understanding 2	Thinking about implications, connections elsewhere at the conceptual level 3	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding 4	Thinking about / searching for things that don't seem correct 5	Thinking in relation to perceived exceptions 6
Evaluating	Thinking about how a student might think differently about a previously learned idea XXX: 'So in future, I will answer VVV or ZZZ when told about YYY depending on …?'	Thinking about how well the outcomes emerging from an evaluation of prior ideas are being understood, e.g. 'so when we learnt that YYY meant ZZZ, there are exceptions when YYY does not mean ZZZ?'	Evaluating a previously understood connection between ideas, e.g. 'Since it appears XXX as I understood it and YYY are not totally independent, how are they related?'	Whilst evaluating the prior understanding of a connection between two ideas, a student might ask, 'since it appears XXX as I understood it and YYY are not totally independent, how should I have modified ZZZ to take account of that when answering this type of exam question?'	When we studied XXX, it always seemed wrong to me when solving problems that we did (this) before (that), thus the student is evaluating the existing idea. This thinking could lead to the question 'Why did we do (this) before (that)?'	'When we studied XXX, we would solve problems the way the lecturer insisted but a more correct approach would have been to do things (this) way, right? Or if not, can you please explain why not?'

Type	Thinking aimed at entrenching / memorising 1	Thinking aimed at monitoring understanding 2	Thinking about implications, connections elsewhere at the conceptual level 3	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding 4	Thinking about / searching for things that don't seem correct 5	Thinking in relation to perceived exceptions 6
Deciding	Thinking in relation to a new idea: 'if this were asked in the exam, should I answer with (this) or (that)?'	Thinking how well the new or revised idea being learned is being understood, e.g. 'the phrase PPPP doesn't make sense to me, what does PPPP mean?'	After monitoring understanding of a new idea, a student might think about how it relates to something else s/he has previously thought about, e.g. a paragraph in a textbook, an explanation of an answer to a problem: e.g. 'does what I have just studied contradict that which I previously studied?'	After understanding a new idea at an abstract level, a student might think 'well that sounds OK in theory but how does it apply in practice? Or 'given this idea, should my understanding of another idea change?'	In the process of thinking about materials or explanations in order to make sense of a new idea and/or its relations with others, a student may identify aspects which seem incorrect. This way of thinking can be inferred from questions such as 'I understand (this) so why isn't it true to say (that)? Here the student is making an argument; or 'the textbook says XXX but that seems wrong because ... Can you explain?'	'The textbook says that XXX are always YYYY but in the context of CCC could not XXX be ZZZ instead?'

Type	Thinking aimed at entrenching / memorising 1	Thinking aimed at monitoring understanding 2	Thinking about implications, connections elsewhere at the conceptual level 3	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding 4	Thinking about / searching for things that don't seem correct 5	Thinking in relation to perceived exceptions 6
Reviewing / restructuring	This way of thinking is unlikely in this phase of conceptual change but if a student's attention was somehow drawn to some other relevant aspect, s/he might ask "so in the case of that relevant aspect it could also be VVV or ZZZ depending on …?"	Thinking about how well the implications of a new idea for other relevant aspects is understood, e.g. "so when I think about RRR in a different context, CCC, should I be mindful that the character of RRR is not as homogenous as I have thought?"	Following on from thinking that monitors understanding (that the character of RRR in the context of CCC is not as homogenous as I previously thought), then could there be an analogy to this in the related field of DDD that I should investigate?	Following on from thinking that monitors understanding (that the character of RRR in the context of CCC is not as homogenous as I previously thought), then a potential question could be 'then what are the implications of less homogeneity in the context of CCC for the way we did SSS in practice? Does it mean we should do SST instead?	When reflecting upon how a new idea might lead to restructuring other related ideas or relevant aspects, the student may think to deny the need for restructuring: e.g. "Why is it necessary for me to re-think what I understand about 'this'?" Or see a reason to reject an aspect of the new idea: e.g. "'This' seems wrong because if it were right, then 'that' can no longer be correct. Right?"	I can see that, because I now think differently about XXX, I need to think differently about YYY, but only when YYY is in the specific context of CCC, right?

The following Table 5-2 provides examples in relation to Types 2* and 4*. For ease of comparison, they are presented alongside Types 2, 3 and 4.

Table 5-2 Examples of questions targeting each stage of sense-making process from which Types 2* and 4* can be inferred

Type	Thinking aimed at monitoring understanding 2	Thinking about the rationale or purpose that underlies an idea 2*	Thinking about implications, connections elsewhere at the conceptual level 3	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding 4	Thinking about the wider implications and application of the rationale or purpose that underlies an idea 4*
Recognising	Thinking about something previously learned (i.e. prior ways of understanding, prior ideas), e.g. 'Isn't it the case when we learnt XXXX that the presence of YYY meant ZZZ?'	Thinking about the rationale or logic underpinning something previously learned e.g. 'Isn't it the case that the reasons why the presence of YYY meant ZZZ was AAA?'	Thinking about a previously understood connection between ideas, e.g. whilst reflecting on existing ideas, a student could ask, 'when I learnt XXX, I understood XXX was totally independent of YYY. That's right isn't it?'	Whilst reflecting on existing ideas, a student who thought XXX and YYY were totally independent, might ask the question 'and a consequence of that when I answered this type of exam question was that I would do ZZZ. That's right isn't it?'	Following on from 2*: 'because AAA was the reason why the presence of YYY meant ZZZ, didn't it also mean that the presence of BBB meant CCC?'

Type	Thinking aimed at monitoring understanding 2	Thinking about the rationale or purpose that underlies an idea 2*	Thinking about implications, connections elsewhere at the conceptual level 3	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding 4	Thinking about the wider implications and application of the rationale or purpose that underlies an idea 4*
Evaluating	Thinking about how well the outcomes emerging from an evaluation of prior ideas are being understood, e.g. 'so when we learnt that YYY meant ZZZ, there are exceptions when YYY does not mean ZZZ?'	'What is the rationale for the exceptions?' or 'Given this realisation, what really is the logic why YYY meant ZZZ?'	Evaluating a previously understood connection between ideas, e.g. 'Since it appears XXX as I understood it and YYY are not totally independent, how are they related?'	Whilst evaluating the prior understanding of a connection between two ideas, a student might ask, 'Since it appears XXX as I understood it and YYY are not totally independent, how should I have modified ZZZ to take account of that when answering this type of exam question?'	Given 2*, 'What does this newly discovered rationale for these exceptions imply for this other idea I have?' or 'What are the implications of the corrected logic for this other idea?'

Type	Thinking aimed at monitoring understanding 2	Thinking about the rationale or purpose that underlies an idea 2*	Thinking about implications, connections elsewhere at the conceptual level 3	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding 4	Thinking about the wider implications and application of the rationale or purpose that underlies an idea 4*
Deciding	Thinking how well the new or revised idea being learned is being understood, e.g. 'the phrase PPPP doesn't make sense to me, what does PPPP mean?'	Thinking about the logic or rationale underpinning the new or revised idea being learned, e.g. "what is the rationale underlying the phrase PPPP?' or 'What is its theoretical basis?'	After monitoring understanding of a new idea, a student might think about how it relates to something else s/he has previously thought about, e.g. a paragraph in a textbook, an explanation of an answer to a problem: e.g. 'does what I have just studied contradict that which I previously studied?'	After understanding a new idea at an abstract level, a student might think 'well that sounds OK in theory but how does it apply in practice? Or 'given this idea, should my understanding of another idea change?'	Given the logic or rationale underpinning an idea, linking or making connections from that logic, e.g. 'how is this logic different to the rationale for this other idea?' or is my understanding of this other idea based on incorrect logic?'

Type	Thinking aimed at monitoring understanding 2	Thinking about the rationale or purpose that underlies an idea 2*	Thinking about implications, connections elsewhere at the conceptual level 3	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding 4	Thinking about the wider implications and application of the rationale or purpose that underlies an idea 4*
Reviewing / restructuring	Thinking about how well the implications of a new idea for other relevant aspects is understood, e.g. "so when I think about RRR in a different context, CCC, should I be mindful that the character of RRR is not as homogenous as I have thought?"	'Why is the logic underpinning the new idea relevant to context CCC?'	Following on from thinking that monitors understanding (that the character of RRR in the context of CCC is not as homogenous as I previously thought), then could there be an analogy to this in the related field of DDD that I should investigate?	Following on from thinking that monitors understanding (that the character of RRR in the context of CCC is not as homogenous as I previously thought), then a potential question could be 'then what are the implications of less homogeneity in the context of CCC for the way we did SSS in practice? Does it mean we should do SST instead?	'Is the logic underpinning the new idea relevant to other contexts?'

I stress that Table 5-1 and Table 5-2 are not intended to be summarizing what the students actually asked, rather they show, conceptually, that, at least in the great majority of cases questions reflecting all eight types of thinking can be directed towards ideas in each phase of the sense-making process. Accordingly, it supports research methods concerned with comprehensively evaluating how students think in the process of reconstructing prior knowledge and ultimately extending new knowledge to other contexts. Secondly, it has potential as a curriculum aid, e.g. to raise awareness by students of the range of questions they could ask, and/or stimulate a broader appreciation of the process of sense making. Moreover, it may be that it could be used to frame an exercise in which students are challenged to generate different types of question in relation to a particular topic.

The next section presents results relating to the second part of Research Question 2, the relationship of mental processes to knowledge structures.

5.2.3 Types of thinking and their relation to knowledge structures

As described in Section 4.7.1.4 of the Methodology chapter, as well as analysis in terms of the type of thinking and sense-making phase, tute-prep questions relating to three cost accounting topics were analysed in terms of the ideas within the web that were being targeted and hence their knowledge structures. Within the model, 'knowledge structure' was conceptualised as a type of idea, and there are three types: Foundational (F), Relational (R), and Modelling (M), is described in Section 4.7.1.1 and summarised in Table 4-4. For convenience, that table is reshown here. Collectively the information that can be inferred from these graphical presentations of the data show that the frameworks of types of thinking and knowledge structure have allowed some useful analysis.

Table 4-4 Types of Idea

Type of I	**Label**	**Description**
Foundational	F	concerns the meaning of something, whether it is the same as some other idea, how it is different to others, its purpose or role in practice.
Relational	R	concerns the integration of multiple component ideas, how it works and, in some cases, how it can be applied procedurally or via algorithms.
Modelling	M	a more sophisticated version of a relational idea. It is integrated with, or is situated within, some understanding of the discipline and the often messy and imprecise real world context in which it is applied. A modelling idea goes beyond the scope of traditional learning objectives or outcomes, and reflects the "ways of thinking and practising" (Entwistle, 2005; McCune & Hounsell, 2005) in the real world.

The following chart, Figure 5-1, depicts the distribution of thinking types across the three different types of idea. The data relate to the total sample of self-questions for all three cost accounting topics (N = 251), but, due to their low incidence, excludes presentation of Types 2* (n=1), 4* (n=0), and 7 (n=0).

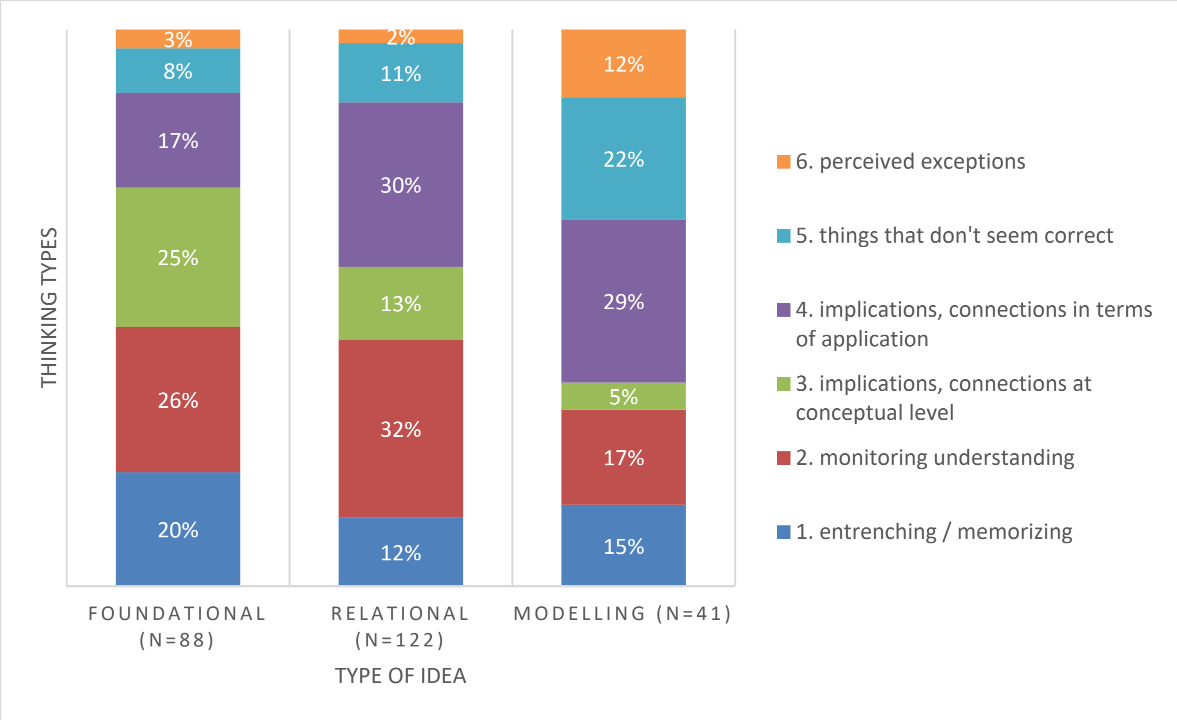


Figure 5-1 Distribution of thinking types by type of idea

The chart shows that all thinking types play a role in making sense of all idea types; however, the mix of types varies in ways that are consistent with how both the thinking types and idea types have been defined. These data both support and elaborate the arguments made in Section 1.3 about the pedagogical importance of *thinking-centred models* of both the process and product of learning. More specifically, these data show how a learner's thinking is different in respect to Foundational, Relational and Modelling ideas. Although the data is insufficient to show this, the same is likely for Types 2* and 4*.

The proportion of Types 1 and 2 is higher for Foundational (46%) and Relational (44%) than Modelling (32%) types. This supports the proposition that compared to Modelling, the study of Foundational and Relational types is more about memorizing and understanding the core idea.

In addition, the proportion of Types 5 and 6 directed towards the study of Modelling types (34%) is higher than both Relational (13%) and Foundational types (11%), reflecting a proportionately higher concern whilst studying a Modelling type for when the idea may be misapplied. In other words, the study of Modelling ideas involve more critical thinking than do the other two types of structure.

The proportion of the combination of Types 3 and 4 are similar for Foundational and Relational types of idea but is significantly less for Modelling ideas because of the relatively high proportion of Types 5 and 6 that Modelling ideas attract. The balance between Types 3 and 4 changes across the three knowledge structures with the emphasis on Type 3 declining with the greater sophistication of idea. This, along with the observation that the proportion of Type 4 overall is similar for Relational and Modelling types, reflects the greater concern with the application of these ideas in practice.

In total, the distribution of thinking types whilst studying Modelling ideas is consistent with the Modelling types being more of a skill requiring critical thought and judgement, i.e. skills reflective of 'thinking like an accountant'.

Finally, the chart in Figure 5-1 supports the expectation that, being foundational to a topic, Foundational ideas will typically have more connections with other ideas within a web than will Relational ideas. This likely explains the greater proportion of Type 3 in Foundational ideas (25%) than Relational (13%) ideas. At the same time, being relational, the proportion of Type 4 applied to Relational ideas (30%) is expected to be higher than that applied to Foundational ideas (17%).

A chart showing the distribution of thinking types for each of the three cost accounting topics is shown in Figure 5-2.

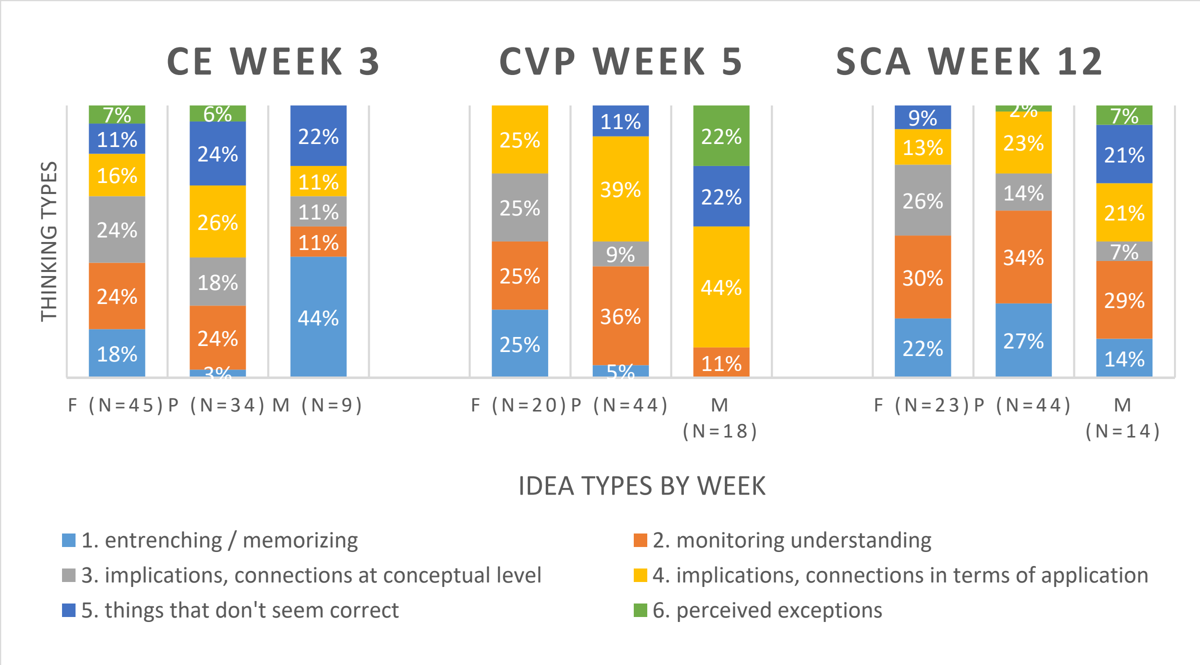


Figure 5-2 Distribution of thinking types for each of the three cost accounting topics: Cost Estimation (CE), Cost Volume Profit analysis (CVP), and Standard Cost Analysis (SCA).

At first sight, the data in Figure 5-2 appears to suggest some topic specific differences in thinking types, for example the high level of Type 6 (12%) thinking, i.e. about perceived exceptions, directed toward modelling ideas (Figure 5-1) was mainly due to CVP. An analysis of six patterns in these data was done and is reported in Appendix M. However many factors will cause variation in distributions across weeks, including amongst others, the nature of the topic and their mix of idea types, the mix of textbook exercises selected for the tutorial, the changing familiarity with the generation of self-questions as the semester progresses, and shifts in students' priorities as they near the end of semester. As the analysis in Appendix M shows the numbers of questions of each question type in each topic are small and hence the percentages would change significantly with only a small change in the question types. This means drawing conclusions about topic specific differences is unwise.

Nevertheless, the data illustrate the potential of the methodology when used with larger datasets to provide findings concerning the relationship of thinking types to knowledge structures at topic level.

The next chapter, Chapter 6, presents data and inferences about students' perceptions of, and behavioural responses to, the teaching approach and the exploration of their epistemic beliefs.

6 Beliefs, perceptions, behaviours

6.1 Preface

The reasons why the pedagogy was redesigned as well as a description of it are presented in Section 3.6. In summary, the two major innovations in the pedagogical redesign were:

1. The focus on student self-generated questioning in order to achieve deep understanding, and
2. A lecture approach focused on teaching the skill of problem solving as opposed to the traditional teaching approach

The redesigned pedagogy aimed to promote a view of accounting as being subjective and uncertain and both of these innovations demanded students adopt active ways of learning. This chapter presents data and findings in relation to students' epistemic beliefs, perceptions, and behaviours in this context.

As presented in Section 2.1.4, in this research, the term 'epistemic beliefs' is conceptualised to be a set of relatively independent beliefs about knowledge and knowing consistent with Schommer (1990), which were outlined in Section 2.1.1. The beliefs are understood to be domain dependent, however, and thus in this context include beliefs about accounting knowledge and the learning of accounting.

This chapter proceeds as follows. Firstly, the interviewees and the data used in the chapter are described. Secondly, preliminary evidence is presented to indicate the extent to which students were aware of the pedagogical redesign and their responses to it. Thirdly, evidence is presented regarding a range of student beliefs about learning and accounting, followed fourthly by evidence in relation to the development of epistemic beliefs in the context of the redesign. Fifthly, some factors affecting the development of beliefs are identified and in sub-section 6.7 student perceptions of the redesigned pedagogy are presented. Sub-section 6.8 presents findings about how students responded to the teaching of the three cost accounting topics in terms of the types of thinking inferred from their questions. All of the findings in this chapter are then explored in Chapter 7 in relation to the research questions.

6.2 The data and interviewees

As explained in the Methodology chapter, the sources of qualitative data used in this research were answers to survey questions and anonymous comments provided in response to the SETU survey, and transcripts of interviews with four students. Sections 4.7.2 and 4.7.3 described the procedures by which these data were analysed.

In relation to the interview data, these arose from a pilot test of the data collection plan that was proposed at confirmation of candidature. Only four students were involved in the pilot that was intended, firstly, to test the interview protocols and secondly, to gain a sense of what might be revealed from more extensive data collection. These interviews yielded rich data, and so are considered in this chapter. Along with SETU data, the discussion uses these data to provide insights into issues of epistemic beliefs and achieving change in these at a general student level, as well as insights to student perceptions and behaviours.

As it turned out, the four interviewees split into two very different pairs in ways that allow some useful insights. Two of the interviewees, Lewis and Myron, are Australian and attended private secondary schools in Melbourne. The other two, Sue-ellen and Yurek, are international, and entered Monash University at second year level after completing a pathway course at Monash College in Clayton.

Details of the four interviewees' final grades and participation in the two optional assessments intended to assist students adopt more active learning approaches, Lecture Engagement and Critical Thinking, are shown in Table 6-1.

Table 6-1 Interviewees' participation in optional assessments and final grades

	Yurek	**Myron**	**Lewis**	**Sue-ellen**
Number lectures attended	3	11	11	10
Pre-lecture quiz: Number 'did not submit'	5	1	0	1
Number satisfactory lecture engagements (maximum = 11)	2	9	11	7
Number tutes attended	5	10	12	12
Powerful questions: Number 'did not submit'	4	0	0	1
Powerful questions: Number 'satisfactory' (maximum = 10)	3	8	10	9
Final grade achieved	53%	76%	87%	41% (Fail)

The small number of interviewees that was possible is a limitation that restricts the extent to which comments can be made at the general student level; however, there were multiple interviews totalling nearly 16 hours and the data do provide rich insights into these students, especially Lewis and Myron.

The distribution of the SETU commentary data is largely bimodal. In other words, the data are a mix of comments from students who were critical of the teaching approach and students who ended up being supportive. This is generally reflective of SETU data– most commonly, comments come from students who have something they want to say. This means that whilst the SETU data should not be interpreted as a balanced sample from the cohort, they do provide insights into the two ends of what would be expected to be a continuum along the dimension of support for and opposition to the teaching approach. Table 6-2 shows the amount of favourable and unfavourable commentary across various aspects of the redesigned pedagogy.

Table 6-2 Number of SETU comments favourable and unfavourable to aspects of the redesigned pedagogy (N = 52 respondents)

Aspect of redesigned pedagogy	Favourable	Unfavourable	Total	% of total
Lectures	11	18	29	25%
Critical Thinking / Questioning	10	12	22	19%
Structure / Transition	4	11	15	13%
Tutorials	7	7	14	12%
Content	7	3	10	9%
Assessments	3	3	6	5%
Staff	5	1	6	5%
Flexible coursework assessment regime	2		2	2%
Support outside classroom	1	1	2	2%
Other	1	8	9	8%
Total	50	65	115	100%

There were seventeen tutorial classes and five tutors. Two of the tutors, Bill and Jack, block taught two of the classes, meaning that Bill taught two classes for six of the twelve weeks, and Jack taught them for the other six. As described in Section 3.6.6, Bill was outspokenly negative about what I was doing and Jack misunderstood what I intended with the student question writing. All four interviewees attended tutorials taught by one or both of these two particular tutors and the results must be interpreted with this in mind. Details of tutor, attendance and final grades for the four interviewees are shown in Table 6-3.

Table 6-3 Student tutorial information

Student	Number of tutorials attended	Tutor(s)
Lewis	12	Bill
Myron	10	Bill & Jack
Sue-ellen	12	Jack
Yurek	5	Jack

At the pathway institution, Monash College, Sue-ellen and Yurek experienced significantly more class contact time per unit (two 1.5 hour lectures and two 1.5 hour tutorials per week) than in this unit (one 2 hour lecture and one 1 hour tutorial) and the style of teaching was highly teacher-directed. Therefore, the redesigned pedagogy was a dramatically different experience for them and one to which they found it very difficult to adapt:

> Yeah. I think it is quite weird because in my college then, there are teacher who talk about every tutorial questions (sic) and then teach us how to do, but in this unit, the tutorial, the tutor didn't teach us anything about tutorial questions (Sue-ellen, Week 5).

> I didn't like to go in the tutes because I think there was some sense of ambiguity somewhere, because whenever I used to go into the tute I was confused… And I felt a little bit, I felt a sense of ambiguity and like... For example, when they make groups and all, I think there's a lot going on and it's... Time is really less and there is some ambiguity in regarding to that those questions which are supposed to be uploaded and everything. And I think that, for example, those critical thinking questions and almost all the stuff in this unit, I think it's very minimal like, if someone does it, its not so much time consuming but the number of those things is not less. So, somewhere I think it starts somewhere (Yurek, Post-exam interview).

Moreover, Yurek seemed unable to contemplate adapting to a different approach to learning:

> I think there should be a set of questions which the tutorial teacher should explain. Like, there should be some particular questions. Not like, for example now, in the unit there used to be, students used to upload those questions and they used to sit in groups

> and discuss each of the questions and try how to solve them. But I guess like if there are particular questions for each tutorial which the teacher explains to the students (Yurek, Post-exam interview).

Thus, apart from expressing a strong preference for transmissive styles of learning, Sue-ellen and Yurek could not offer much insight to the interplay between epistemic beliefs and the redesigned pedagogy. I infer that this is not because they did not want to expend the intellectual effort or time to discuss it, but because their absolutist views of knowledge denied them the opportunity to contemplate alternative perspectives. They just struggled with the redesign, as if it were entirely alien. On the other hand, with minds more open to relativist views of knowledge, Myron and Lewis could contemplate alternative perspectives, experience dilemmas, and could offer insight.

6.3 Evidence of awareness and response to the redesigned pedagogy

The SETU summary data presented in Table 6-2 above show that many students were well aware that there was a significant difference in the pedagogical approach and that there were mixed reactions to this. Fifty-seven comments (49.6% of total) were directed at the two key aspects of the pedagogy (lectures and critical thinking activity) and the transition to the redesign, and these comments were fairly evenly split, 25 favourable to 32 unfavourable.

Two contrasting pairs of SETU comments are indicative of positive and negative responses to the redesign:

> Structured differently, made students think about accounting in a different manner, concepts were explained in a way which made them seem quite easy (SETU, 37)

> I think the encouragement to think critically has greatly improved the way that I approach all questions in all areas of my studies and so therefore has been greatly beneficial (SETU, 21)

> Structure of this unit. I believe that submitting questions and doing pre-lecture quizzes are not the ideal way of studying a unit, particularly an accounting unit. (SETU, 92)

> more content learning needed rather than focusing on HOW to study (SETU, 80).

The quotes reported in the preface to this chapter show Yurek and Sue-ellen were aware of aspects of the redesign, especially the requirement for questioning, but were unable to respond in an effective manner. The following three quotes from Lewis however, made at different times throughout the semester, show Lewis's awareness of key principles under-pinning the redesigned pedagogy. The first refers to the SOLO taxonomy, a device used in the redesign to illustrate variation in levels of understanding to students and to help them evaluate the understanding evident in their own work.

> You keep bringing up this taxonomy, I've never really thought about my education that way. It's always been about understanding the course, it's never been about really understanding the fundamental principles underpinning things and that's challenging for me actually. It's a big challenge because it's just not what I'm used to (Lewis, Week 4).

The second quote shows awareness of the focus of the redesign on thoughtful questioning:

> It's actually a bit in isolation, like this teaching method hasn't been used elsewhere. The emphasis that you place on critical thinking, thinking for ourselves that hasn't been in other units. So that's also what makes it hard, a hard concept to grasp (Lewis, Week 6).

The third quote refers to accounting being taught as a set of tools to be used critically and with judgement in order to solve problems rather than a set of mechanical formulas:

> The fact that what I interpreted at the time, what we were supposed to learn, I saw it as a bunch of formulas, really. And it wasn't taught that way (Lewis, Post-exam interview).

Lewis's response in Week 7, to the redesigned pedagogy is encapsulated in the following quote:

> Well the obvious answer is I just have to start approaching my learning a bit differently, kind of see it outside of the constraints of just passing the unit, kind of look to extract a bit more meaning out of it than that. I don't know if that's probably easier said than done considering the way I've learnt for the past 12 years or so (Lewis, Week 7).

Myron demonstrated his awareness of the redesign by contrasting it with the prior accounting unit. My interpretation of this quote is that this subject made and stimulated much more linking between ideas taught in different weeks than was the case in other units; he sees this as leading to what I would describe as richer understandings of the content

> I think it's definitely more structured than other units and in the sense like everything sort of leads up and builds up to something, whereas other units you just like go into a tute and you'll go to the tute questions, that'll be it. You don't really ask questions or you don't even look at things in much more depth or if it's like another topic to be considered it's not in the tute questions, you wouldn't look at it because there's not enough time. So I guess it's good in that sort of, in that sort of sense because you can sort of base your critical thinking questions on something that you want clarified and not necessarily the tutorial questions. So I guess it's good (Myron, Week 5).

It is reasonable to conclude that the teaching did result in Lewis and Myron thinking about aspects of their epistemic beliefs. Data presented in later sections provide further support for this, as well as show it to be the case for other students.

6.4 Beliefs

6.4.1 Preface

This section presents a range of epistemic beliefs inferred from the SETU and interview data. The beliefs are categorised in five ways: those about learning and the learning process, the real world relevance of accounting, student self-generated questioning, the teaching of skills, and finally note-taking. The subsequent sections of the chapter will examine how beliefs change (develop) and key factors affecting how they change before presenting a summary.

6.4.2 Beliefs about learning and learning process

It is likely that this unit was the first time many students were asked to talk about epistemic beliefs. Accordingly, many may have lacked a rich vocabulary to think and talk about learning and thus the language they used, e.g. the meaning they ascribed to the word 'knowledge', may often have been imprecise and their expression of their thoughts may have lacked the benefit of significant reflection.

Despite these limitations, the data show a growing awareness, at least, that there was variation among conceptions of learning –that there was not just a single way of thinking about learning.

The following exchange in regard to Myron's answer to a conception of learning question akin to that of Marton et al. (1993) provides an example:

> **Myron:** I remember I chose to gain a greater quantity of knowledge.
>
> **Interviewer:** Yeah. Yeah, you did? And what I was saying afterwards, what was your reaction to this business about, you know, more than 50% of people's idea of learning, seeming to match this idea that learning is about acquiring more knowledge, as opposed to developing the ability to think? Was that just academic rubbish?
>
> **Myron:** No, no. Just like... Different way of like looking at, I definitely thought it would all be about knowledge, I never really considered skill. But I mean I think it's definitely with learning, now that you've said skill, I think it's an element of both, you can't have the skill without the knowledge (Myron, Week 6).

A conception of learning as the mere acquisition of more knowledge of content as opposed to a skill, i.e. a conception of learning that recognises the need to be critical and make judgements in the application of knowledge, is likely associated with a conception of exams as testing reproduction. The following quote is suggestive of that:

> The format of teaching did train students to think critically but was not exam-oriented. Compared to other units, I have to spend more time than the suggested time to invest in this unit (SETU, 97)

It is also interesting that the previous comment was made before the student saw the exam: that their experience of the redesign as well as the initiatives described in Section 3.6 had little influence on their conception of the exam they were to sit.

Sadly, the data show that, sometimes, learning activities are believed, despite their appearances, to be little more than busywork and not activity which is helpful in the process of sense making:

> Oh I understand the purpose of them (i.e. pre-lecture quizzes), it's getting us to read the lecture problems before we come to class or before we come to lectures so we come prepared. And maybe like this week we had to refer back to a couple of weeks ago because it links in terms of the folding stuff and... So I definitely do see that it is, when it comes down to it, still another piece of work that you have to do. Well, in my mind (Myron, Week 5).

The next three quotes, also from Myron, a hitherto successful student, suggest initially a level of comfort about his beliefs in his ability to self-evaluate, yet an openness to improving his ability to self-evaluate, and surprise that SOLO-like evaluations might be expected of him at his stage of development.

Firstly, the purpose of the assessment skills seminar was to give students insight to variation in levels of understanding and thus assist them evaluate and reflect on their own work. A YouTube video that explains SOLO had been presented to students in the previous week.

When discussing the video, Myron expressed confidence in his own ability to judge his own work and said SOLO made sense:

> It was interesting, never thought... I dunno, I think it was more of a theoretical way of looking at things. I definitely know different answer types and how much you understand something, but obviously puts proper theory to what it is. I guess it does make sense (Myron, Week 5).

Commenting on the SOLO-based evaluation activity, apropos his own ways of evaluating, Myron said:

> Yeah, I thought it's just like a simple measure. Like how well we can sort of phrase things in our own words, and how effective we are at doing that, like looking at something and reading into it, and seeing if we understand it and sort of like putting it into our own words. But then, like, obviously it's like to think in a more extended abstract nature, critical thinking. A bit of a shock to the system to see how detailed or how much you have to challenge traditional thought in terms of your questions. Or in terms of the answers and what you're looking at? I didn't realize (Myron, Week 5).

Prior to the assessment skills seminar students prepared answers to the following exercise: “Imagine you have applied for a job in a new business and you have been given an interview with the owner. During the interview, the owner asks you ‘Tell me what you understand about depreciation.’ You want to win the job and so you are keen to impress him with your level of understanding of accounting. What would you say? Write it down”.

The topic of depreciation had been taught in an earlier, first year financial accounting unit. At the seminar, in the class setting some sample answers were evaluated in terms of the observed level of understanding (SOLO) and students were helped to evaluate their own answers.

In relation to that Myron went on to say he thought such an activity, i.e. evaluation of one's own demonstrated understanding, would be covered in a future, more advanced management accounting unit. He does not seem to have appreciated the activity related to a financial accounting task he completed the previous year, and that reflection upon the quality of understanding is not in essence confined to the management accounting domain:

> Oh, no, it's not like, it's not my experience, but I saw it as a bit of shock to the system because I didn't expect to have that, or that'd be something we'd be doing this year, maybe like... I don't know. Maybe second management accounting you'd look at doing this stuff. I definitely didn't expect it at first. So I thought we'd get the basics first (Myron, Week 5).

Pre-lecture quiz questions, particularly early in the semester, were often directed at prior experience or relevant knowledge in non-accounting contexts. This section ends with presentation of evidence of beliefs that domains other than accounting are irrelevant in students' conceptions of learning accounting:

> Pre-lecture in moodle is useful, but I think some questions are not related to our course (SETU, 36).

This comment from Lewis suggests a similar belief early in the semester, and further, that if the content was not accounting then it deserved no effort:

> Yeah, I found it actually quite confusing. It had nothing to do with accounting on first glance... So I didn't have to put that much thought into it (Lewis, Week 6).

However, later in the semester, Lewis acknowledged the benefit and therefore relevance of experience in a non-accounting domain to his learning. The discussion concerned the accounting concept of 'equivalent units', one quiz question was concerned with the allocation of prize money based on the number of full bottles of liquid achieved by contestants, and a second quiz question modified the allocation of prize money in the same situation to take account of partially full bottles. Lewis readily understood in the latter case that prize money would be allocated based on the number of 'full bottle equivalents' achieved by the contestant, e.g. two half-filled bottles is equivalent to one full bottle:

> Whereas when I was doing exercises about equivalent units, I could actually kind of use that quiz question to help my understanding of it (Lewis, Week 10).

This section has presented beliefs about learning and the learning process. It shows students were becoming aware that learning was more complex than they realised; or at least began to engage in reflective thought and discussion about it and therefore began to experience learning as a more complex phenomenon than it was in their past experience. In the next section, beliefs about the real world relevance are presented.

6.4.3 Beliefs about real world relevance, certainty of accounting information, and the need to think critically and make judgements

The belief that accounting tends to exist in a world of its own rather than as a means of understanding and facilitating decisions in the real world is a belief typically held by accounting students (Lucas, 2000). For example, this quote suggests the student's conception of accounting toward the end of semester remained that accounting is more about mathematics than real life:

> … the unit due to the nature of the course being mainly maths based (SETU, 73).

In contrast, early in the semester Lewis had become aware of a different way of thinking about accounting:

> It's the first unit where you're asked to challenge things and not accept stuff without challenging it first. And also because it's the first Management Accounting unit that I've done it's also different because things are no longer reliable and things are no longer adhering to standards and things like that (Lewis, Week 4).

In saying "no longer reliable and things are no longer adhering to standards" Lewis recognised that adherence to a procedure in Management Accounting does not result in a certain 'truth'. Since accounting tools are not objective, there is a need to think critically and make judgements when using them. He understood management accounting was the first accounting unit where this is the case but the financial accounting unit he studied in the previous year is not objective and certain either, however the teaching in that unit had not led him to this understanding.

In other words, based on prior experience of accounting units, Lewis seems initially to have had a conception of accounting as being a set of procedures for finding answers and that clues, i.e. starting points, regarding the procedure for answering a particular accounting question would be clear in the question or by virtue of the data provided by the question. The following quote suggests his exposure to cost accounting problems challenged that belief:

> I just think it's hard to find a starting point for each line of question. There's always a starting point. There has always been a starting point in previous accounting units because you've been given a method, but... Or for relevant costs for those types of non-routine decisions. You can't start the question unless you know what kind of question it is. Whether it's a constrained resource or a keep drop, or whatever type of question it may be. Then after that, you have to find out what the relevant information is. And if you don't know, then you can't start the question (Lewis, Post-exam interview).

The following exchange suggests two things: firstly, that Lewis perceived there is only one correct answer to accounting problems and it is the one 'handed down from authority', and secondly, his surprise that an answer, in this case whether the behaviour of a particular cost is fixed, required his judgement:

> It actually left me with a few questions that tute. Because the way I went into it, I went in there thinking that, 'He's gonna [sic] tell me exactly what he wants to hear in his assessment task. He's gonna [sic] tell me what a...
>
> **Interviewer:** A good answer looks like?
>
> Exactly, exactly. 'He's gonna [sic] tell me, yeah, what he wants to hear,' I guess. But I actually left that tute with more questions than I went into it with because all of a sudden I had to start challenging whether a fixed cost, which has been fixed for the past three months, is actually fixed, or which has been constant for the past three months, is actually fixed (Lewis, Week 6).

Developing a different belief about the nature of accounting information can be challenging. For example, a pre-lecture quiz question asked students to imagine they were sitting in a plane beside the pilot. Through the front window, they could see the plane was on course to crash into the side of a mountain yet the instrument panel reported data that indicated no danger. The question asked whether, in making a decision, the student would rely on what they saw through the window or on the information provided by the instrument panel.

When the parallel with accounting was discussed at interview, Lewis had difficulty coming to terms with the implication that accounting information, because it is merely an imperfect representation of something real, must be used critically:

> Yeah, it's a hard concept to grasp, I think. A very hard concept to grasp. To kind of get it out of the conceptual world into reality. It is a difficult concept (Lewis, Week 6).

Another pre-lecture quiz question asked students in Week 1 to imagine a pilot flew a return trip to Sydney the previous day, and that he was going to fly another one the next day. The question was, "Is the pilot better off with the forecast of tomorrow’s weather, the facts of yesterday’s weather, or neither." Clearly, the information about the future flight is more relevant even though it is not certain. Commenting on this, Lewis said:

> Accountants or accounting students, sorry, I think they'd be inclined to use the past information. It's what we've been taught to do, I think, to use past information. And I think that's pretty integral to the unit, this question actually, because future predictions, although they don't have the hard evidence of past information to back them up, that's obviously gonna [sic] be the most relevant information to base decisions on (Lewis, Week 6).

The following quote shows that, in contrast to previous accounting units, Myron was aware that a goal of the redesigned pedagogy was to situate accounting in the real world, and that accounting information must be used critically and with judgement for decision making in real world contexts:

> Yeah, 'cause I think maybe accounting, or what of it the theory you're doing in uni in class, I mean for any subject, they sort of say like, <u>this is the end all</u>, you know. Well, it comes across, imply that maybe it's like the way to do it. I never really considered management accounting but I sort of thought maybe financial accounting. It could be a bit more different because it's structured and you gotta follow more laws and accounting standards and stuff like that. But now when you say that obviously you can't base it on like, your skills that you have. <u>Your best professional judgement sort</u>

of weighs it at in the real world. It definitely makes sense ([sic], Myron, Week 5, emphasis added).

When discussing with Myron the part of a lecture conversation about the choices available when solving a particular problem, he did not appreciate the availability of choice implied a requirement for critical thinking and judgement. Instead, he thought, like most lecture problems in his past, that there would be a correct way of answering it that would produce the correct answer. He did not perceive a need for skill:

> I don't know if a lot of kids will see it like that. I didn't necessarily see it like that. To be honest, I saw it just like a lecture problem. It's not necessarily like a skilled tool (Myron, Post-exam interview).

The following quote from Myron shows in his hindsight that he was learning to justify judgements when solving accounting problems. In completing the coursework task in Week 4, he arrived at an answer and then searched for a justification for the judgements he used, rather than making justified judgements in the process of producing an answer. However, by Week 6 he reported a change in his thinking:

> Yeah, they're my justifications... But my justifications are merely claims because obviously once I've started, because I did... I went through the motions, I went through and did all the actual stuff first and then I'd go and justify. But the thing is after I'd done all I sort of researched it again, I realized 'Oh that's not right because I could've done it this way and that would be better'. So then going to justifying it, it was as you said just claims, they weren't... They were meaningless (Myron, Week 6).

This section closes with two quotes that suggest the unit helped establish the belief of the relevance of accounting to the real world. Moreover, the comment about the content being challenging in the second suggests an appreciation of the subjectivity and therefore uncertainty of accounting. Both were comments in response to the SETU question 'what were the best aspects of the unit?

> Useful in daily life (SETU, 51).

> Challenging content that enabled me to think within a real-world context (SETU, 4).

Thus, this section shows in the context of the redesigned pedagogy, that students could become aware of the uncertain nature of accounting knowledge, its sources and forms of justification. There was a clear change and this change was significant for the students.

6.4.4 Beliefs about the role of student self-generated questioning

In both the interview and SETU data, the student-generated questioning activity was often referred to as 'critical thinking' by respondents because 'Critical Thinking' was the name given to the weekly tutorial preparation assessment that required the generation of questions.

Not surprisingly, students who conceived of accounting as being objective and certain, as being about mathematics, and/or who had a reproductive view of assessments, did not believe in the value of questioning or in the relevance of critical thinking in the more generic meaning of that term:

> The critical thinking idea, I think is a good idea in a perfect world, and may help later in life, but unfortunately I don't think it can help me complete the unit due to the nature of the course being mainly maths based (SETU, 73).

Moreover, others saw the questioning activity as counter-productive:

> Remove the critical thinking assessment as it does not help student to understand the content. Instead it further complicates the materials (SETU, 89).
>
> I believe that submitting questions and doing pre-lecture quizzes are [sic] not the ideal way of studying a unit, particularly an accounting unit (SETU, 92)

Others saw the role of questioning as positive, but in a behaviourist sense where its purpose is to force a response:

> I still think it's a method just to get students more involved with the material, the key concept (Lewis, Week 10).

Another perspective, also from Lewis, was more constructivist because his quote shows he was beginning to show recognition of the value of generating worthy questions, of reviewing course material, and thus finding good answers:

> Well, actually, if you don't know the answers, and you look back on the course material and you get the answer, that's where I find the use is, out of that (Lewis, Week 10).

Others were even more positive about self-questioning:

> I think the encouragement to think critically has greatly improved the way that I approach all questions in all areas of my studies and so therefore has been greatly beneficial (SETU, 21)

A measure of how well a student understands an aspect of accounting is how well they can explain it in layperson terms. After discussing an impending coursework task that required students to explain an aspect of accounting to a layperson, Myron recognised the dependency of performing that well on questioning:

> That's like sort of... And that's like the critical thinking 'cause you're able to explain in that sort of way (Myron, Week 9).

Thus, a clear finding from this research is that many accounting students disapproved of, or did not see a place for, self-questioning. Others understood the value of self-questioning but were not enthusiastic about it; and this is consistent with the literature (Gourgey, 2001; Sternberg, 2001). Lewis and Myron, in particular however, moved to see the value of thoughtful questioning.

The data on students' responses to self-generated questioning is perhaps somewhat less positive than the data in the previous section on them re-thinking their beliefs about accounting. This could be due to the fact that thinking critically in order to generate relevant questions required students to invest intellectual effort on developing a new skill - a more demanding challenge.

6.4.5 Beliefs about the teaching of application knowledge (skills): content vs big idea.

Typically, at the time, students' beliefs about how they learn application skills, and therefore their beliefs about the conduct of lectures, were consistent with their experience of the traditional accounting pedagogy. Not only were traditional lectures transmissive in nature, leading to passive learning, they reflected the historic view of some academics that academia teaches content and perhaps makes intellectuals of students but skills training is the province of the profession, as discussed in Section 3.2 'Accounting in higher education'. Moreover, such a role for the traditional lecture is in line with contemporary thought that a solid base of declarative knowledge is a necessary pre-requisite to the learning of higher order knowledge (for example, Bransford et al., 2000).

The following quotes are illustrative of these beliefs:

> clarify what exactly needs to be understood, and actually teach the concept not work through an example (SETU, 58).

> It's not ideal, for me personally it's not ideal. I see lecture time is the time to really make sure everyone's on the same page, get in all the fundamental concepts before you go and apply them in examples and most of your lecture time is obviously spent on lecture problem. Right? I think so. I think those problems could be done outside the lecture and the lecture could be done really explaining the theory of it all better (Lewis, Week 4).

In contrast to the traditional approach, the redesigned pedagogy sought to teach to the ‘big idea’, which usually meant conducting lectures as conversations about alternative methods of solving a problem. An illustration of this is presented in Appendix F. Thus, students were taught a variety of knowledge types holistically, i.e. in a way that integrates them. This approach promotes active learning and has some commonality with the apprenticeship model of learning. It responds to calls to teach less content by teaching only what matters.

After the rationale for the approach was explained and he was asked if it made sense, Lewis indicated it did. However, his belief in the need to summarise lecture content in the form of notes presented a barrier to change:

> Yeah, yeah. But I agree with that, in terms of time it takes for you to learn the concepts, but then there's also the aspect of the quality of your understanding. If you've got it on paper, you can go through it over and over and over and make sure you got every definition down and what not. Isn't there a learning pyramid where you only remember 10% of what you say and 20% of what you write and... So, if you've only been taught it, it's been told to you and you haven't written it down or you haven't done anything better than that, what's the quality of your understanding is gonna [sic] be like if it's taught in Week Two and the exam is in Week 12 (Lewis, Week 7).

Similarly, Myron indicated the approach made sense, but he remained resistant to it:

> No, it does, but with my way of learning, I feel really like it's comforting to know that there is a theory behind everything that I can refer back to. Obviously, a good way of teaching would be like, I love to look back on things and just... 'Cause it sort of helps me, you know what I mean? Like I just can't...
>
> **Interviewer**: So theory as in... Textbook descriptions?
>
> Text descriptions as well. Yeah, and from the combination of both, I can then form my own idea, and what it is and my own understanding of it (Myron, Week 6).

Three weeks later, in Week 9, these conflicting conceptions were becoming something of a dilemma for Myron. After being asked ‘How do you remember being taught in first year?’ Myron said:

> It's like those years I just like... The rudimentary approach basically just showing us what the formula is, and then like giving us an example and that was it. I understand like, where you come from sort of both points, but to be like... I guess you can't just take everything in at once, like and just have it once and then expect to know all again….
>
> You need to like have once learning it, have those notes in place you can refer back to, like you've already learned to be like... You have that spark and I know what you're saying... There's two ways of teaching it and your way definitely comes across as better, 'cause it's sort of easy to understand in a more practical approach, but I still think like once being... it still needs to be sort of refreshed, it's just kind of like, process every little bit of information at once (Myron, Week 9).

The following quotes, provided in answer to the question about best aspects of the unit, reflect positive beliefs about the lecture approach:

> Structured differently, made students think about accounting in a different manner, concepts were explained in a way which made them seem quite easy (SETU, 37).
>
> LECTURE PROBLEMS WERE EXTREMELY HELPFUL IN SOLVING TUTORIAL QUESTIONS (SETU, 10.2, emphasis in original).

> Different way of delivering lectures which was more engaging and slightly more interesting (SETU, 11).

Thus, students were divided in their beliefs about the value of being taught accounting in lectures as a skill, as a set of ideas. Consistent with their past experiences, many believed that before acquiring a skill, they had to learn a solid base of content which tends to be a more passive form of learning. One part of this may be that they prefer neatness and find real world uncertainties annoying, but perhaps another part is that dealing with a larger number of ideas at once challenging. In contrast, being taught accounting as a skill involves students in more and deeper thinking: working out what they think about something, recalling/applying past experience, thinking critically and creatively, but also experiencing dismay or disbelief that there isn't more to know. It can produce superior learning outcomes but it is more demanding intellectually. The variation in willingness to engage in more and deeper thinking reflects variation in students' beliefs about learning; whether learning is self-guided or predetermined, and whether learning is complex and effortful or not (Schommer, 1990).

6.4.6 Beliefs about role of note taking

The term 'notes' in the following quote is interpreted to mean content-related notes, e.g. summaries of key points. The quote suggests a student's confidence in their learning is proportional to the quantity of notes:

> Compared to my other units, I had very small amount of notes to this unit whereas in other units I had a lot of notes, which kind of proved to me that I had actually learned something... What was going to be on the exam was in there somewhere, in those wide set of notes (Lewis, Post-exam interview).

That comment about notes suggests an epistemic belief about the role of notes that is more aligned to a transmissive rather than a constructivist view of learning.

The second coursework task required students to explain job costing to a layperson. The following exchange suggests Myron believed in the value of his notes, but it also shows a misplaced belief in the value of content-related notes. Explaining how he would approach the task, Myron said:

> **Myron:** So what I'll do, I'll essentially refer back to my notes and then I'll go over the topic again, fundamentals and then sort of display that... Arrive at that relevant to

> what's going on, but like not obviously, put it in my own words. I'm not gonna [sic] say, 'Oh the textbook says this.' I am not gonna [sic] reference that, but it's gonna [sic] be in my own words. And like how I can have a simplified version to the new MD or CEO or whoever it was for.
>
> **Interviewer:** Thinking about job costing, is there any one stand-out item that you remember taking out of the lecture with you about job costing? What's it all about? What's at the heart of it?
>
> **Myron:** The allocation of overhead costs to the job… (Myron, Week 6).

Myron's answer to what is at the heart of job costing is a technical accounting explanation when what would have shown a deeper understanding was a non-technical response. This is to be expected if the notes only record accounting content. Moreover, the explanation is only partial. He did not connect his answer to a deeper conceptual context. This would seem a natural consequence of the serial way in which subtopics are traditionally taught, and therefore notes are taken by students. A better answer to the question is that the purpose of job costing is to provide managers with an estimate of the full cost of completed work by ensuring the costs of all resources required to complete it are appropriately taken in to account. Thus, an inappropriate belief in the value of note taking appears to hamper deep learning.

However, the belief in the value of, or a dependency on, note taking may be explained by the student's language efficacy, i.e. how confident the student is that they can explain their understanding in their own words. For example, the following quote suggests notes equip Lewis with the words he will require when providing a good answer:

> Well, again, what I said about tomorrow about knowing what I don't know when I've got it on page, I know what I know. When it's just in here, I'm not quite sure if I'd be able to answer the, give the responses to questions that demonstrate my full understanding. If I've got it on paper, then that probably makes it easier (Lewis, Week 7).

Incidentally, this quote also illuminates Lewis's belief about understanding. He appears to believe that full understanding can be shown by the ability to give responses to questions. He does not seem to appreciate that understanding needs to be in his head, in the form of a self-constructed way of thinking.

Further, as the interview conversation about note taking proceeded, there was an indication that Lewis's belief about the role of note taking had begun to shift:

> Yeah. I guess that's kind of related to this, actually, because the way I've tried to remember it from our lecture material, I've tried to remember it in that same rote learning kind of way instead of an understanding kind of way (Lewis, Week 7).

In other words, the shift was from a belief that the value of notes lies in the quantity of key points summarised from the content, to a belief that the value lies in how they aid recall of the key realisations associated with the development of a way of thinking.

This section, 6.4.5, shows that students' beliefs about the role of note taking were strongly held and attempts to change them were challenging.

6.5 The development of beliefs

6.5.1 Preface

This section presents four inferences from the data about change in beliefs and the association of these changes with behaviour.

6.5.2 When faced with change, prior beliefs are influential

The extant epistemic beliefs of students, especially those who have been high performers in the past, are likely to be strongly held, and can lead to the conclusion the pedagogical design is faulty. For instance, the first coursework task was designed to reinforce to students the requirement to think critically and make judgements. The novelty and therefore challenge of this task was recognised and therefore tutors role-modelled the critical use of data and judgement making in the prior tutorial with an exercise similar to that of the coursework task. However, few students performed it well, and thus the task was perceived as being marked unfairly hard. For example:

> And I came into your unit and got a three out of ten in my first course work. I thought, 'Hold on, I'm employing the exact same methods I did last year and the year before that and the year before that, and I'm getting a three out of ten. Am I wrong or is the unit wrong?' (Lewis, Post-exam interview).

Moreover, the study strategies that led to success in the past may work as a barrier to the adoption of new strategies:

> I think it's (i.e. that success is associated with past strategies is) absolutely a barrier. At the risk of boasting, I've always been told I'm a good student. I got 97 in VCE, I got high distinction average last year. My weighted average mark is 86. I've been told that I'm a good studier by all these indicators (parenthetic comment added, Lewis, Post-exam interview).

Thus, previously successful students retain strong beliefs about their past approaches to learning and they may resist, rather than respond to, new approaches when they lead to poorer scores.

6.5.3 At least for a period, students will hold conflicting and unreconciled beliefs

The purpose of Sections 6.3 and 6.4 was to explicate a range of epistemic beliefs. This range also showed many examples where the different beliefs a student holds conflict.

For instance, one example relates to the reliability and relevance of information. Students will typically indicate a belief that accounting information is both reliable and relevant, and this seems to be explained by the fact that accounting information is regarded as important – since it is taught, studied, and used extensively by business – and so accounting should enjoy both attributes. Learning about the subjectivity and uncertainty of accounting requires students to see that these attributes tend to have an inverse relationship and they must become comfortable with the idea of needing to strike a balance between the reliability and relevance of information. The data presented in Section 6.4.3 show that reconciling beliefs about reliability and relevance was problematic for many. For instance, a quote from Lewis is repeated here. It shows a degree of conflict between a belief in the utility of past information – a belief strengthened by past teaching – and a belief in the utility of information not backed up with hard evidence:

> Accountants or accounting students, sorry, I think they'd be inclined to use the past information. It's what we've been taught to do, I think, to use past information. And I think that's pretty integral to the unit, this question actually, because future predictions, although they don't have the hard evidence of past information to back them up, that's obviously gonna [sic] be the most relevant information to base decisions on (Lewis, Week 6).

Another example is the conflict that arises between a belief in the authority and usefulness of an outcome of an accounting procedure and the belief that accounting information is a mere representation of a real world reality. Related to that, is the challenge of reconciling a belief that accounting is mechanical and procedural with a belief accounting requires critical thought and judgement. The challenge arising from this conflict is clear in the following quote:

> Yeah, it's a hard concept to grasp, I think. A very hard concept to grasp. To kind of get it out of the conceptual world into reality. It is a difficult concept (Lewis, Week 6).

Another was the conflict between a belief in learning from an active, skills-based approach to teaching and a belief in the traditional content-first approach. Section 6.4.5 presents data for both Myron and Lewis that shows they value the skills-based approach but at the same time will not let go of the traditional form of note taking. Other examples of conflicted and unreconciled beliefs follow.

At a point in the redesigned pedagogy, the SOLO taxonomy was used to inform students of variation in levels of understanding evident in students' work and to equip them in future to self-evaluate their work. The following discussion evidences a conflict as, on the one hand, Lewis acknowledges the taxonomy makes sense, yet on the other hand, he is inclined to reject it because he has not needed it in past educational systems:

> Yeah. It (the SOLO taxonomy) does make sense. I didn't actually see it as being useful. I thought coming to this unit that I already had a good idea of what constitutes a good answer and what doesn't constitute a good answer. I didn't really need taxonomy to tell me that. It might be different for other people. I know I've had a pretty good educational background. I went to [a prestigious private school], and so I have a pretty good educational background and that probably contributes to it. But, yeah. I think SOLO taxonomy, it seems like it's over-complicating an issue which should actually be really simple (Lewis, Week 6, name of school deleted).

In Week 4, Lewis recognised that the redesigned pedagogy asked him to challenge things and yet in Week 6 he expected his tutor would tell him what he 'wanted to hear' in response to the forthcoming assessment task. Further, in a Week 6 discussion, Lewis acknowledged the need to learn accounting as a way of thinking as opposed to having knowledge. However, what he went on to say shows he was conflicted; arguing that it was not true in all areas of accounting:

> I just think it's hard in this unit in particular because there are aspects of it which are methodical like that, and they're all about getting the process right rather than

> understanding ... There are some aspects of this unit which go down that line, which are a bit more rigid and don't... Where it's not all about critical thinking (Lewis, Week 6).

Lewis went on to suggest the method of allocating support department costs as an example of where understanding was not necessary, that knowing the procedure suffices. He altered his belief in Week 10, however, when he acknowledged the need, when applying the method, to think critically:

> Okay. Yeah. I guess the critical thinking part's kind of the next level up, isn't it? It's kind of, you've got your figures or you've done the methods, well, what does that mean? That's the essence of the unit, isn't it? (Lewis, Week 10)

Furthermore, he added the insight that deeper understanding includes understanding…

> … why the method comprises what it does (Lewis, Week 10).

Regarding beliefs about assessments, Lewis said in answer to the question 'What made you successful at [his pre-university school], when it came to the exams?'

> Giving them what they want to hear. You learn the course material back to front… Look, that's the way the world works. I wish it didn't work that way, but that's the way you got to play the game (Lewis, Week 6).

Subsequently, on reflecting on his approach to study at the post-exam interview, Lewis claimed a very different approach:

> For me, personally, I did all my in-semester critical thinking and lecture engagements, not necessarily for the fact that I gained marks throughout the semester. That wasn't really my motivation. The motivation was that... It'll help for my final exam, it'll help my final mark overall, it'll help my understanding because I've found that the value of in-semester assessment is not about what it contributes to overall unit score, the value is what it contributes to the knowledge you need to have or the understanding you need to have to pass the unit (Lewis, Post-exam interview)

However, there is evidence to suggest in the course of the semester that Lewis responded to a mix of unreconciled beliefs about assessments. For instance, at times when understanding the content was more challenging, Lewis …

> … was more inclined to kind of just absorb the views of my tutor instead of developing my own (Lewis, Post-exam interview).

Another example concerns reconciling his belief in note taking, something he believes made him successful in the past, with new realisations that emerged from the lecture approach used in the redesigned pedagogy:

> **Interviewer**: but there's this personal thing that says, 'I wasn't taught in my usual way, therefore I can't feel good as I would have if I was taught the usual way.'
>
> **Lewis**: Exactly. I'd agree with that. I always think that a large amount of notes equates to good understanding, but... Well, I'm kind of challenging that now of course.
>
> **Interviewer**: And it's not easy to go with that idea, is it?
>
> **Lewis**: No. It's kind of safe as well because it's worked... It's worked in the past, yeah. So, it's kind of safe approach to take (Lewis, Week 7).

Another example arises in respect of the lecture approach. The lecture aimed to teach methods of solving problems in a way that required critical thinking and judgement. The role of note taking in this context is very different from its role in a lecture context where content is transmitted. Coming to terms with this, and hence reconciling beliefs about the role of note taking and memorisation, is challenging, as exemplified in the following exchange:

> **Interviewer:** ... learning how to think can actually require less time than swotting up all your notes, making all of your notes, then memorising or interpreting your notes. The traditional way could perhaps be the slower, more time-inefficient way.
>
> **Lewis:** But I agree with that, in terms of time it takes for you to learn the concepts, but then there's also the aspect of the quality of your understanding. If you've got it on paper, you can go through it over and over and over and make sure you got every definition down and what not. Isn't there a learning pyramid where you only remember 10% of what you say and 20% of what you write and... So, if you've only been taught

> it, it's been told to you and you haven't written it down or you haven't done anything better than that, what's the quality of your understanding gonna [sic] be like if it's taught in Week Two and the exam is in Week 12? (Lewis, Week 7)

Hence, the data suggest the development of epistemic beliefs is not a linear process in which a learner's beliefs shift from a current to an alternative. Instead, a learner's beliefs about knowledge and learning vary across different aspects of the pedagogy, and a learner may hold multiple, conflicting and unreconciled beliefs simultaneously, at least for a period of time.

6.5.4 Students may not be aware their beliefs are shifting and behaviours changing

The data suggest that in the process of changing epistemic beliefs, behaviours may change in advance of students being aware of the associated epistemic belief. This lag in what students espouse as what they support (say they believe) behind what they actually do means that data describing students' responses to a new pedagogy need to be treated with care - the real situation in regard to improvements in learning may be somewhat more positive than seems to be the case.

For instance, Lewis's study behaviour changed towards seeking understanding:

> Did I end up extracting more meaning out of the course? Probably not to the extent that you were asking for. I did make a conscious effort to make sure I understood the material instead of just memorising the methods, but still probably not to the extent that you were asking for (Lewis, Post-exam interview).

Further, Lewis may not have realised the extent of his own change. The fact he was comfortable with the meaning of the question (extracting more meaning) suggests a shift in epistemic beliefs. Interestingly, Lewis was surprised after the exam by how much he understood the content without having to resort to memorisation:

> But, that said. In the exam, I actually surprised myself with how much I, actually, remembered. Or maybe, it wasn't even how much I remembered that the extent to which I could understand without the need to remember. So, I think I surprised myself, that way (Lewis, Post-exam interview).

In Week 6, Lewis espoused the belief "you learn the course material back to front". By that, Lewis meant that to master a course, he familiarised himself with the content in its entirety and sought to become capable of recalling all of it. It is likely that not all of it would have made sense to him however. On reflection at the post-exam interview, and with reference to the redesigned pedagogy, he indicated a change in belief, for example, to a belief that learning requires the construction of meaning:

> Now I see how it's better (Lewis, Week 6).

In addition, when asked if he could have done as well on the exam if he had adopted a memorisation strategy, he explained a reason for his belief that the redesign was better:

> I would have done as well, yeah. It would have been a lot harder to study for… Just would have been a little more effort. Would have been working harder rather than working smarter (Lewis, Post-exam interview).

Of course, the less the exam required memorisation, the less true Lewis's view would have been. As described in Section 3.6 'The Learning Situation', an analysis of a sample exam was provided to students that showed 39% of marks were associated with uni-structural and multi-structural questions; these being questions whose answers lend themselves to memorisation. In reality, the final exam had a relatively larger amount, 48%. Thus, Lewis's comment was shaped by his experience of the exam that provided considerable reward for memorization.

It probably is not surprising that students learning behaviours and subconscious beliefs may change in ways that are in advance of what they espouse when asked for overall judgements. To make such a judgement requires them to stand back and reflect on things they have never reflected on and which they lack a language to reflect with against agendas that they have little experience in thinking about.

6.5.5 Conscious beliefs may be shifting, but students face the dilemma of staying with old instead of moving to new study behaviours

Data show that the change of epistemic beliefs can be hindered by, as well as result from, dilemmas students face in choosing to stay with prior study methods or moving to new and different methods.

For example, the dilemma implied by the following quote has its genesis in the fact that the pedagogical design in other units in the student's course took traditional approaches:

> And also, given the fact that this unit is... It's actually a bit in isolation, like this teaching method hasn't been used elsewhere. The emphasis that you place on critical thinking, thinking for ourselves that hasn't been in other units. So that's also what makes it hard, a hard concept to grasp (Lewis, Week 6).

Similarly, the following quote highlights the effectiveness of past methods as a cause of behavioural dilemmas:

> The reasons for that is because it's worked in the past. I'll learn the course material and it almost seems like wasted effort to go outside of that and question things; or understand it fully instead of just regurgitating it. I'd just... In the past I've seen it as a waste of time because that's not what they're looking for in exams of other units (Lewis, Week 6).

In a conversation about this unit being about knowing how to solve problems, about having skills, and therefore the need to study for skills not just acquiring content, Lewis's response underlines the acuteness of the dilemma:

> It's a big corner to turn I think. I haven't turned the corner yet, but I think once you have turned the corner it should take care of itself (Lewis, Week 6).

At post-exam interview, in answer to the question 'do you think your approach to study changed at all across the 12 weeks?' Myron indicated that when faced with the dilemma of changing his study behaviour, he chose to stay with his usual approaches. The quote also shows at least, an awareness of an alternate epistemic belief, if not in fact a belief that Myron came to hold:

> Not really honestly. Like I said, I like going over my notes, and I did everything very similar to how I normally do. Like obviously, <u>you learn things doing your way and like, your own way, and I sort of stuck to my guns</u> with that. I think it sort of helped. Like I said, what I do, I write notes and that's very time consuming, and it's <u>not necessarily a smart way to study</u>, but that's how I sort of take in the information. And from that, as I said, I make little notes on the side, not just like notes from the textbook, but stuff that like, that I noticed during the semester, like little hints and tips for myself when I go over and review my notes (Myron, Post-exam interview).

Thus, Lewis and Myron had the dilemma of contemplating changing approaches only for the sake – they believed - of this unit.

6.6 Factors affecting change in beliefs

6.6.1 Preface

Four factors affecting change in students' epistemic beliefs were apparent in the data. They are the textbook, risk, metacognition and language, and the paradigmatic nature of the desired change. This section proceeds by outlining them.

6.6.2 Textbook

The data show the textbook to be a significant influence on epistemic beliefs and their development. In fact, for some students, the textbook was more influential than the lecturer's commentary and other aspects of the redesigned pedagogy such as the assessment requirements.

In part, this may be explained by the historical influences that have shaped the context of accounting in higher education today (Section 3.1). Traditionally, accounting education has adopted a transmissive approach, and higher education institutions have seen the development of practitioner skills as the responsibility of the professional associations. Thus, the nature of textbooks has remained largely the same over the last several decades, as have teachers' ways of using them.

Despite the shift generally in education from transmissive to constructivist views of teaching, the nature of textbooks have changed little. There are reasons for this, partly the challenge of writing a different kind of book but also, more significantly, publishers' willingness to take the risk on such a book. Nevertheless, textbooks aimed at transmitting content instead of facilitating the construction of meaning are deficient. This deficiency in accounting textbooks was highlighted by Lewis in an interview as well as by a student in response to the SETU survey question 'how could the unit be improved?'

> I may have been referring to the textbook questions which they didn't ask the questions from a kind of critical thinking point of view, did they? … They asked it from a kind of traditional kind of learning point of view. So I think that was what I was referring to, the disconnect between what the textbook questions were asking and what we were meant to get out of it (Lewis, Post-exam interview).

> The link between the textbook and critical thinking (SETU, 102).

The lecturer advised students as to the scope and priorities for their learning in lectures, etc. Lectures covered the key ideas and ways of thinking required by the exam. Lewis confirmed this in an interview:

> Yeah. The content of the exam is pretty closely linked to the lectures and very loosely linked to the text (Lewis, Post-exam interview).

However, the counter-productive role of the textbook as the primary influence in a student’s determination of required content and outcomes is apparent in the following quote:

> The fact that you had only focused on the core concepts in the lecture, there was all this stuff that you had to go and look up afterwards… that's the only reason I would go to the text really. I wouldn't really go to the text if it got taught in the lecture. I'd go to the lecture notes (Lewis, Post-exam interview).

The following quote provides further evidence on this point:

> Another problem is with the textbook, our critical thinking expectations are not complemented by the text book, and as the text book is the first thing we look at after the lecture it is hard to know what is really expected of us (SETU, 73).

These data raise an issue that was not anticipated, and is not recognised in the literature: the way concepts are presented (in texts in this case) reflects the epistemic views and the views about the domain of the text writer and thus can be unhelpfully discordant with the way the same concepts are presented and treated in class.

6.6.3 Managing risk

As explained earlier, the data suggest the development of epistemic beliefs is not a linear process in which a learner’s beliefs shift from a current to an alternative. Instead, a learner’s beliefs about knowledge and learning vary across contexts, and a learner may hold multiple, conflicting and unreconciled beliefs simultaneously for at least a period of time within a particular context.

An implication of this is that change in epistemic beliefs is an evolutionary process, not revolutionary, and change may require reflection and the wisdom of experience gained over a significant period of time. Furthermore, change in what the students are doing may come in advance of change in what they see as their beliefs about learning. The data suggest that some students were very aware of the risks associated with the adoption of the epistemic beliefs underpinning the pedagogical design and the associated study methods in the circumstances of a twelve-week semester:

> … but the same thing with a unit, you feel like you've got enough time to trial something and it doesn't work out, then you've wasted however many weeks (Lewis, Week 7).

> Yeah, that's probably what maybe one of the primary reasons I didn't want sort of change my approach 'cause of the risk like... I don't know, this is comfortable to me like I know I can do well with the way in which I do it now, and I'm still learning information and... Yeah, I just think this works for me and I don't... I didn't really want to change it up and shake things up because of the risk involved, like not necessarily, I think learning as efficiently or effectively (Myron, post-exam interview).

Related to the willingness to accept risk is the student's level of confidence to direct their own learning, and their ability to take feedback in order to inform their judgement of confidence. In other words, students who are confident directing their own learning and taking feedback are more likely to be risk-takers. For instance, when discussing the extent to which he adopted surface approaches to study, and in respect to a point during the semester when he was finding the content challenging, Lewis said:

> Yeah, I think this unit was a lot harder. Not a lot harder, but it was harder, more challenging for me. And I just think that meant that I was more inclined to take the view of my tutor and lecturer rather than develop my own view. Because I didn't have confidence that my view was necessarily right. So, I was more inclined to kind of just absorb the views of my tutor instead of developing my own. I think that's probably a reasonable explanation (final interview).

In other words, recognizing the risks associated with changing beliefs about learning and adopting a different approach to learning, Lewis sought to avoid them by taking what he thought would be a safe route, i.e. simply absorbing the views of others. The attitude of his tutor, Bill, would have encouraged this. Thus, if students are to take the risks associated with changing epistemic beliefs, it is vital their environment, especially those teaching them, provide support and make them feel safe.

6.6.4 Metacognition/Language

Metacognitive knowledge and the language ability to express this knowledge seems likely to be a significant, perhaps very significant factor, in the process of changing epistemic beliefs. The data provide some support for this, but a limitation of the data types that was available is that they did not provide rich illumination of metacognitive processes in particular.

The data provide three instances of how this knowledge and ability plays out. Firstly, in the following instance, Lewis appears to have awareness of metacognitive constructs and instincts about his ways of learning but these were not organised as what could be called formal knowledge; he had only a weak language with which to express opinions and reflections. Commenting on his response to a conception of learning question akin to that of Marton et al. (1993) discussed in Section 2.1.1.1 of the literature review, Lewis said:

> I'm pretty sure I answered that learning was to acquire facts, methods, etcetera, to use at a later time, which I didn't reflect too much when answering this question, but the reason I chose that answer was because of how I've used the information I've learnt in class before (week 7).

Secondly, as well as metacognition being a factor in the process of change in epistemic beliefs, it is also a factor determining student's responsiveness to learning about metacognition. For instance, some students reject pedagogy designed to promote metacognition because they do not value awareness of cognitive strategies as being helpful for their learning. For instance, in response to a survey question about opportunities for improvement, a student made the comment:

> more content learning needed rather than focusing on HOW to study (emphasis in original, SETU, 80).

In both of these instances however, it is possible to engage in discussion about, and even debate over, the students' perspectives. The third instance is where metacognition or language is so poor that engagement in discussion is very difficult. As shown in Section 6.1, students with absolutist conceptions of knowledge and a conception of learning as being transmissive rather than constructivist are examples of this. Another example illustrates the dependency on language ability. The following exchange arose in a discussion of a lecture slide distinguishing learning for skill versus learning for the knowledge:

> Yurek: But I guess these slides showed... I guess it made a difference between skill and knowledge and what type of learning inculcates skill in a person and what actual knowledge is. Out of the two, knowledge is better because if the person has the knowledge he can use it anywhere and in any situation, but if just the skill is there, any situation like some tough times won't be able to handle all the kind of work, if only skill is there. But if knowledge is there, I guess the person would be more efficient.
>
> Interviewer: Okay. So learning to acquire facts, just to know more, you think is more important than to developing the skills?
>
> Yurek: Yeah, I guess so, because if you know these, you automatically know these. (Yurek, Week 7).

Thus, a student's level of metacognition and language ability is a factor that influences the process of change in epistemic beliefs because it affects their engagement in conversations about them.

6.6.5 The paradigmatic nature of change

Coming to terms with the significance of epistemic beliefs and conceptions of learning accounting is difficult, potentially life changing, and thus paradigmatic in magnitude. For example, a discussion about the question 'How much blind faith can you have in the calculations you perform when your calculations are based on uncertain information about the future?' centred on a conception of accounting as being subjective and uncertain. In the course of the discussion, Lewis said:

> Yeah. I don't really have anything to add to that. <u>I'm still getting my head around it now</u> (Lewis, Week 6, emphasis added).

6.6.6 Postface

Sections 6.4, 6.5, and 6.6 have presented data and findings regarding different perspectives on epistemic beliefs: the range of beliefs; how they develop; and key factors affecting their development respectively. The final quote (above) presented in closing the three sections in toto encapsulates the challenges associated with epistemic beliefs.

In the next section, data and findings concerning student perceptions of the redesigned pedagogy are presented.

6.7 Perceptions of redesigned pedagogy

6.7.1 Preface

This section presents SETU data relating to students' perceptions of the redesigned pedagogy. It does this by firstly, presenting responses to closed survey questions and then, secondly, presenting illustrative student comments about aspects of the redesign made in response to two open-ended survey questions that asked about the best aspects of the unit and the needs for improvement. Lastly, it presents perceptual themes that were inferred from the comments. I note in passing that it was these data that led to me being removed as lecturer in charge of this subject.

The data has limitations. As described in Section 4.6.3, the response rate to the closed survey questions was 33.2% of the 310 enrolled students and comments were provided by only 50.3% of the responders, which equates to 16.8% of all enrolled students. These response rates are likely to reflect bias, in that it is more likely students responded when they had strong positive dispositions, and even more so when their dispositions were strongly negative. Moreover, since the SETU survey was anonymous, it is not possible to match responses to closed survey questions or survey comments to other individual data such as those pertaining to epistemic beliefs, types of thinking, etc.

The responses to the survey questions presented in the next section show that the opinions of students about the redesigned pedagogy were highly varied. In fact, in broad terms the distribution of responses was tri-modal with roughly the same proportions favourable, unfavourable and neutral on all items. This, in conjunction with the limitations of the data, means that the findings in relation to this research question are essentially descriptive, rather than a quantitative analysis.

6.7.2 Students' responses to survey questions

As described in Section 4.6.3, the SETU survey was administered by the University during the period commencing Week 9 and concluding at the commencement of the final exam period. In the following charts, very satisfied and satisfied responses are aggregated and shown as favourable responses, and very dissatisfied and dissatisfied responses aggregated as unfavourable.

The distribution of responses suggests a mildly favourable perception of all five aspects of the unit, as indicated by the five charts below. The first, in respect to overall satisfaction, is shown in Figure 6-1. The spread of the proportions of the three categories (11%) is smaller than spread in relation to the more detailed questions that follow.

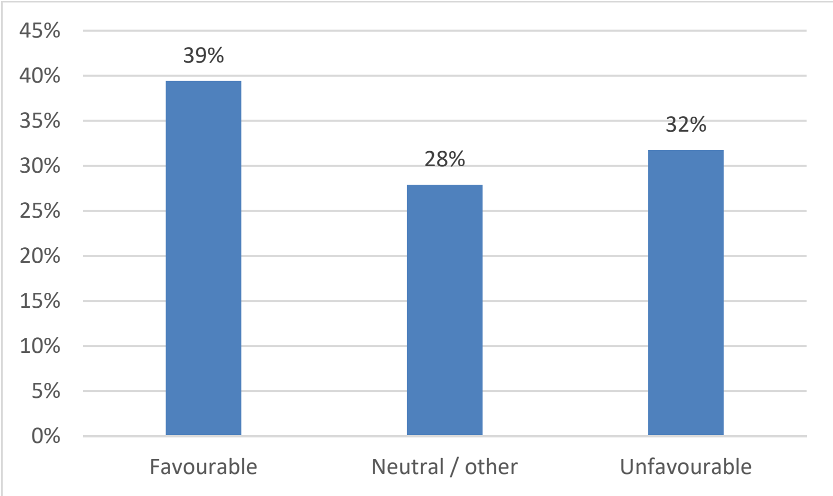


Figure 6-1 Overall favourability to the unit

There is a similar though slightly more favourable distribution of responses for the next four questions. The second chart, in respect to how well the unit enabled students achieve the learning objectives, is shown in Figure 6-2.

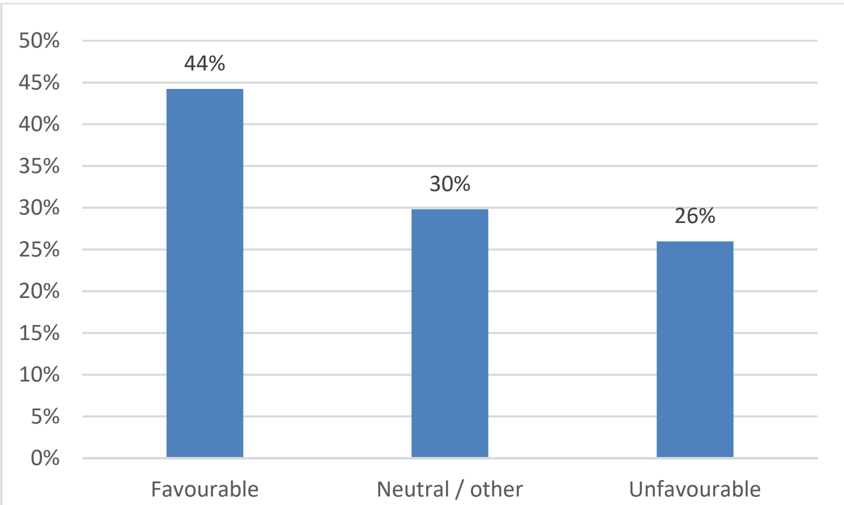


Figure 6-2 The unit enabled me to achieve its learning objectives

The third, in respect to the level of intellectual stimulation experienced by students, is shown in Figure 6-3.

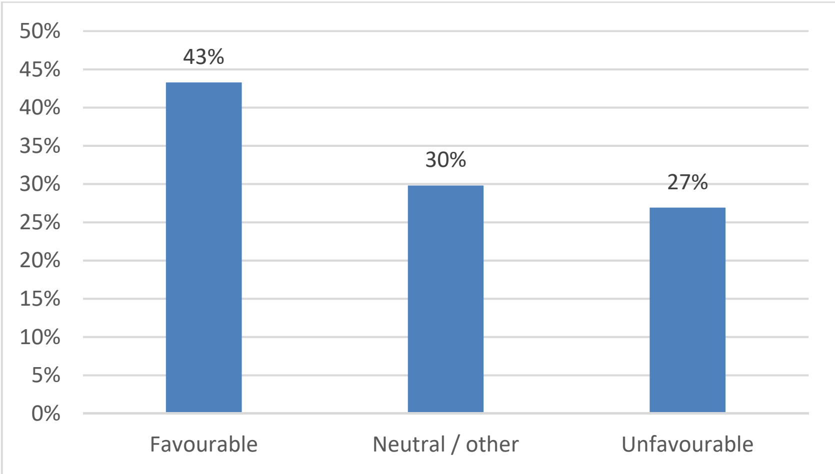


Figure 6-3 I found the unit to be intellectually stimulating

Figure 6-4, shown below, concerns whether the learning resources supported students' study.

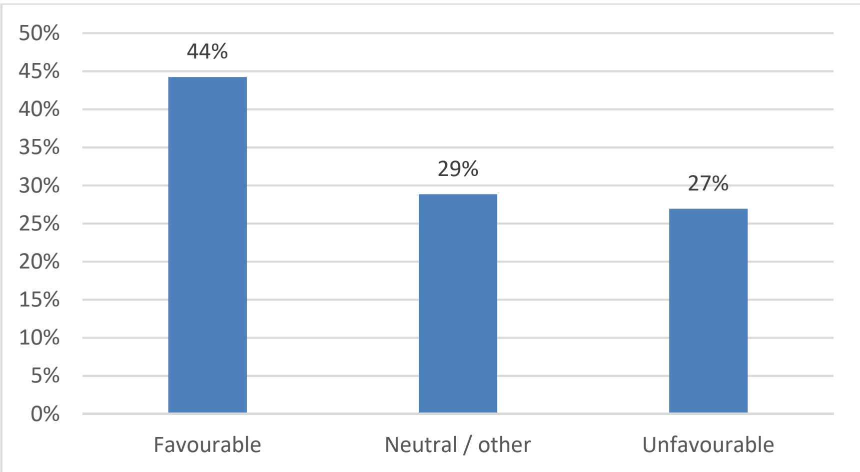


Figure 6-4 The learning resources in this unit supported my studies

Finally, Figure 6-5 shows the responses regarding satisfaction with the feedback received.

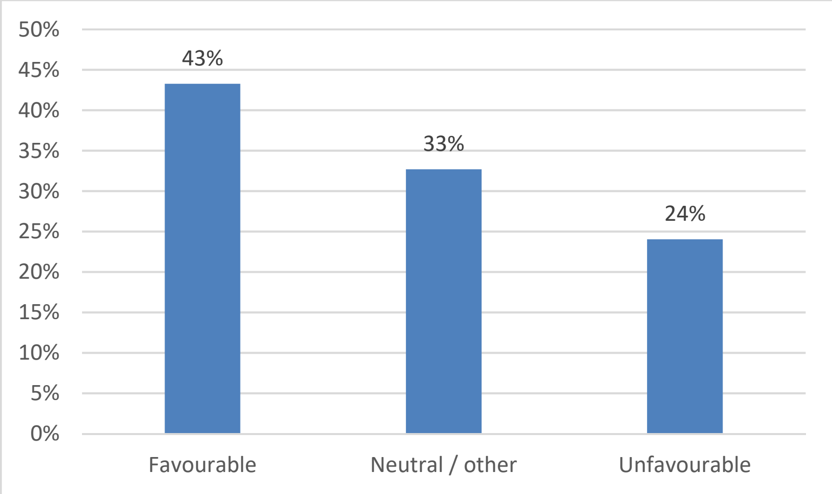


Figure 6-5 The feedback I received in this unit was useful

The distributions of responses across the categories of favourable, neutral and unfavourable are well spread in all five aspects. However, the percentage of respondents who were favourable significantly exceeds that of those who were unfavourable in all cases but least so in the case of overall satisfaction. It is not possible to be certain of the reason for this difference, although what follows gives some indications, but it is seems likely that there was an issue not captured by the last four more specific questions that was important for some students.

Given that this kind of instrument is likely to provide a voice for students unhappy with what was done, this balance could be taken to be relatively positive, but we cannot know. However, it is clear that there were significant numbers of students who ended the unit with favourable and with unfavourable perceptions.

The next section will present student comments that provide some insight why students were favourable or not.

6.7.3 Students' perceptions of aspects of the redesigned pedagogy

The comments provided in this sub-section were extracted from 104 responses given by 52 students to two SETU survey questions: what were the best aspects of the unit, and what is in most need of improvement? Some comments were disaggregated for the purpose of the analysis. The data has limitations in that the answers nominate aspects of the design yet often do not provide explanations why an aspect is good or how it might be improved.

The sub-section presents and discusses the comments in relation to five of the most commented upon aspects of the redesigned pedagogy: firstly, the overall structure and transition to the redesign, and then the more specific aspects of the design: lectures, the critical thinking / questioning activity, the tutorials, and the unit content. The presentation is in the form of five tables (Table 6-5 to Table 6-10 inclusive). Comments in the table, and when quoted in this section, are followed by a number in parentheses, e.g. (17). This number serves the simple purpose of an index to which comment is being used

The main perceptual themes that emerge from the comments about the five aspects are explored in the next sub-section. So that the discussion of these themes in the next sub-section can be related to the content of Tables 6-5 to 6-10 in this section, labels and themes are introduced at this point in Table 6-4 and the tables in this section show for each comment the label pertaining to the respective theme.

Table 6-4 Themes inferred from student comments

Label	Theme
1	Perceived approach led to better learning outcomes
4	Perceived approach was more interesting
5	Approach was perceived to engage students better in sense making
A	Objection to a different learning approach of any kind
D	Objection to amount of time perceived to be unproductive
R	Content of the unit was perceived to be too abstract
S	Perceived the encouraged approach to learning was too difficult
T	Rejection of self-questioning in the way required by the assessment

6.7.3.1 Unit structure, transition to it

As explained in Section 1.4 Introduction to the 'fundamental question', the unit transitioned to a new pedagogical design due to three concerns with the traditional approach. These were that it seemed accounting was perceived by students to be objective and certain, students appeared to adopt surface learning approaches, and there was an apparent lack of self-direction by students in their learning. Table 6-5 shows a range of comments made concerning the redesigned unit structure. They show that redesigned structure was somewhat successful in regard to two of the concerns.

Firstly, the favourable comments show the redesign helped shift students' conceptions of accounting, e.g. "made students think about accounting in a different manner" (37) and "there are no right and wrong answers" (43). Secondly, comments show the redesign was successful in helping students recognise the need to move away from surface learning approaches and "transition … from regular 'memorise the textbook' style" (56) and seek to integrate all aspects of a topic: "holistic thinking" (16). These suggest the unit structure had a positive effect on the first two of the three original concerns. However, one of these comments also stresses the criticality of managing the transition to a new design carefully: "… many students were overwhelmed by the sudden change and found it difficult to take it all in so suddenly" (56).

On the other hand, the unfavourable comments highlight some of the challenges faced by the redesigned pedagogy, in the form of some students' assumptions and presumptions. These assumptions and presumptions were tackled in lectures with little success in the case of the students who made these comments.

The first assumption is "a new approach to learning … that will only be used in one subject" (69). This assumption was held despite explanations of the approach in lectures and the justification that the approach aimed to support students in their aspirations to become professional accountants by helping and rewarding them to begin 'to think like accountants'. Another example of this is the comment "this critical thinking idea thankfully I will never see again" (73).

Related to this is the presumption that, in the students' limited experience of having studied accounting, their past way of studying financial accounting is the appropriate way of studying accounting generally, and cost accounting in particular. For example, "I believe that submitting questions and doing pre-lecture quizzes are not the ideal way of studying a unit, *particularly an accounting unit"* (emphasis added, 92). There is an interesting aspect to this; accounting can be called a professional degree in that it is preparing the students for a specific set of possible jobs, unlike, for example a degree in philosophy or mathematics. However for a significant, but unknowable number of the students this was not part of their thinking -their job was to pass the exams not to prepare for working in the profession. Of course it is likely that some students did not come to believe in the uncertainty of real world accounting, but the data indicates that probably most did.

Another presumption is about the nature of the final exam: that the student is confident in their knowledge of an exam that they have not yet seen, and that it will be similar to financial accounting exams they have sat before: “The format of teaching … was not exam-oriented” (97).

Thus, the comments about the redesign are mixed, and this will be evidenced further in the following discussions about more specific aspects of the redesign. The comments show some students had a favourable perception of the redesign and responded well to it, whilst others did not. They also suggest that for some students, the unit structure had a positive effect on two of the original concerns: that it seemed accounting was perceived by students to be objective and certain and that students appeared to adopt surface learning approaches. Details of the redesigned structure and findings about students’ perceptions of it and their transition to it contribute to two of the three research aims introduced in Section 1.7: explorations of how the redesigned pedagogy might promote thinking in the process of sense making and of the role of epistemic beliefs in relation to accounting information reports and techniques and pedagogy redesigned to develop beliefs about these.

Table 6-5 Comments regarding structure / transition to different pedagogical design

Favourable	Theme	Unfavourable	Theme
Structured differently, made students think about accounting in a different manner, concepts were explained in a way which made them seem quite easy (37)	1	…however I find it extremely inappropriate for the lecturer to try and introduce a new approach to learning in a second level subject that will only be used in one subject…(69)	A
There are no right and wrong answers, as long as you express your point properly. (43)	5	Structure of this unit. I believe that submitting questions and doing pre-lecture quizzes are not the ideal way of studying a unit, particularly an accounting unit. (92)	T
As it is such a different style of teaching, a more appropriate transition phase from regular 'memorise the textbook' style teaching to this style, as many students were overwhelmed by the sudden change and found it difficult to take it all in so suddenly. (56)	5	The format of teaching did train students to think critically but was not exam-oriented. Compared to other units, I have to spend more time than the suggested time to invest in this unit. (97)	
Holistic thinking (16)	1	Hated the whole structure, worst subject I have encountered to date. I am aiming for a pass. Enough said. (15)	
		… this critical thinking idea thankfully I will never see again, and hadn't seen before this subject which makes it hard to see the value. My view is I made it this far with traditional based learning so why risk failure by changing now. (73)	T
		Teach this unit as all other accounting subjects are taught in the future!! (55)	A

6.7.3.2 Lectures

As introduced in Section 3.6.3, lectures were redesigned as interactive conversations about methods of solving business problems. They aimed to stimulate thoughtful learning and consisted of four concurrent agendas. These were

- introducing and building meaning for the most relevant declarative knowledge,
- the application and solving of problems in real world contexts,
- building recognition of the uncertainty and messiness of real world data and solutions and thus the need for critical thinking and judgement, and
- teaching how to learn.

As often as was practicable, these agendas were linked to the likely prior knowledge or experiences of the students. Table 6-6 shows a range of general comments students made regarding lectures and Table 6-7 shows some comments specifically about the perceived productivity of lecture time.

Some students were favourable to the multi-agenda design of lectures, finding them more interesting than the traditional approach, for example, “Different way of delivering lectures which was more engaging and slightly more interesting” (11). However, others were concerned that the foci on real world implications and improving learning diminished the foci on declarative knowledge and problem solving they felt they needed, for example “I think that it was good to have the examples and questions but it would have also been good to have a little more reinforcement of the content (70) and “Not enough focus on covering the content of the unit in lectures” (86).

Others perceived the latter two agendas as entirely irrelevant to their learning and thus unproductive: “Apart from everything ...... lectures didn’t cover relevant material well enough ... too much time wasting in lectures” (54). Moreover, as well as these two agendas others were not so concerned about the application agenda either, for example “clarify what exactly needs to be understood, and actually teach the concept not work through an example’ (58).

On the other hand, some students valued the application agenda since they could apply the thinking gained in lectures to tutorial problems, for example, “LECTURE PROBLEMS WERE

EXTREMELY HELPFUL IN SOLVING TUTORIAL QUESTIONS” (emphasis in original, 10.2).

Others appeared not to be concerned with understanding for themselves how problems are solved, preferring to simply to be shown, for example “Lectures need to focus on tutorial questions” (78). This comment seems to suggest the student is content to reproduce lecture solutions in answer to tutorial questions.

Others rejected the ‘how to learn’ agenda. For example, “more content learning needed rather than focusing on HOW to study” (emphasis in original, 80). Student concerns with the multi-agenda design of lectures is not surprising; it is a change from what they are familiar and change is almost always unsettling. Thus, lecture time was allocated to dealing with transitionary issues, but since the need for transitionary support was not the same for all students, some students perceived the use of time in this way negatively, for example, time was “wasted … explain(ing) information that was readily available in the unit guide” (99.1), or lecture activities “became repetitive” (53.2). However, some students continued to hold erroneous presumptions and assumptions about the unit as described in the previous sub-section 6.7.3.1 despite the time invested to facilitate transition.

Some comments show students favourable to the linkage of agendas to their likely prior knowledge or experiences. For example, this was one of the main purposes of pre-lecture quiz questions and comments 30 and 42 are favourable about them. Others appreciated the use of examples in lectures based in their personal experience, for example, “using alternate examples in lectures to explain things” (12.2).

Others, however, could not see the relevance of the pre-lecture quiz content to the topic, for example, “Pre-lecture in moodle is useful, but I think some questions are not related to our course” (36).

Finally, some students were concerned with the real or perceived additional effort associated with the multi-agenda lecture design, for example, “Attendance of lecture AND completion of a quiz to obtain one mark for the overall grade was … not worth the effort” (emphasis in original, 57). Others however, were happy to make the effort since it could be rewarded with assessment marks for Lecture Engagement, for example, comments 29 and 41.

Table 6-6 Comments regarding lectures

Favourable	Theme	Unfavourable	Theme
Pre-lecture in moodle is useful, but I think some questions are not related to our course (36).	4	Attendance of lecture AND completion of a quiz to obtain one mark for the overall grade was very time consuming and not worth the effort. (57)	
LECTURE PROBLEMS WERE EXTREMELY HELPFUL IN SOLVING TUTORIAL QUESTIONS. (10.2)	5	Lectures need to focus on tutorial questions (78)	S
Different way of delivering lectures which was more engaging and slightly more interesting. (11)	4	I think that it would be more beneficial to cover the content a little more extensively in lectures. I think that it was good to have the examples and questions but it would have also been good to have a little more reinforcement of the content (70)	R
using alternate examples in lectures to explain things (12.2).	4	clarify what exactly needs to be understood, and actually teach the concept not work through an example. (58)	R
marks for attendance (29)	8	Apart from everything ...... lectures didn't cover relevant material well enough ... too much time wasting in lectures. (54)	R
Multiple choice quizzes. (30)	4	Four other responses nominated lecture format (74), lecture material (75, 95) or lectures (77) in response to the aspect needing improvement question.	R
The marks awarded for going to lectures. (41)	8		
The pre-lecture quizzes (42)	4		
Lectures (24.1, 25, 26)	4		

Table 6-7 Comments regarding perceived productivity of lecture time

Unfavourable	Theme
Sometimes in lectures, focus on previous study took up 30+ minutes which didn't really need to be taken and became repetitive. (53.2)	D
more content learning needed rather than focusing on HOW to study (80).	D
The lecturer wasted at least 30 minutes every lecturer to explain information that was readily available in the unit guide. I understand there were people studying the unit whose first language wasn't English, however for the majority of students valuable learning time was wasted. (99.1)	D
Not enough focus on covering the content of the unit in lectures (86)	D
Time taken to begin the week's content in the lecture was way too long. (60.2)	D

6.7.3.3 Critical Thinking assessment / questioning

The original concerns explained in Section 1.4 were that it seemed accounting was perceived by students to be objective and certain, students appeared to adopt surface learning approaches, and there was an apparent lack of self-direction by students in their learning. The review of the literature on student self-question in Chapter 2 shows the importance of student self-questioning to all three of these.

This section presents comments regarding the Critical Thinking assessment and its focus on questioning. Some of the favourable comments show the redesign was successful with some students associating the critical thinking assessment and questioning with more or better ways of thinking, for example, “CRITICAL THINKING QUESTIONS HELPED ME THINK MORE CRITICALLY ABOUT EACH RELEVANT CHAPTER” (emphasis in original, 10.1) and “make us think more” (28). Another comment suggests that the activity promotes thinking, for instance, “teaches us a different way of thinking” (38). Moreover, other comments show the association between the activity and deeper understanding, for example, “we are encouraged to actually think about and understand the topic and content, which l have always tried to do rather than rote-learn” (52). A second example of this is “IF WE WERE ENCOURAGED TO GENERATE 3 POWERFUL QUESTIONS INSTEAD OF ONE, IT WOULD HELP US UNDERSTAND THE UNIT MATERIAL MORE THOROUGHLY” (emphasis in original, 71).

However, some unfavourable comments show that some students perceive the activity to be irrelevant. For example, "I found the material in the course relevant however they were not complemented by the processes (critical thinking/powerful questions)" (19.1). Others reject it completely, for example, "Critical thinking questions were a waste of time" (60.1) and "Getting rid of the powerful question, it is more annoying than helpful" (66).

One comment suggests the ways of learning promoted by the unit's redesigned pedagogy may be transported to other units, for instance, "I think the encouragement to think critically has greatly improved the way that I approach all questions in all areas of my studies and so therefore has been greatly beneficial" (21).

Two of the unfavourable comments raise the question of how early – in terms of how large a knowledge base must be acquired - before a student can be questioning what they are learning. These are "Lucky I had a … tutor who didn't focus on critical thinking but taught us the 'basic knowledge' that the lecturer assumed we already had (27), and "critical thinking seems not suitable for my stage, need to learn 'how to do it' first" (61). This last comment raises an important issue; the value for students of their investing energy in constructing questions is heavily dependent on the skill of the tutor in working with these - and one tutor was actively opposed to the whole endeavour and another misunderstood my thinking,

Other unfavourable comments are interesting in that they call attention to the types of learning that students recognise or value. The focus on questioning was concerned with developing ways of thinking and skills as well as the acquisition of knowledge. The following comment suggests the more abstract nature of the former is not recognised, or the learning of it is not valued: "The continuing process of critical thinking and the lack of substance on it as well as the lack of actual material presented" (94). In a similar vein, this comment suggests the more abstract material interferes with quality learning: "… the critical thinking assessment … does not help student to understand the content. Instead it further complicates the materials" (89).

The generation of questions as part of the assessment was a means to an end; not an end in itself. Consequently, the redesigned pedagogy sought to value all but the obviously thoughtless or effortless questions on the basis that any question whose answer a student thought was worthwhile to find should be regarded as a good question. Thus, a balance must be found between the focus on the types of question generated and the focus on ensuring students find answers to them. The following unfavourable comment may be suggestive of the balance being lost in the case of their tutorials: "I beleive [sic] tutorials still focused too much time on the critical thinking aspect of the unit, whereas this time could have been better spent by going over tutorial questions" (99.2).

The final comments draw attention to the reality that thoughtful learning, based on self-generated questions, is intellectually hard work compared to traditional, passive learning. The first comment shows the student recognises and values this by the use of the term "the real brain work" (90). On the other hand, some students might value brainwork but find it very difficult: "sometimes, I genuinely do not have a question" (53.1).

Thus, the comments made about critical thinking assessment and its focus on questioning provides a range of perspectives on this aspect of the redesigned pedagogy and its value. They also show signs that the critical thinking assessment and its focus on self-questioning had a positive impact on two of the original concerns: students appearing to adopt surface learning approaches and the apparent lack of self-direction by students in their learning. Consequently, details of the critical thinking assessment and findings about students' perceptions of it contribute to two of the three research aims introduced in Section 1.7: explorations of how the redesigned pedagogy might promote thinking in the process of sense making and of how redesigned pedagogy might promote self-directed learning.

Table 6-8 Comments regarding critical thinking assessment / questioning

Favourable	Theme	Unfavourable	Theme
Critical thinking built in learning process so student know the logical reasoning behind the objectives (8)	5	I found the material in the course relevant however they were not complemented by the processes (critical thinking/powerful questions). (19.1)	T
Critical thinking is emphasized in both lectures and tutorials, which is essential for good grades in this unit. (9)	1	Lucky I had a more practical tutor who didn't focus on critical thinking but taught us the 'basic knowledge' that the lecturer assumed we already had. (27)	R
CRITICAL THINKING QUESTIONS HELPED ME THINK MORE CRITICALLY ABOUT EACH RELEVANT CHAPTER. (10.1)	1	Although I understand the reasoning behind the Questions we must submit every Week ... sometimes I genuinely do not have a question. I find that my I can't generate a question until we really delve into a topic during tutes, and by then it is too late to receive marks for it. (53.1)	S
I think the encouragement to think critically has greatly improved the way that I approach all questions in all areas of my studies and so therefore has been greatly beneficial (21)	1	Critical thinking questions were a waste of time. (60.1)	D
make us think more (28)	5	critical thinking seems not suitable for my stage, need to learn 'how to do it' first. (61)	S
(continued next page)			

teaches us a different way of thinking (38)	5	I beleive tutorials still focused too much time on the critical thinking aspect of the unit, whereas this time could have been better spent by going over tutorial questions. I beleive [sic] the critical thinking aspect of the course needs to be changed. (99.2)	D
we are encouraged to actually think about and understand the topic and content, which l have always tried to do rather than rote-learn. (52)	5	The way that I critically THINK about something may very well be different to the way someone else critically THINKS. (76.3)	T
IF WE WERE ENCOURAGED TO GENERATE 3 POWERFUL QUESTIONS INSTEAD OF ONE, IT WOULD HELP US UNDERSTAND THE UNIT MATERIAL MORE THOROUGHLY (71)	5	Remove the critical thinking assessment as it does not help student to understand the content. Instead it further complicates the materials. (89)	T
Show how to do the work in a way that does not give answers as it will skip the real brain work (90)	5	Getting rid of the powerful question, it is more annoying than helpful. (66)	T
critical thinking (7)	5	The continuing process of critical thinking and the lack of substance on it as well as the lack of actual material presented. (94)	R
		The powerful question aspect (104)	T
		critical thinking (59)	T

There is an important aspect of the question data to be considered when evaluating all of the above - overwhelmingly most students posted multiple questions and most of these reflected high order thinking. Hence it may be that the SETU data reflects a bias towards those students with negative reactions, it may also be that numbers if students who engaged in valuable thinking in constructing their questions did not recognise that this was valuable. This comment is in no way an attempt to suggest that the reaction to the pedagogy was not mixed, only that the data allows for no clear sense of the reactions across the whole cohort.

6.7.3.4 *Tutorials*

Comments in relation to tutorials are shown in Table 6-9. Some of them indicate discussion took place in tutorials, potentially an indication that, if students were engaged in making sense of something, then deep learning was taking place. For example, “Class discussion” (5) and “Tutorials were well discussed” (49). It is not possible to determine however, whether the discussion valued by these students was initiated by the tutor in the traditional way, or inspired by questions the students generated.

Clearly, some comments reflect a focus by students on the set exercises and the receipt of explanations of the solutions, and thus the value of discussions in the traditional approach. For example, “Getting solutions to the tutorial questions” (14), and on some occasions, participating in active tutor-facilitated discussion of the solutions, for example, “Doing questions in the tutorials and discussing the answers” (12.1).

It is not clear that any of the comments indicate that students valued the discussions inspired by their own self-questioning. However, comments reflect that some students wanted less of that type. For example, “focus more on tutorial question in class” (65), “allocate some time in every tutorial to go through practical questions rather than spending so much time discussing critical questions” (87), and “Need more explain [sic] for tutorial questions” (82).

Another comment shows the student’s preference for mechanical calculative exercises and their lack of recognition that self-questioning applies to calculative exercises too: “Need for more calculation exercise in tutorial because sometimes students just put up questions just because they will be scored from that and may not actually review the tutorial question …” (81).

Finally, another comment shows a student’s dependence on hearing solutions explained to the point of requiring explanation of every solution, not only in this unit but also in other units: “Discussion of tutorial questions in detail in class. Like other tutorial sessions in other units, tutor doesn't go through all tutorial questions during class. This makes us [sic] a bit difficult to study …” (63). This suggests a poor ability to direct one’s own learning or to cope in the university context.

In summary, discussions in small groups and in class are suggestive of deep learning activity and there are comments to indicate these took place in tutorials, thus addressing to some degree one of the three original concerns. However, the construct of deep versus surface processing is a construct that is describing the intentions of the learners; deep processors are dissatisfied if they feel they do not well understand what they are doing, surface processors simply want to get the task done expending as little extra energy as possible. There is always a spread along this continuum and students who entered the course who were towards the surface processing end would be expected to have some negative reactions.

No comments indicate that the tutorials were actually effective in addressing the other two original concerns: accounting was perceived by students to be objective and certain, and there was an apparent lack of self-direction by students in their learning. However, details of the nature of the redesigned tutorials and findings about students' perceptions of it make a contribution to one of the three research aims introduced in Section 1.7: to explore how the redesigned pedagogy might promote thinking in the process of sense making.

Table 6-9 Comments regarding tutorials

Favourable	Theme	Unfavourable	Theme
Class discussion (5)	5	focus more on tutorial question in class. (65)	S
Doing questions in the tutorials and discussing the answers (12.1)	5	Not all tutors did the tutorial questions and instead focused on the powerful questions. (85)	R
Getting solutions to the tutorial questions (14)	8	Probably allocate some time in every tutorial to go through practical questions rather than spending so much time discussing critical questions. (87)	D
I actually learn something in the tutorial. (18)		Need more explain for tutorial questions (82)	R
		Discussion of tutorial questions in detail in class. Like other tutorial sessions in other units, tutor doesn't go through all tutorial questions during class. This makes us a bit difficult to study and follow up with the necessary calculations. Also, the tutorial answers provided on moodle, are a bit confusing. This confusion might not occur if they are discussed and gone through in class. (63)	R
Tutorials were informative and consise (48)		Need for more calculation exercise in tutorial because sometimes students just put up questions just because they will be scored from that and may not actually review the tutorial question but overall it is good. (81)	R
Tutorials were well discussed (49)			
Tutorials (24.2)			

6.7.3.5 Content

The redesigned pedagogy sought to cast cost accounting topics, not as textbook descriptions of mechanical procedures that required to be learnt, but as ideas of ways of solving problems in a business context. Thus, the design objective was more about the acquisition of personal ways of thinking, i.e. problem solving skills, and less about the reproduction of textbook content and techniques. Table 6-10 presents comments in relation to topic content.

Despite reinforcement of this objective in lectures, in assessment tasks and assessment rubrics, the unfavourable comments show, for various reasons, that some students did not internalize this difference.

One effect of the difference was that there was less content to learn: what mattered was that the student could apply the skill of solving a problem; not that they could reproduce most of the content of a textbook chapter. The aspiration was that students would therefore see cost accounting as relatively simple, and as grounded in their personal experience. Two of the favourable comments are indicative of this: "It was simple" (23) and "The content is quite simple and straight forward" (40).

However, the aspiration to reduce content to ways of thinking and the application of skills unsettled students who expected the content to be textbook-driven, for example, "give more notice about important part" (67) and "need to be clearer on the actual material rather than only the way of thinking" (83). One of the favourable comments shows an appreciation of how the textbook had become deficient in its support of the redesigned pedagogy and hence indicated this was an opportunity for improvement: "The link between the text book and critical thinking" (102). With content framed as a problem solving skill, another student highlighted how the application of the skill could be enhanced: "Maybe excel [sic] use can be included in the process" (79).

Another indication that some students did not internalise the difference was that some could not apply the problem solving approaches introduced in lectures to tutorial problems; in fact, they did not see the similarity between tutorial problems and the ones used in lectures: "Some lecture problems/techniques taught in the lecture differ from tutorial problems which was a bit confusing. …" (91).

The original concerns with the traditional pedagogy were that it seemed accounting was perceived by students to be objective and certain, that students appeared to adopt surface learning approaches, and there was an apparent lack of self-direction by students in their learning. Comments suggestive of an appreciation of content as problem solving skills, especially as skills that require critical thought and judgement, indicate this aspect of the redesigned pedagogy was successful in addressing all three concerns for many students. Accordingly, the way content was presented in the redesigned pedagogy and students' perceptions of it make contributions to all three research aims introduced in Section 1.7. In summary, where the goals of pedagogies include promoting deep learning, more sophisticated epistemic beliefs and self-directed learning then for many students the pedagogies will be more effective if the content is presented in a more sophisticated form. However, this aspect of the pedagogical design was not effective in relation to all students.

Table 6-10 Comments regarding content

Favourable	Theme	Unfavourable	Theme
Challenging content that enabled me to think within a real-world context. (4)	4	give more notice about important part (67)	R
It was simple. (23)	1	need to be clearer on the actual material rather than only the way of thinking (83)	R
The content is quite simple and straight forward (40)	1	Some lecture problems/techniques taught in the lecture differ from tutorial problems which was a bit confusing. Need more clarification. (91)	S
Useful in daily life (51)	4		
Maybe excel [sic] use can be included in the process (79)	4		
The link between the text book and critical thinking. (102)	5		

6.7.4 Major perceptual themes

Eight major themes regarding students' perceptions of the redesigned pedagogy were inferred from the comments across the five aspects discussed in the previous sub-section; three related to favourable perceptions and five to unfavourable. These sub-section proceeds by describing them and providing illustrative examples.

The three favourable themes concern perceptions about the learning outcomes, engagement in the pedagogical activities, and engagement in sense making.

6.7.4.1 Perceived approach led to better learning outcomes (Label 1)

A number of comments infer that students gain a better product from their learning because of the redesigned pedagogy. For instance, the following comment suggests the redesigned pedagogy was successful in its aspiration to change students' conceptions of accounting:

"Structured differently, made students think about accounting in a different manner, concepts were explained in a way which made them seem quite easy" (37).

Other comments refer to other attributes of good outcomes. Often, good outcomes are evidenced by a high degree of integration of the various aspects of the topic. A comment that exemplifies this is one that references "Holistic thinking" (16). Another attribute is the realisation that, once understood, the topic appears less complex than it seemed initially. Example comments of this include "It was simple" (23) and "The content is quite simple and straight forward" (40).

Other comments acknowledge that quality outcomes are related to critical thought; firstly as in the achievement of good final grades "Critical thinking is emphasized in both lectures and tutorials, which is essential for good grades in this unit" (9). Secondly, that the achievement of a critical perspective of a topic depends on a process involving critical thought "CRITICAL THINKING QUESTIONS HELPED ME THINK MORE CRITICALLY ABOUT EACH RELEVANT CHAPTER" (emphasis in original, 10.1).

Finally, a comment suggests the redesigned pedagogy will have indirectly improved outcomes in subsequent units studied by this student "I think the encouragement to think critically has greatly improved the way that I approach all questions in all areas of my studies and so therefore has been greatly beneficial" (21).

6.7.4.2 Perceived approach was more interesting (Label 4)

Students are likely to find interesting teaching approaches in which the pedagogical design stimulates or facilitates engagement in tasks and other learning activities. One way in which the redesigned pedagogy appears to have been successful in this was its use of problems set in students' personal experience. Comments that exemplify this are "using alternate examples in lectures to explain things" (12.2) and "Useful in daily life" (51).

Pre-lectures quizzes, comprising questions designed to stimulate interest in the lecture topic or help students recall relevant prior experience or knowledge were mentioned favourably by some students. For example, "Pre-lecture in moodle is useful…" (36) and comments 30 and 42 that nominated the quizzes as the best aspect of the unit.

In contrast to didactic lectures, the redesigned pedagogy sought to conduct lectures as interactive conversations about methods of solving a business problem. This form of engagement was commented upon “Different way of delivering lectures which was more engaging and slightly more interesting” (11) and “Challenging content that enabled me to think within a real-world context” (4).

The final comment suggest the problem-solving approach taken could be enhanced and presumably made more interesting by the integration of business tools, “Maybe excel [sic] use can be included in the process” (79).

6.7.4.3 Approach was perceived to engage students better in sense making (Label 5)

The final identified favourable theme is one that recognises the aspiration of deep learning and accepts the role of questioning and critical thought in that process.

One comment shows an emerging recognition that an absolutist approach to learning no longer fits accounting, at least cost accounting that is “There are no right and wrong answers, as long as you express your point properly” (43). Similarly, the following comment attests to the shift away from surface learning: “… transition phase from regular 'memorise the textbook' style teaching to this style …” (56).

Not only did some students find the lecture approach interesting, for some it was effective in equipping them with the way of thinking (skill) to solve unfamiliar problems. For example, “LECTURE PROBLEMS WERE EXTREMELY HELPFUL IN SOLVING TUTORIAL QUESTIONS” (emphasis in original, 10.2).

The essence of approaches to engage students better in sense making in contexts similar to cost accounting however, is thoughtful, critical learning. In other words, “the real brain work” (90) as opposed to sponge work. Other comments attest to the dependency on thinking: “make us think more” (28), “teaches us a different way of thinking” (38), and “we are encouraged to actually think about and understand the topic and content …” (52).

Moreover, the role of self-questioning as a means of inspiring and/or expressing thoughtfulness in the redesigned pedagogy was acknowledged “IF WE WERE ENCOURAGED TO GENERATE 3 POWERFUL QUESTIONS INSTEAD OF ONE, IT WOULD HELP US UNDERSTAND THE UNIT MATERIAL MORE THOROUGHLY” (emphasis in original, 71). With reference to the critical thinking activity that required generation of questions, the following comment provides additional support for this theme: “Critical thinking built in learning process so student know the logical reasoning behind the objectives” (8).

These three perceptual themes of students favourable to the redesigned pedagogy are of course counterbalanced by the unfavourable perceptual themes. This section proceeds by examining the five of these.

6.7.4.4 Objection to a different learning approach of any kind (Label A)

For some students, the unfavourable perception of the redesigned pedagogy reflects a rejection of new approaches; a resistance to change. It is an understandable human response but unfortunately, all measures taken within the redesigned pedagogy to overcome it failed for some students.

Two comments are sufficient as examples from which this theme was inferred. The first is “… however I find it extremely inappropriate for the lecturer to try and introduce a new approach to learning in a second level subject that will only be used in one subject…” (69). The second is “Teach this unit as all other accounting subjects are taught in the future!!” (Emphasis in original, 55).

6.7.4.5 Objection to amount of time perceived to be unproductive (Label D)

This theme was especially apparent in a particular type of comment about the lecture discussed in 6.7.3.2. This type of comment relates to the perception of time being used unproductively. Table 6-7, previously presented, shows examples of these comments and so only two are repeated here: firstly, “The lecturer wasted at least 30 minutes every lecturer to explain information that was readily available in the unit guide. I understand there were people studying the unit whose first language wasn't English, however for the majority of students valuable learning time was wasted” (99.1).

Secondly, as well as activity related to information about assessment requirements available in the unit guide, this perception applied to other activity within the lecture, for example, too much time “focusing on HOW to study” (80).

However, the theme was apparent in other aspects of the redesigned pedagogy. For instance, firstly, in relation to the critical thinking assessment and its focus on questioning: “Critical thinking questions were a waste of time” (60.1). Secondly, in respect of time spent in tutorials:

"Probably allocate some time in every tutorial to go through practical questions rather than spending so much time discussing critical questions" (87).

6.7.4.6 *Content of unit was perceived to be too abstract (Label R)*

This theme stands in stark contrast to the more typical undergraduate perception of cost accounting as being a unit that comprises sets of calculative procedures that result in objective and certain outcomes. This unit sought to develop in students a recognition that accounting information is not objective and certain, and thus critical thought and judgement is required in both the 'doing' of accounting as well as in the use of accounting information for the purpose of decision making. This theme reflects the comments of students who did not understand, or could not accept this different conception of cost accounting.

The consequences of the two different conceptions of cost accounting for students' perceptions of the unit are significant. When cost accounting is understood to comprise calculative procedures that result in objective and certain outcomes, then students are concerned with the content that describe these and demonstrates their application. The content that is the focus of their study is relatively concrete. In contrast, when accounting is conceived as subjective and uncertain the focus becomes the nature of the problem and consideration of the assumptions and judgements employed in thinking through potential approaches to a solution. Consequently, the content that is the focus of study is a mix of concrete and abstract.

The difficulties experienced with the greater emphasis on the abstract aspects of the content is evident in the unfavourable comments illustrative of this theme. The comments vary in the degree to which the abstract nature was understood or accepted. For example, some comments suggest the abstract nature was barely accepted, if at all: "clarify what exactly needs to be understood, and actually teach the concept not work through an example" (58), and "The continuing process of critical thinking and the lack of substance on it as well as the lack of actual material presented" (94). Not surprisingly, these students tended to lack confidence they could recognise the more important content and consequently experienced discomfort; e.g. "give more notice about important part" (67). Some of these students would be dependent on the tutor to make clear what must be remembered, or what students must be able to do. For example, "tutor doesn't go through all tutorial questions during class. This makes us [sic] a bit difficult to study and follow up with the necessary calculations" (63).

Other comments show that students allowed for the abstract, but suggested the unit would be improved if the balance shifted towards more of the concrete. As examples, firstly, “I think that it would be more beneficial to cover the content a little more extensively in lectures. I think that it was good to have the examples and questions but it would have also been good to have a little more reinforcement of the content” (70). Secondly, “… lectures didn’t cover relevant material well enough …” (54).

6.7.4.7 Perceived the approach to learning encouraged by the pedagogical redesign was too difficult (Label S)

The redesigned pedagogy aspired to helping students adopt a particular approach to learning, for example, by engaging them in lecture conversations about methods of solving problems, and encouraging questioning of content and solutions to problems. Whereas the previous theme pertained to unfavourableness towards the abstract nature of much of the content, this theme pertains to unfavourableness towards the more abstract nature of the learning approach.

Firstly, some students had difficulty applying the problem solving methods role modelled in lectures to tutorial exercises. For example, “Lectures need to focus on tutorial questions” (78). Another example is “Some lecture problems/techniques taught in the lecture differ from tutorial problems which was a bit confusing” (91).This unfavourable perception may have been fuelled by the perception, and reinforced by experience in past units, that tutorial exercises had concrete, correct solutions, which is typical of textbook exercises. There is an important point here for textbook authors’ textbook exercises could be improved if they drew more attention to the assumptions and judgements upon which a solution depends. The goal here would be to stimulate students to reflect on the thought processes involved and possibly recall them from the lecture.

Secondly, some had difficulty initiating relevant questions about content despite being given a scaffolding tool (described in Section 3.6) early in the semester. For example, “Although I understand the reasoning behind the Questions we must submit every Week ... sometimes I genuinely do not have a question. I find that my [sic] I can't generate a question until we really delve into a topic during tutes, and by then it is too late to receive marks for it” (53.1). Whilst this comment raises a question about the dependency of questioning on an adequate base of knowledge, it also raises the question of why the delving into the topic that took place at the lecture did not suffice. Another example is “critical thinking seems not suitable for my stage, need to learn 'how to do it' first” (61).

6.7.4.8 Rejection of self-questioning in the way required by the assessment (Label T)

In contrast to the previous theme that was concerned with the difficulties students experienced regarding the learning approach, this theme is one of outright rejection of self-questioning as a formal learning activity. One comment shows the student rejected self-questioning especially because of its perceived misfit with accounting: “I believe that submitting questions and doing pre-lecture quizzes are not the ideal way of studying a unit, particularly an accounting unit” (92).

Another student rejected self-questioning because it complicated the content: “Remove the critical thinking assessment as it does not help student to understand the content. Instead it further complicates the materials” (89). Another rejected it because it hasn’t been important to their learning in the past: “… this critical thinking idea thankfully I will never see again, and hadn't seen before this subject which makes it hard to see the value. My view is I made it this far with traditional based learning so why risk failure by changing now” (73).

Finally, two other comments show a rejection of self-questioning because it was perceived irrelevant to learning: “I found the material in the course relevant however they were not complemented by the processes (critical thinking/powerful questions)” (19.1), and “it is more annoying than helpful” (66).

6.7.5 Insights into students’ epistemic beliefs

The reasons for many of the reactions reported above are likely explained by students’ epistemic beliefs. Starting with the negative responses it is clear that many, if not all students entered the course with beliefs about learning. Some students entered with little sense of what a rich understanding could feel like, it may be that their prior school experiences were influential here. Some students saw learning as being about accretion of declarative knowledge rather than building rich understandings - they may have had no experiences that allowed them to build meaning for the latter alternative. Many students clearly entered the course with entrenched views of the roles of lectures, notes and textbooks. These prior views were clearly of critical importance in how the students would respond to the teaching approach I took.

Related to the above is that the students who were accepted into the course had been successful in their previous education, were consequently confident in the value of what they had done previously and were resentful if their apparent performance dropped because of new criteria for successful performance.

Then there were a series of things that can be grouped under "some students were reluctant to…" They were reluctant to see learning as a complex construct, they were reluctant to move out of the confining boxes of learning the declarative knowledge in each chapter of the text, they were reluctant to confront the messiness and uncertainties of the real world of accounting and they were reluctant to see student reflection and critical thinking as valuable for them.

The nature of the data means that it is less easy to explore reasons for positive reactions, but clearly there were many of these. The removal of the planned data collection means that we know less about changes in students' beliefs, but clearly these did occur in a process that was incremental and where changes in learning practice led changes in articulated beliefs. However the sense of building richer and better understandings was important to some students as was the nature of the sharing of intellectual control in tutorials and lectures.

6.7.6 Postface

This section presented SETU data relating to students' perceptions of the redesigned pedagogy. It did this firstly, by presenting responses to closed survey questions. This data showed a fairly even tri-modal distribution of responses (favourable, neutral, and unfavourable) with a slight bias to the favourable. Secondly, it presented illustrative student comments in response to two open-ended survey questions that asked about the best aspects of the unit and the needs for improvement and thus a limitation of these data was that there were no neutral comments. This analysis showed polarisation in the distribution of comments favourable and unfavourable to each of five aspects of the redesign. Thirdly, eight perceptual themes inferred from these comments, three favourable and five unfavourable, were described and some possible reasons for these were given.

In the next section data describing how students behaved, cognitively, in the context of the redesigned pedagogy for three cost accounting topics are presented.

6.8 Behaviours

6.8.1 Preface

This section presents findings in relation to how students behaved in response to the redesigned pedagogy. Firstly, it presents findings in relation to participation in, and engagement with, various aspects of the pedagogy.

Next, findings are presented in relation to the cognitive behaviours of students when studying the three cost accounting topics lectured in Weeks 2, 4 and 12 of the semester: Cost Estimation (CE), Cost-Volume-Profit Analysis (CVP), and Standard Cost Analysis (SCA) respectively.

The cognitive behavioural findings are based on thinking behaviours inferred from tute-prep questions. The types of thinking were introduced in Table 4-8 and the related data presented in Chapter 5. For convenience, Table 4-8 is repeated here:

Table 4-8 The complete list of thinking types

Type	Type of thinking
1	Thinking aimed at entrenching/memorising
2	Thinking aimed at monitoring understanding
2*	Thinking about the rationale or purpose that underlies an idea
3	Thinking about implications, connections elsewhere at the conceptual level
4	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding
4*	Think about the wider implications and application of the rationale or purpose that underlies an idea
5	Thinking about, searching for, things that don't seem correct
6	Thinking in relation to perceived exceptions
7	Thinking about generating a question for the sake of having a question

As discussed in Section 4.10, the database of tute-prep questions has limitations. Firstly, the data are questions students judged as the 'most powerful' and hence were submitted by students as part of the weekly Critical Thinking assessment. As such, the data is not representative of all the questions a student may have generated; but represent the questions students judged as the most important to the improvement of their understanding.

Secondly, the questions were generated in private study in preparation for the tutorial. Thus, the questions were normally generated at a point in time in the learning process after students had experienced the lecture, and prior to them experiencing the tutorial. Nevertheless, the data enables insights to how students responded, cognitively, to the pedagogical design of these three cost accounting topics.

The number of questions indicative of type 2* and 4* thinking was very small, and therefore for the purposes of the following presentation, they are combined with the data for types 2 and 4 respectively.

This section proceeds by presenting findings in relation to participation and engagement, and then findings for all three topics about thinking behaviours in terms of sense-making phase, the mix of thinking types, the mix of types of knowledge structure, and the mix of topic ideas. It concludes with a summary.

6.8.2 Participation and engagement

The redesigned pedagogy and the way in which its aspects sought to encourage active learning were described in Section 3.6. Information apropos student participation and engagement in those aspects of the redesigned pedagogy follows:

Lecture attendance

This was high. One lecture (Week 7) clashed with a public holiday and a make-up lecture was made available in the intra-semester break. The average attendance across the other eleven lectures was 86%. Ten per cent (10%) of students attended four or fewer lectures (including the public holiday lecture). Only 2% of students never attended a lecture.

Lecture pre-quiz

On average, 19% of students each week did not participate in the pre-lecture quiz. This rate trended upwards in the latter half of the semester. Including the public holiday week, 56% of students participated in either ten or all eleven quizzes, and 5% did not participate in eight or more. Only 1% of students never submitted a pre-lecture quiz.

On average, 89% of the submitted quizzes were assessed as satisfactory.

Lecture engagement assessment

As explained in Section 3.6.5, the combination of students' activity in relation to lecture attendance and lecture pre-quizzes each week formed the Lecture Engagement assessment. On average each week, 64% of students achieved a satisfactory grade for lecture engagement. Across the eleven weeks, 50% achieved satisfactory in eight or more weeks, and 21% achieved satisfactory in four or fewer weeks. Only 3% never achieved a satisfactory lecture engagement in any week.

Tutorial attendance

On average each week, 75% of students attended tutorials. Attendance declined in the latter half of the semester. Seventy-one percent attended eight or more of the twelve tutes, and 9% attended four or fewer.

Critical thinking assessment

On average, 27% of students each week did not participate in the critical thinking assessment i.e. did not submit self-generated questions. This rate trended upwards in the latter half of the semester. Including the public holiday week, 61% of students participated, and 12% did not participate, in eight or more of the ten weeks. Only 5% of students never submitted a critical thinking assessment in any week.

On average each week, 83% of the submissions were assessed as satisfactory. Forty-one percent were assessed as satisfactory in eight or more of the ten weeks and 30% in four or fewer.

Final exam assessment

Of the total eligible students, 6.5% did not sit the exam. Of those who did, the grade distribution is shown in Table 6-11.

Table 6-11 Unit grade distribution

Grade	% of students
Fail	11.0%
50 – 59%	32.8%
60 – 69%	26.2%
70 – 79%	20.3%
80 – 100%	9.7%

Flexible coursework assessment

Under the flexible coursework assessment, a student's unit score would be the higher of a score based on all four assessments (Critical Thinking, Lecture Engagement, coursework tasks, and final exam) and the score based on the two more traditional assessments (coursework tasks and final exam) alone. The unit score of 64% of those who sat the exam was based on all four assessments.

In summary, the data show a very high degree of not only participation, but engagement in all of these aspects of the redesigned pedagogy. Consequently, engagement with the optional assessments, Lecture Engagement and Critical Thinking resulted directly in a higher unit score for 64% of students than if they had not been included. Potentially, they also resulted indirectly in higher unit scores for many of the other 36%.

6.8.3 Attention paid to sense-making phases

Section 4.7.1.2 of the Methodology chapter explained, within a constructivist view of learning, how analyses of self-question data would take account of the construction/reconstruction of ideas in the process of learning. Table 4-5, repeated here for convenience, summarises the framework used for this purpose. Moreover, Section 5.2.2 posits, by showing examples, how questions reflective of all types of thinking may potentially be directed to ideas in all phases of the sense making process.

Table 4-5 Phases of sense-making process

Phase / label	Description
1	Recognising existing ideas and/or relevant experience.
2	Evaluating them.
3	Deciding whether to reconstruct prior ideas / adopt the desired idea.
4	Reviewing/restructuring other relevant aspects.

Figure 6-6 shows, for each of the three cost accounting topics, Cost Estimation (CE), Cost Volume Profit analysis (CVP), and Standard Cost Analysis (SCA), the percentage of questions directed to each phase of sense-making process. It shows, for each topic, that almost all questions were directed at phase 3: deciding whether to reconstruct existing ideas and, if so, adopting the idea desired by the teaching approach.

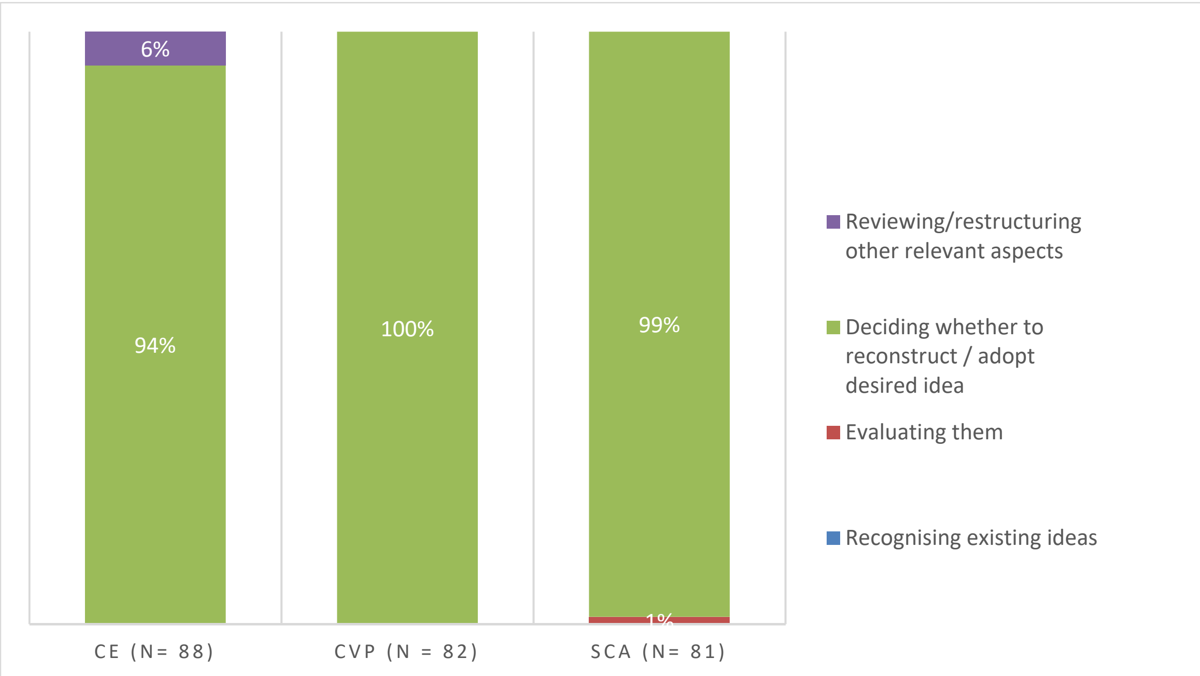


Figure 6-6 Attention paid to sense-making phases

Only a single question relating to the SCA topic was coded as ‘evaluating existing ideas’ and it referred to the answer to a pre-lecture quiz question that was discussed in the lecture. The quiz question was designed to tap into students’ pre-existing knowledge and/or prior experience of why the cost of fuel used in a driving holiday might have exceeded its budget.

The responses to the pre-lecture quiz question then were used to facilitate a discussion and analysis of the potential causes of budget variances in a manufacturing situation.

Thus, notwithstanding the limitation that the data consisted only of students' "most important" questions, students did not appear to attach great importance to recognising or evaluating existing ideas. This was despite a constructivist teaching approach that sought to help students make sense of cost accounting topics by connecting them to personal experience or prior knowledge.

6.8.4 The mix of thinking types by topic

The balance between lower and higher types of thinking

The use of the terms 'lower' and 'higher types of thinking' was explained prior to Section 5.2.1. Lower types included Types 1 and 2, and higher types included all others except Type 7. Figure 6-7 shows, for each topic, the distribution of thinking types underlying students' questions. It shows, on average across the three topics, the balance of thinking directed towards the higher types of thinking (types 3 to 6) was 31% greater than towards the lower types of thinking (types 1 & 2). In absolute terms, of the 251 questions sampled, higher types of thinking were inferred for 142 of them. This suggests many of the students were quite skilled at framing questions suggestive of higher types of thinking. This would appear to be a consequence of the redesigned pedagogy, in particular the assessment (Critical Thinking) from which the question data were collected.

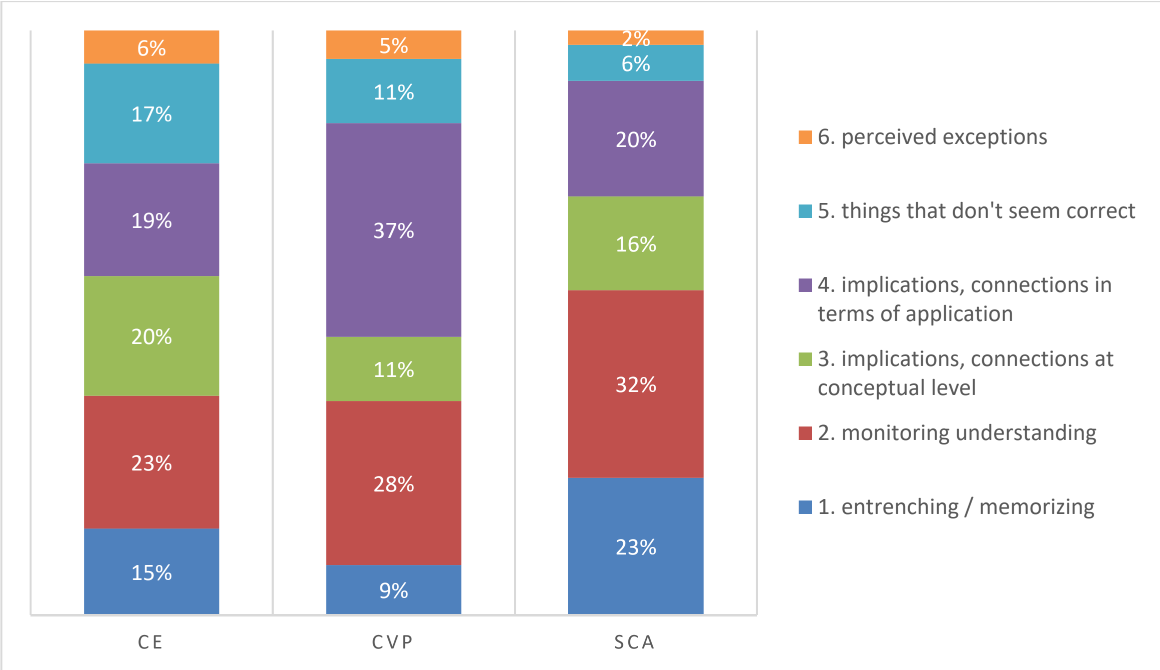


Figure 6-7 The mix of thinking types by topic

In addition, Figure 6-7 shows a decline across the three topics, and hence throughout the semester, in the combined percentage of types 5 and 6. Accordingly, the combined percentage of types 1 and 2 have increased. There is no obvious explanation for this in terms of topic content since the topics were similar in nature and complexity. However, the questions in relation to CE, CVP, and SCA were generated in Weeks 2, 4 and 12 respectively. Thus, it is possible that as the semester progressed and exam time approached, students became less critical of what they were being asked to understand in favour of being able to reproduce in the exam what they perceived was expected by the examiner.

The balance between thinking about application links vs conceptual links

Figure 6-7 also shows that, on average across the three topics, the incidence of Type 3 (thinking about implications and connections elsewhere at the conceptual level) is 16% and Type 4 (thinking about implications and connections elsewhere in terms of application of the ideas) is 25%. It is possible that this indicates a general student preference to learn what they 'will need to be able to do' rather than learn the abstract and theoretical ideas necessary to 'think like a professional'. In other words, this may reflect a student preference for the practical over the conceptual or theoretical.

6.8.5 Knowledge structures to which attention was paid

So that the analyses of self-question data would take account of the different types of idea of which a student was endeavouring to make sense, Section 4.7.1.1 of the Methodology chapter explained three types of idea: Foundational, Relational, and Modelling.

For each of the three cost accounting topics, Figure 6-8 shows the distribution of questions across the different types of target idea.

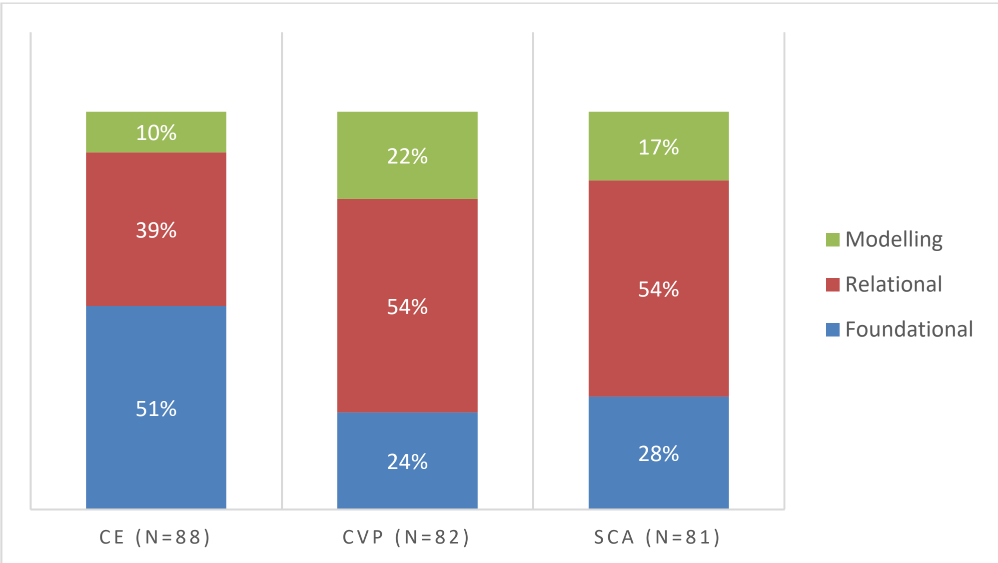


Figure 6-8 Idea types to which attention was paid

The table shows, on average across the three topics, the majority of questions (83%) were directed towards foundational and relational ideas, and 17% towards modelling ideas. This may indicate a general student preference to learn what they will be expected to do in summative assessments rather than learn to appreciate truly the nature of the domain and the necessity to begin to 'think like a professional'. It may also indicate difficulty in recognising the big ideas of the topic. However, in interpreting these data it is important to keep in mind that the modelling level involves sophisticated thinking that receives very little support from the students' textbook. Moreover, while each of these types of ideas is important, there is no basis for an argument that attention should be equally divided between them. It seems reasonable that modelling issues may arise less frequently that the other two.

6.8.6 Topic ideas to which attention was paid

As described in Section 4.7.1.1, the topic content was analysed in terms of the ideas and clustering of ideas regarded as having priority in the teaching approach. These ideas were categorised in terms of idea type (foundational, relational, and modelling) and portrayed as a web of ideas. Importantly from the point of view of pedagogical design, the web distinguished the level of understanding with which accounting students typically exit the learning process (the relational level) from the desired level (modelling)[13].

The Web of Ideas for the Cost Estimation topic consisted of five clusters (see Appendix J.1); three of which were relational (numbers 2, 3 and 5 in Appendix J.1) and two modelling (numbers 1 and 4). For that topic, Figure 6-9 shows at the point in the students' study process at which the data were collected: i.e. after the lecture and in preparation for the tutorial; the attention paid by students (on the X axis) to different idea types within each of the five clusters (on the Y axis) that comprise the cost estimation topic. The amount of attention paid to different ideas was measured by the number questions inferred as having been directed toward them. The labels on the Y axis indicate the cluster number and idea type (foundational, relational, and modelling) in parentheses.

This approach to analysis results in a chart that serves as a 'heat map' indicative of the extent to which students asked questions about the various aspects of the topic. Such insight, especially when unexpected, can inform pedagogical improvements.

[13] For example, a desired idea is that students are mindful that, prior to performing regression analysis, some historical data points might require adjustment or deletion and that the use of the output of the analysis will require critical thought. However, it is likely a student will focus on the simpler idea of how to perform a regression analysis.

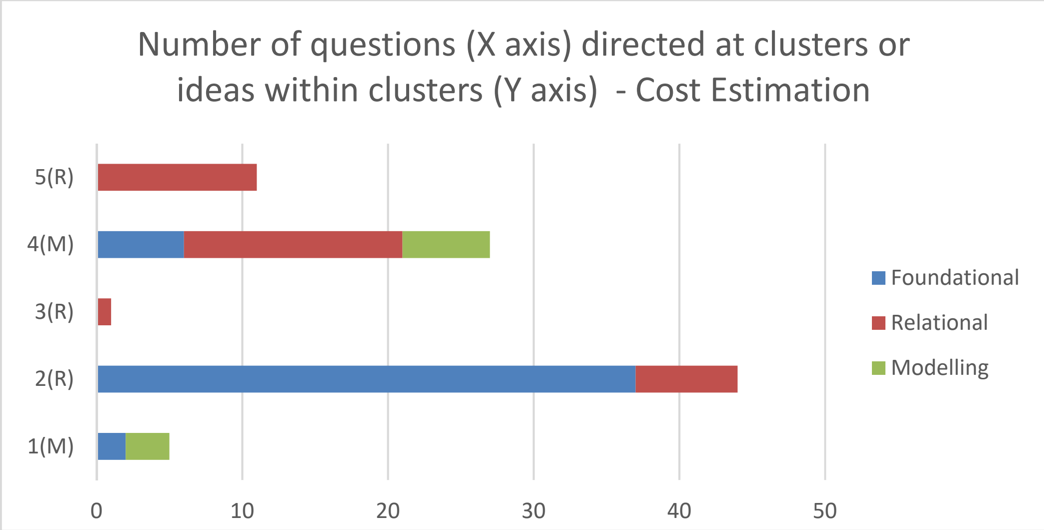


Figure 6-9 Topic ideas to which attention was paid – Cost Estimation

The level of understanding desired by the pedagogical design is associated with two modelling ideas. The first, Cluster 1, is the idea that "The future can be predicted from the past provided the future is consistent with the past. To the extent the future varies, uncertainty arises and judgements are necessary about how predictions based on the past may be adjusted in order to increase confidence in the prediction". The data show a small number of questions directed toward making sense of the modelling component of this cluster.

The second, Cluster 4, is the idea that "A variety of methods exist by which cost functions (mathematical equations relating cost to volume of activity) can be estimated from historical data. The choice of method involves a judgement about their relative cost/benefit". Similarly to Cluster 1, the data show only a small number of questions directed toward making sense of the modelling component of it as well.

Regarding the clusters at the relational level, the data show that Cluster 2 dominated students' attention, and the majority of the consequent questions were directed towards understanding foundational ideas of the cluster rather than the relations between or integration of them at the cluster level.

Cluster 2 is the idea of 'cost behaviour'; that various kinds of cost can be classified as fixed or variable in relation to an activity of interest. This idea then connects with Cluster 3 and two other ideas to lead to another relational idea that a mathematical equation can be developed that can be used to predict future costs (Cluster 5). Ultimately, an understanding of the two modelling clusters requires integration of the ideas and clusters at the foundational and relational levels.

Overall, the data suggests students were highly pre-occupied with understanding the idea of cost behaviour and how to identify behaviours (Cluster 2). This may indicate students were having considerable difficulty with the concept of cost behaviour. Second to that, students were paying most attention to the methods by which mathematical equations could be developed from this behavioural information (Cluster 5). The proportion of questions directed at the key ideas – the modelling ideas within Clusters 1 and 4 – was small at this point in the students' learning process, i.e. after the lecture, and in preparation for the tutorial

Since the level of understanding desired by the pedagogy is at the modelling level, the small proportion of questions directed toward the modelling ideas raises a question about its effectiveness. Before considering that however, it is important to note, firstly, that the data was not collected at the point where students were exiting the learning process; it was at a midway point, and therefore the data does not allow definitive conclusions about the level of understanding students would have upon exit. Secondly, the data comprise single questions asked by individual students which they chose to submit for assessment, not the mix of questions that individual students may have thought of while grappling with the topic.

Clearly, there would be scope to improve the pedagogy if students 'fixated' on foundational and relational ideas; i.e. if they only paid attention to foundational and relational ideas. However, the pedagogy would be effective if attention paid to these ideas was part of a process by which students made sense of the modelling cluster. In simple terms, there would appear two ways in which this might occur. Firstly, it might occur as a result of students switching the target of their study down from the modelling idea to an idea at a lower level: improving their understanding of the modelling idea by 'drilling into' its constituent ideas. For example, a student, understanding that critical thought and judgement is necessary when using historic data to predict future costs, turns their mind to understand the mechanics of applying a cost function. Secondly, it might indicate the opposite; that the student, once having better understood a relational idea, would 'build up' their understanding to the modelling level by integrating their understanding of it with their understanding of other ideas. For example, a student having understood the mechanics of applying a cost function, would integrate an understanding of the assumptions on which the cost function is based and thus develop a critical understanding of how cost functions can provide information useful for decision making.

I speculate that sense making facilitated by effective pedagogy would involve both of these, such that understanding of ideas at all levels would develop over time and concurrently. In other words, sense making of modelling ideas is neither a simple process that builds up from understanding of foundational ideas, nor a simple process that drills down from an understanding of the modelling idea. A proposition explored in this thesis is that provided students' epistemic beliefs (examples given in Section 6.4.5) can be managed, students will learn better if all learning takes place in the context of the modelling ideas of the topic. This proposition stands in contrast with propositions that the development of expertise starts with the development of a solid base of declarative knowledge and is discussed in Section 7.4.

Figure 6-10 shows the distribution of questions across the three clusters that comprise the topic of Cost Volume Profit analysis (see Appendix I.2).

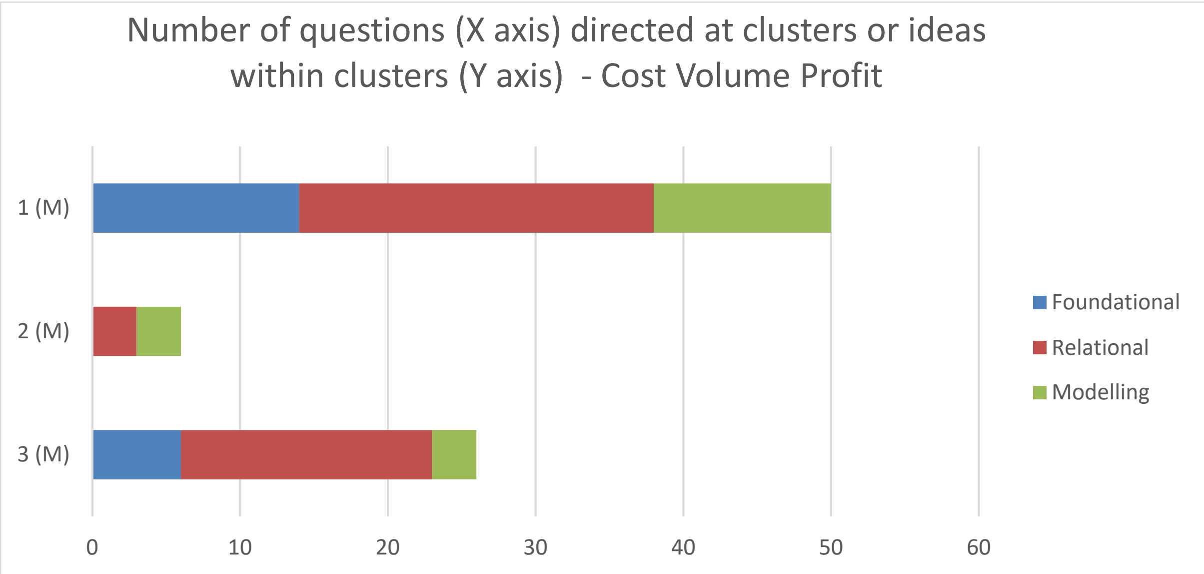


Figure 6-10 Topic ideas to which attention was paid – Cost Volume Profit

Cluster 1 is the idea that decisions about financial benefit can be assisted by quantifying relationships based on volume and using them in the calculation of profit. This cluster covers the majority of the content in the topic and so, as would be expected, it attracted the majority of students' attention whilst studying. Furthermore, the majority of questions directed towards the cluster were directed towards foundational and relational ideas within it. Nevertheless, a reasonable proportion of the total questions (12 of the 50), were directed toward the modelling idea within the cluster, and this indicates students were thinking about the complications inherent in developing and applying the CVP formula.

Cluster 2 is the modelling idea that analytical approaches, such as CVP, can be adapted for assumptions that may be unsafe in the real world. By integrating the understanding of Cluster 1 with other ideas such as sensitivity analysis, a superior level of understanding is achieved that enables judgement and critical thinking. Only six questions reflect thinking about this key idea, and half of these reflect thinking about the procedural aspects, for example, thinking about how to perform sensitivity analysis. Thus, only three questions reflect thinking about the modelling cluster as a whole, that is, how to adapt analytical approaches to take account of the 'messiness' of the real world so as to provide information to assist decision making.

Cluster 3 in the CVP topic is the idea that cost structure, the degree to which total costs are fixed versus variable, informs decisions about operational risk. It is related to many of the same foundational ideas as Clusters 1 and 2, and is essentially the second key idea or sub-topic. Given the relative proportions of content related to Clusters 1&2 and to 3, the number of questions directed towards Cluster 3 seems reasonable.

Thus, the data show the majority of questions directed toward the three clusters were directed toward foundational and relational ideas within them. This again raises a question about the effectiveness of the pedagogy that was designed to facilitate the development of modelling level of understanding by the time students exit the learning process. The answer to this question was explored above and thus will not be repeated here.

Figure 6-11 shows the distribution of questions across the five clusters that comprise the topic of Standard Cost Analysis (see Appendix J.3).

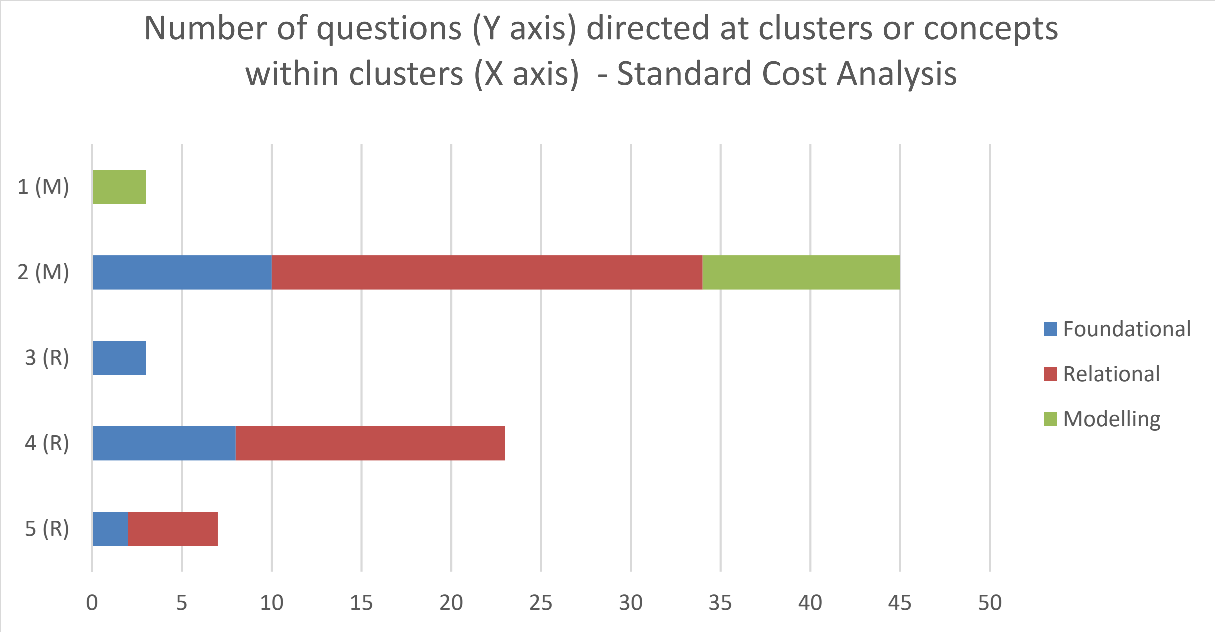


Figure 6-11 Topic ideas to which attention was paid – Standard Cost Analysis

Clusters 3, 4 and 5 are ideas that describe accounting procedures: 'flexing' the budget, variance analysis, and an aspect of general ledger accounting respectively. Together with the idea that performance evaluation may be assisted by accounting information, the four ideas comprise Cluster 2. Cluster 2 is the idea that these four together, when used with judgement and critical thought, can help provide explanations for real world outcomes and therefore help diagnose the causes of performance variations.

Relative to the number of questions directed toward Cluster 4, the small numbers of questions directed towards Clusters 3 and 5 may indicate students underestimate the importance of these. However, this may be explained by the fact a proportionally larger amount of the textbook chapter and end-of-chapter exercises focus on Cluster 4.

Cluster 1, which builds upon Cluster 2, concerns the idea that the application of Cluster 2 is limited to particular real world situations. Overall, the SCA data show a pattern similar to those in the previous two cost accounting topics: that at the point in the learning process when the data were collected, only a small proportion of students' attention, measured by the number of questions they generated, was directed at the level of understanding desired by the pedagogical design.

6.8.7 Summary

On the one hand, the data suggest the redesigned pedagogy was effective in promoting a range of positive behaviours.

At an average weekly rate of 86%, the rate of attendance at lectures was very high. This compares, anecdotally, with approximately 30% prior to the redesigned pedagogy and in other accounting undergraduate units generally. Although the attendance rate was partly driven by an association with an optional assessment, students nevertheless attended and there were no instances of students behaving in a disruptive manner during the semester.

Participation in the optional assessments was very high. Only 5% of students rejected the tutorial preparation activity (Critical Thinking) by never submitting a question. Only 3% rejected lecture engagement by never submitting a pre-lecture quiz.

At 75% on average each week, a high level of tutorial attendance relative to traditional tutorials was maintained. This rate remained similar to the attendance rate prior to the redesigned pedagogy.

The data show the redesigned pedagogy was effective in helping students develop high order questions, and more importantly, from these it is inferred the redesigned pedagogy was effective stimulating thinking that goes beyond simply memorising or making sense of a concept. Instead, a large proportion of questions reflect thoughts about application, connections, and critical thinking, i.e. Types Three to Six. Accordingly, the data suggest some acceptance of the shift away from the transmissive approach, but rejection by some others.

Finally, despite the redesigned pedagogy seeking to ground understanding of cost accounting topics in students' prior knowledge and experience, the data show a striking pre-occupation with the idea at hand as opposed to the reconstruction or evaluation of pre-existing ideas. This may, however, be explained by a data limitation in that all data was collected after the topic had already been explored in depth in the lecture and that the data comprise only students' most important question.

Overall, it must be concluded that the redesigned pedagogy was successful in promoting high levels of participation and engagement in learning activities, and extensive use of questioning, much of which was reflective of high order thinking. Lectures were redesigned as active-learning spaces in which topics were taught in the form of 'big' ideas, i.e. modelling ideas, that are representative of how accountants think in real world practice, and students helped to understand these by taking account of students' real world experience and prior knowledge. Consequently students would recognise the ideas usually 'made sense' even outside of the world of accounting. How effective the redesigned pedagogy was in this respect is an open question. Collected at the point in the learning process that they were, the data show a relatively small amount of attention was paid to developing understanding at the modelling level. Better assessments and further research would illuminate this in future.

The findings in Section 6.7.4 include perceptual themes positive toward the redesigned approach, and the data in Section 6.4.5 suggest the possibility of managing supportive students' epistemic beliefs about the pedagogy. Thus additional research may in future unlock the real potential of the redesigned pedagogy. This will be discussed further in Section 7.4.

The next chapter, Chapter 7, presents a discussion of the findings and explorations of the answers to each of the four research questions.

7 Discussion

7.1 RQ1 Epistemic beliefs

As introduced in Section 1.6, in the wake of the disruption to the plan for data collection, a key factor that shaped the adjustment of the research design was the preliminary findings about the significant influence of students' epistemic beliefs. This led to the first research question: "what is the evidence of epistemic beliefs and their development in the context of the redesigned pedagogy?"

As described in Section 4.6, SETU and interview data were collected and, as described in Section 4.7, analysed. Summarised data and findings about the role of epistemic beliefs and their development in the context of the redesigned pedagogy are presented in Sections 6.4 to 6.6 inclusive.

The discussion of the evidence in this section is at two levels. Firstly, the evidence in relation to the four interviewees is discussed in the next section. Next, the evidence in relation to the cohort generally is discussed in Section 7.1.2.

7.1.1 The four students interviewed

As explained in Section 3.6, the redesigned pedagogy included two optional assessments. Part of the design intended to address the three original concerns, these were intended to assist students adopt more active learning approaches. The original concerns explained in Section 1.4 were that it seemed accounting was perceived by students to be objective and certain, students appeared to adopt surface learning approaches, and there was an apparent lack of self-direction by students in their learning.

A satisfactory grade each week for the first assessment, Lecture Engagement, depended on responding satisfactorily to the pre-lecture quiz and attending the lecture. A satisfactory grade for the second assessment, completed in preparation for the tutorial each week, depended on generating three questions and having one of them assessed as satisfactory. Details of the four interviewees' participation in these assessments were presented in Table 6-1. For convenience, that table is shown again here.

Table 6-1 Interviewees' participation in optional assessments

	Yurek	Myron	Lewis	Sue-ellen
Number lectures attended	3	11	11	10
Pre-lecture quiz: Number ‘did not submit’	5	1	0	1
Number satisfactory lecture engagements (maximum = 11)	2	9	11	7
Number tutes attended	5	10	12	12
Powerful questions: Number ‘did not submit’	4	0	0	1
Powerful questions: Number ‘satisfactory’ (maximum = 10)	3	8	10	9

By chance, the four students interviewed had two very different backgrounds. Sue-ellen and Yurek both came from educational backgrounds which emphasised drill-learning and which did not challenge the misconception of the certainty of knowledge. This meant that they probably faced greater challenges to understand and value what was intended by the redesigned pedagogy. As shown in Table 6-1 reshown above, Yurek participated at a low level in both assessments, having attended a relatively small number of tutes and lectures and submitted requirements in relatively few weeks. The mismatch between his background and the redesigned pedagogy would seem to explain the low level of Yurek’s participation in the assessments: he did not see them as useful to his learning. Sue-ellen participated in both assessments; having not submitted a requirement only once in each assessment, but the qualitative data show the intent of the redesign made little sense to her. The fact that both of them struggled with the pedagogy and hence content (with Sue-ellen failing) probably also would have given them less time and energy to explore news ways of learning.

However, Table 6-1 shows both Lewis and Myron not only participated in, but also engaged successfully with the two optional assessments. Consequently, they were able to provide good evidence of some significant changes as well as insight into what sorts of changes were more challenging for them. This is despite the fact their tutor for all twelve weeks in the case of Lewis, and for six weeks in the case of Myron was explicitly unsupportive of the redesigned pedagogy. They did come to realise that learning was more complex than they had previously believed. They provided evidence of some real change in how they thought about cost accounting, what cost accounting actually looks like in the real world and the ways cost accountants need to think, make judgements and cope with messiness. They also showed changes in how they saw their role in the course and the role of critical thinking in learning – issues that the SETU data show clearly divided the student body. For them, these changes were profound.

In some areas, Lewis and Myron's changes did not go as far as I would have liked. My approach in lectures required more intellectual effort from students and a consequential change to their use of lecture notes. Since the lecture promoted thinking about problems and methods of solving them instead of explanations of content, I hoped note taking would shift from the traditional approach of recording key points arising from the lecturer's explanation of the content to recording personal discoveries and realisations in relation to how the student came to think about the methods of solving a problem. However, Lewis and Myron remained ambivalent about this and showed little change in their use of notes. They were aware of the risks associated with responding fully to the redesign and remained unsure how to handle them. By the end of the semester these dilemmas were still unresolved for them, however since changes in these areas are likely to be evolutionary rather than revolutionary, this outcome is not surprising. Their views of learning and teaching seemed to change quite a bit more than they realised, but it would not be reasonable to claim that they made a comprehensive, paradigmatic shift.

If I were to teach this course again, my teaching would be more attuned to the issues of changes revealed by these data and would likely be better as a result. However, the university contextual features of twelve teaching weeks and far less teacher-student contact time than is the case in schools will always limit what can be achieved.

An important point that can be argued from the data is that these students' epistemic beliefs were important in determining how they responded to the pedagogical approach. In other words, for the sorts of changes that I was making to be effective, teachers need to recognise the crucial role of these beliefs and to plan ways of effecting change. This issue was made explicit and students were encouraged to reflect on their thinking in this area, but this was not enough. The first coursework task described in Section 3.6.5 was designed to draw students' attention to this issue, and for most their mark on the assessment was a rude shock (Section 6.5.2). In future, assessment design is key to tackling this issue but assessments would need to be implemented more sensitively than was the first coursework task.

7.1.2 Students in general

In summary, the exploration of the data in Sections 6.4 has produced a range of fine-grained descriptions of student epistemic beliefs in this accounting context. The findings in Sections 6.5 and 6.6 show that change in beliefs is heavily influenced by prior beliefs, especially in the cases of students with absolutist conceptions of knowledge who see the nature of exams as being essentially reproductive. The data show that previously successful students also retain strong beliefs about their past approaches to learning. They often have expectations that they will succeed in units they will study in future. When new approaches lead to poorer marks, some of these students do not respond with a motivation to 'learn new ways'. Instead, they resist them.

The findings also show the process of change in epistemic beliefs to be characterised, at least for a period, by confusion and uncertainty. Changes in these beliefs are typically not characterised by a smooth process of belief A replacing belief B, students can hold to both A and B, but in different contexts. Thus their views are conflicted. Students are likely to be confused when holding conflicting conceptions of aspects of learning and accounting; aware of different conceptions whilst at the same time reluctant or unable to let go of their current ones. During these times, students can be observed to hold a progressive conception and contemporaneously regress from it. This conceptual confusion transfers into uncertain behaviours regarding both their learning and their roles as learners in lectures and tutorials.

The data suggest accounting students adopt behaviours associated with progressive epistemic beliefs before they appear to have clarified them. This is consistent with the findings made over 30 years ago in relation to teacher development by Guskey (1986). In addition, the data suggest unreconciled and conflicting beliefs lead to behavioural dilemmas, where students may be uneasy that the study approaches they are adopting will work out well for them. As explained in the Literature Review, the mechanism of change in beliefs in the integrative personal epistemology model proposed by Bendixen and Rule (2004) is a linear, three-stage mechanism comprising epistemic doubt, epistemic volition, and resolution strategies such as reflection and social interactions. They emphasise the recursive nature of change: from later to earlier stages of the mechanism as well as from advanced to prior beliefs. The findings from this research add different perspectives to how this process of change is, at least in many contexts, messy.

The data show that implementation of highly effective unit-level initiatives are rendered more difficult, and significantly so, without a 'course-wide' approach to redesigning unit pedagogies with the goal of shifting epistemic beliefs. When such units operate in this way in isolation, and thus one unit's pedagogy is not consistent with pedagogies of other units, the data show that students understandably are wary. Rather than simply trust the university to provide quality teaching, they are confronted with a situation about which they must make a judgement: will the approach in this unit compared to others help or hinder me? This issue looms larger in tertiary contexts than in school contexts firstly, because of the much smaller teacher – teacher interaction in tertiary contexts, and secondly, the much smaller amount of teacher - student interaction: both as a result of the smaller number of teaching weeks and the (much) smaller number of contact hours within each week.

The attitudes of the members of a teaching team are always important in respect of students' approaches to learning content (Ramsden, 2003). However, this is especially so when shifting students' epistemic beliefs is a pedagogical aim. This is illustrated in the instance of the tutor, Bill, who was committed to behaviourist teaching approaches for content and had no time for other pedagogical approaches. The data show that he undermined the redesigned pedagogy and contributed to the confusion experienced by his students.

The data also show the powerful influence of the textbook; that it can be perceived as the most authoritative source of what a student should learn. The data also raise an issue that was not anticipated, and is not recognised in the literature: the way concepts are presented in textbooks reflects the epistemic views of the text writer. Often the textbook is structured according to the 'structure of the discipline', and very rarely structured according to what is known (or even assumed) about the student learning of that discipline. Typically written for the purpose of explaining what a student should learn, the textbook leads students to seek simplistic and neat explanations when things are not clear as opposed to leading them to find ways of making sense of them. At risk of over-simplification, textbooks tend to 'transmit' content rather than help students 'construct' meaning. Consequently, the textbook can be unhelpfully discordant with the way the same concepts may be presented and treated in class.

Whilst designing and writing a different kind of textbook, even an electronic one, may be challenging, it may be more difficult to find a publisher willing to take the risk on such a textbook. For instance, Gunstone (personal communication, April 2 2019), the secondary supervisor of this thesis and author of three physics and science school textbooks prior to becoming an academic in 1974 (and subsequently a number of academic books used as texts), has described persistent approaches from publishers during and after his later time as Year 12 Physics examiner in Victoria to write a senior high school physics textbook. He was always keen to accept such an invitation, but only if his clear ideas about the ways such a text needed to be structured so as allow a range of different student purposes for their use (including developing greater understanding). No publisher was ever willing to embrace such structures and presentations that would be substantially different to the norm, something Gunstone characterized as endless regression to the mean.

Engagement in conversation is essential to recognising and revising epistemic beliefs. The data provide illustrations of the dependency of effective conversation on metacognition and language ability. This means the development of epistemic beliefs is very likely to be particularly challenging in multi-ethnic cohorts.

Reluctance to change beliefs is well-understood (for example, Simpson & Nist, 2000), and instructional interventions can be problematic (for example, Vermunt & Verloop, 2000), but the process of changing beliefs is clearly very difficult for both the student and the teaching academic. The recommendations described in the Literature Review Section 2.1.3 regarding the implications for instruction are worthy and helpful, but the data show that to affect epistemic beliefs more is needed over and above apparently simple prescriptions such as the adoption of constructive alignment. This is discussed further in the context of the redesigned pedagogy in Section 7.4.1.

7.2 RQ2 Sense-making

The second research question is "What mental processes are associated with self-questions asked by cost accounting students, and how do these processes vary with the production of different knowledge structures?"

The following discussion of the research question is structured in four parts; mental processes, variation of processes with phase of sense making, variation with the production of different knowledge structures, and finally a conclusion.

As explained in Section 2.3 of the literature review, this question was motivated by gaps in the literature: the call by Wong (1985) for more clarity in regard to the mental processes involved in active learning, which in turn would help explain how self-questions function and vary as monitoring operations in self-regulated learning (Winne & Hadwin, 1998) and how "wonderment questions" help students learn deeply (Scardamalia & Bereiter, 1992). Consequently, as explained in Section 4.3, a qualitative, post-positivist approach was taken to the exploration of this research question. Data, in the form of questions generated by students in preparation for tutorials, was collected in the normal course of administering a weekly assessment. The questions were input to a process described in Section 4.7.1.3 by which mental processes, conceptualised as types of thinking, were inferred. The outcome, described in Section 5.2 and summarised in Table 4-8, reproduced for convenience below, was of eight types of thinking. A ninth was found (Type 7), but as a type by which questions were being generated for the sake of having a question, for example, to complete an assessment task, and not associated with active learning.

Table 4-8 Complete list of thinking types

Type	Type of thinking
1	Thinking aimed at entrenching/memorising
2	Thinking aimed at monitoring understanding
2*	Thinking about the rationale or purpose that underlies an idea
3	Thinking about implications, connections elsewhere at the conceptual level
4	Thinking about implications, connections elsewhere in terms of application of the conceptual understanding
4*	Think about the wider implications and application of the rationale or purpose that underlies an idea
5	Thinking about, searching for, things that don't seem correct
6	Thinking in relation to perceived exceptions
7	Thinking about generating a question for the sake of having a question

Until recently, self-regulated learning research has focused on how regulation varies amongst students according students' traits and aptitudes. Self-questions are events that take place in the process of learning, and thus in contrast, this research provides insight to how learning occurs in relation to events. Researchers in the field of self-regulated learning have recently been calling for research based on events (Bannert et al., 2014, p. 161) and thus this research makes a useful contribution.

Moreover, the identification of eight types of thinking in the process of learning contributes conceptual clarity to active learning instruction by giving insight to the mental process involved in active learning. Elaborated in Section 2.3 of the literature review, this was called for by Wong (1985). However, the present findings contribute a new perspective. The literature has been concerned with thinking responses to questioning behaviour, e.g. that students must generate questions to shape, focus and guide their thinking (Hunkins, 1976; Singer, 1978; Tinsley, 1973). However, the present findings show how different types of thinking employed in the process of sense making are expressed in question form. Thus, this perspective adds to a more complete constructivist conceptualisation of the role of questioning in learning in that thoughtful activity leads to questions that in turn leads to more activity that is thoughtful.

Also, from an information processing perspective of self-regulated learning (Winne & Hadwin, 1998), the various types of thinking underlying different types of questions also provide insight to questioning as a form of what Winne and Hadwin call 'monitoring' activity. This point raises the issue of if, and when, the students were being metacognitive - thinking about their own thinking. When framing this research I expected that identifying moments of metacognitive thought would be an important aspect of my analysis. After the experiences described earlier, I believe that promoting metacognitive reflection would be at least very useful in getting students to understand and value the multi-level structure of my "lectures". The boundary between high order cognition and metacognition is fuzzy and is not clearly defined in the literature. Wilson (2017) argued that if the focus of thought is one's own thinking or beliefs then the thinking is metacognitive, if the focus is the content then it is cognitive. This is a useful distinction; numbers of the weekly questions that students posted suggest that they may have been thinking metacognitively by Wilson's definition. In other words, that they were reflecting carefully on their own thinking and understandings is a high level and valuable process of monitoring their learning. However, when the only datum is the final form of the question that was eventually posted, it has generally not been possible to confidently categorize this as an example of metacognition rather than high order cognition and I have avoided doing so.

In a similar vein, and as explained in Section 2.3 of the literature review, Scardamalia and Bereiter (1992) speculated that "wonderment questions" helped students learn deeply by stimulating them to generate explanations and propose solutions to problems. These findings provide insight to how questions do this.

These findings were extended by consideration from a constructivist perspective of how, and whether, they may be applied throughout the process of sense making. A fundamental premise of the constructivist perspective is that a learner's prior knowledge, often a product of experience, plays a key part in learning. This premise was taken into account in the present research by the adoption of a four-phase sense making framework, based on the work of Gunstone and Mitchell (1998) and explained in Section 4.7.1.2. The framework conceives of sense-making as a process that involves pre-existing knowledge or relevant experience, some form of deconstruction and evaluation of that existing knowledge, an interpretation of an idea being studied and efforts to make sense of it, and the potential extension of what is learnt to other contexts. Empirical analysis showed overwhelmingly the students' questions were directed towards ideas in the third phase, 'interpreting the idea being studied and making efforts to make sense of it'. Consequently, consideration of how, and whether, the types of thinking may be applied throughout the process of sense making was largely a conceptual exercise. The outcome, presented in Section 5.3, is elaborated in the form of two tables, Table 5-1 and Table 5-2. These illustrate that all types could conceivably be applied in all phases of sense making.

Tables like these customised with examples of questions that may be indicative of these types of thinking in a particular discipline can provide guidance to the formulation of pedagogical techniques aimed at making the stages of conceptual change explicit and the scaffolding of associated questions. They may also provide a means of evaluating pedagogical design. These possibilities will be considered further in the findings in relation to RQ4.

The final part of the second research question concerned how the processes, i.e. types of thinking (Table 4-8 reshown above) vary with the production of different knowledge structures. The approach to exploring this was shaped significantly, firstly, by the influence of the work of Shulman (1987). As explained in Section 4.7.1.1, in the context of teacher development, Shulman called for less focus on teaching as the management of students in the classroom and more on teaching as the management of 'ideas'. Accordingly, a model (the Web of Ideas[14])

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[14] As described in detail in Section 4.7.1.1, the Web of Ideas model is a pedagogical design tool that was used to analyse topic content in this research. The development of the tool was required to support a pedagogical approach concerned with how students think about what they know and learn. This concern is consistent with von Glasersfeld's (1995) exhortation that "the teacher must be concerned with what goes on in the student's head. …

was developed in which knowledge structure was conceptualised as idea type. This model was used to analyse the content of each of three cost accounting topics.

Subsequent empirical analysis of the sample of questions, as explained in Section 4.7.1.3 enabled findings in relation to how the mix of types of thinking varied with variation in idea type. The first was that all thinking types play a role in making sense of all types of idea; however, the mix of types varies. Secondly, the proportion of Types 1 and 2 thinking and Types 3 and 4 is higher for Foundational and Relational Ideas than for Modelling Ideas. Thirdly, the proportion of Types 5 and 6 directed towards the study of Modelling Ideas is higher than Relational and Foundational ideas. Thus, the mix of thinking types whilst studying Modelling Ideas is consistent with Modelling Ideas being representative of skills requiring more intensive critical thought and judgement.

As described in Section 2.4 of the literature review, King (1994b) speculated that "the use of different types of guiding questions might promote the building of qualitatively different knowledge structures" (p. 341). This research responds to King's call by outlining how configurations of thinking types, as manifested by different types of questions, vary with type of idea.

Types of thinking 5 (thinking about, searching for, things that don't seem correct) and 6 (thinking in relation to perceived exceptions) are instances of critical thinking. Thus, this research shows how 'critical thinking' is part of an 'active learning' process in the same way as types of thinking that clarify (Types 1, 2 and 2*) or inquire about (Types 3, 4 and 4*) what is being learnt. Thus, these findings suggest that learning conceptualised as 'acquired knowledge' cannot be separated from having ways of thinking about that knowledge. Moreover, the findings suggest the ability to think critically about an aspect of knowledge is grounded in

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The teacher must … build up a model of the student's conceptual structures" (p. 14). Thus instead of analytical approaches of content based on concepts such as declarative knowledge etc., this research interprets content in terms of the 'ideas' desired for students and which therefore in the course of teaching require management (Shulman, 1987). The Web of Ideas comprises three types of idea, each requiring different ways of thinking: e.g. the most complex type, modelling ideas, refer to ideas that reflect real world practice. In the context of accounting, typically these require critical thinking and judgement. As well as a tool that supports analytical research, the Web of Ideas facilitates the design of pedagogy.

critical thought being part of a thoughtful process of learning it. This is contrary to models that dissociate knowledge from thinking, and in particular, critical thinking (e.g. Sternberg, 2001).

In conclusion, discussion of this research question is in the context of private study of cost accounting. Three features of this context are that it is a form of learning that contributes towards certification as a professional, it involves conscious sense making as opposed to automatic or subconscious learning, and it requires independent learning. These features are in common with studies in other professional contexts, such as finance, engineering and law. Thus this discussion of RQ2, in particular, the applicability of the types of thinking in the process of sense making, the conceptualisation of learning as the acquisition of ways of thinking, and critical thought as part of the process of learning, likely applies to disciplines other than accounting.

7.3 RQ3 Perceptions

As is evident in Section 2.4, the literature shows students can feel either positive or negative about self-questioning (Pedrosa de Jesus et al., 2005). Their questions can invoke feelings, and these feelings can, in turn, generate and shape further questions (Pedrosa de Jesus et al., 2005). There are many types of self-question and, in practice, there are many forms of scaffolding to support it. Moreover, many barriers impede self-questioning by students.

However, the effectiveness of active learning activities such as self-questioning is significantly shaped by the interplay of students' perceptions and cognitive behaviours (Pintrich & Zusho, 2007). Thus, the third research question to explore perceptions, introduced in Section 2.4.6, is "How do students perceive activities requiring them to generate questions?"

As explained in Section 4.6.3, data were collected via a University administered Student Evaluation of Teaching and Units (SETU) survey. The survey report provided an analysis and presentation of results of the responses to five survey questions, and comments in response to two, voluntary, open-ended questions. They were 'What were the best aspects of the unit?' and 'What aspects of this unit are most in need of improvement?'

These data were analyzed using a data-driven coding approach (Gibbs, 2007) as explained in Section 4.7.3. The outcomes are described in Section 6.7.

In summary, firstly, in Section 6.7, responses to the five closed survey questions were presented. This showed an even, tri-modal distribution of responses (favourable, neutral, and unfavourable) with a slight bias to the favourable.

Secondly, illustrative student comments in response to the two open-ended survey questions were presented. This analysis showed polarisation in the distribution of comments favourable and unfavourable to the Critical Thinking assessment and the self-questioning activity it required, as well as to the other four aspects of the redesign: the overall structure, lectures, tutorials and topic content.

Regarding the self-questioning activity, in summary, on the one hand, some students with favourable perceptions associated self-questioning with more or better ways of thinking and others associated it with deeper understanding. Some of these students saw the relevance of self-questioning more broadly and as an activity that may usefully be transported to other units.

On the other hand, some students with unfavourable perceptions doubted their readiness to ask questions, perceiving either they lacked the intellectual capacity to self-question or they lacked a sufficiently large knowledge base from which to ask questions. Other students could not recognise the value of the more abstract nature of skill development as opposed to the more concrete nature of knowledge acquisition and the importance of self-questioning in that process of learning. Accordingly, some students with unfavourable perceptions perceived self-questioning to be irrelevant, and perceived the more abstract nature of the activity to interfere with what they perceived to be quality learning.

More generally, students' perceptions of self-questioning as part of the Critical Thinking assessment were sensitive to the balance struck between the assessment's focus on the types of question generated and the focus on ensuring students find answers to them; i.e. on the means versus the ends. Moreover, being novel, many students perceived learning based on self-generation of questions, and then finding and making sense of the answers to them, to be intellectually hard work compared to the more passive forms of learning to which they were accustomed.

Thirdly, Section 6.7 presented eight perceptual themes that were inferred from comments made in relation to redesigned pedagogy in toto. Three themes reflect favourable perceptions, and five unfavourable. The table that summarised them, Table 6-4, is reshown for convenience here.

Table 6-4 Themes inferred from student comments

Label	Theme
1	Perceived approach led to better learning outcomes
4	Perceived approach was more interesting
5	Approach was perceived to engage students better in sense making
A	Objection to a different learning approach of any kind
D	Objection to amount of time perceived to be unproductive
R	Unit was perceived to be too abstract
S	Perceived the approach to learning encouraged by the learning approach was too difficult
T	Rejection of self-questioning in the way required by the assessment

All but two of these themes were evident in comments specifically about self-questioning and the assessment that required it. In respect of these two exceptions, the first (theme 4) is that, whilst comments suggested self-questioning led to better outcomes (theme 1) and better engagement in the process of sense making (theme 5), none suggested the generation of self-questions in the process of learning made learning activity more interesting (theme 4). This may be explained by the possibility students perceive learning in this way, i.e. via an active approach, compared to traditional passive approaches, to be hard intellectual work. However, as hard intellectual work, the activity may be purposeful (hence theme 1) and engaging (theme 5) but not 'interesting' in the way that they found lectures 'interesting'. Thus, students may value self-questioning but not like it, and this is consistent with the literature (Gourgey, 2001; Sternberg, 2001; White, 1988).

The second is that no comments about self-questioning was indicative of theme A: *objection to a different learning approach of any kind*. This outcome may be explained by the analytical method. Both this theme and theme T, i.e. *rejection of self-questioning in the way required by the assessment,* reflect rejection of teaching approaches. The difference between these themes is that theme T is narrow and specific whilst theme A is broad. Given the data being analysed concerned comments about self-questioning specifically, all comments reflecting rejection would be coded as theme T.

Thus, other than rejection, the themes suggest that when students perceive self-questions unfavourably it is because the activity is intellectual, and hence different from their prior experience and preferences. The activity is intellectual in three ways. Firstly, intellectual learning involves evaluativist (Kuhn, 1991; Kuhn, Cheney, & Winstock, 2000) views of knowledge. In the case of cost accounting, this requires recognition that knowledge is not absolute and certain. Consequently, critical thinking and judgement is at the heart of knowledge but some students will see this as too abstract (theme R), preferring more concrete outcomes instead.

Secondly, there is an overhead associated with intellectual learning. Not only does this form of learning require investment in learning the topic itself, it also requires investments in self-reflection and dialogue. Consequently, some students perceive time devoted to particular activities as unproductive (theme D).

Self-reflection, including reflection that results from metacognition, requires not only private time but also instructional time. For example, time may need to be devoted to raising metacognitive awareness (King & Kitchener, 1994; Posner et al., 1982; Sandoval & Reiser, 2004; Vosniadou, 2013); and confronting less sophisticated epistemic beliefs (Alvermann et al., 1990; Hynd et al., 1995), conceptions of learning, and of accounting (McGuigan & Weil, 2011; Mladenovic, 2000).

As an activity that takes place in social settings, learning, i.e. knowledge construction, benefits from dialogue amongst students and with tutors (Vygotsky, 1978; Wertsch, 1985). Dialogue, for example, that which takes place in small groups in tutorials, presents opportunities for students to clarify questions, explain their misunderstandings, and explain the understandings sought by other students in the group. Students may perceive this to be overcomplicating what is to be learnt, and they may be correct in cases of concrete knowledge, but they are not likely to be correct in cases of more sophisticated knowledge.

Thirdly, the activity is intellectual because, as a process of sense making (Gunstone & Mitchell, 1998; Leont'ev, 1978), learning is more complex than simple memorization. Moreover, the complexity of learning is heightened when connected to prior knowledge and experience and connected to real world contexts. Consequently, some students perceive an active learning process based on self-questions as difficult (theme S).

This discussion of student perceptions derives from features of the redesigned pedagogy aimed at addressing the three original concerns with the traditional pedagogy outlined in Section 1.4. These were that it seemed accounting was perceived by students to be objective and certain, students appeared to adopt surface learning approaches, and there was an apparent lack of self-direction by students in their learning. Accordingly, the discussion contributes to the three research aims of this thesis. However, the discussion of student perceptions also points to the rewards as well as the challenges of pedagogy redesigned with a goal of intellectual development, as called for in accounting by Wyer (1984).

In conclusion, the favourableness of students' perceptions of active learning activities such as self-questions depend significantly upon their epistemic beliefs. Moreover, in the context of redesigned pedagogy, their perceptions depend significantly on the extent to which the redesign succeeds in helping students realise more sophisticated epistemic beliefs. These factors were discussed in Section 7.1.

A finding in Section 7.1 is that behavioural change often precedes students' awareness that their epistemic beliefs have changed accordingly. That finding has particular relevance to this discussion in that the significant level of unfavourable perception evident in this discussion is countered by findings about student behaviours in Section 6.8. The findings in that section show that despite the level of unfavourable perception, the redesigned pedagogy was successful in promoting high levels of participation and engagement in learning activities, and extensive use of questioning, much of which was reflective of high order thinking. This is an encouraging outcome.

7.4 RQ4 Implications for pedagogical improvement

Student self-questioning was a key component of the redesigned pedagogy and, as summarised in Section 2.5.5, students' epistemic beliefs were found to be a significant influence on the effectiveness of the redesign. The literatures on the implications for teaching stemming from research on epistemic beliefs and self-questioning were reviewed in Sections 2.1.3 and 2.5 respectively. Accordingly, the fourth research question is "what are the implications of the research for the redesigned pedagogy and pedagogy in general?"

The discussion of RQ4 in this section is in two parts. Firstly, Section 7.4.1 provides a discussion of the implications of the research for potential improvements to the redesign and secondly, Section 7.4.2 provides a discussion of the implications for pedagogy in general.

7.4.1 Implications for the redesign

In the consideration of improvements to the redesign, this section makes a distinction between design improvements and practice improvements and concentrates on the former. By the term 'design improvement' I am referring to changes in the design of existing practices or consideration of the inclusion of a practice that is largely absent from a pedagogical design and thus there is an opportunity for the designer of pedagogy to change the design and exploit an opportunity for improvement. By the term 'practice improvement' I am referring to a practice that is a part of a pedagogical design but for which it is possible to implement more effectively. Rather than the designer, these opportunities depend on individual members of a teaching team, and their interest in, and commitment to, making improvements.

The literature reviews of implications for teaching of both the self-questioning and epistemic beliefs research are replete with practices that would improve teaching and pedagogy; practices which would be either design improvements or practice improvements depending on the context. However, the specific studies reported add little value to this thesis because, in this context, they are not design improvements. For example, recommendations to make the classroom environment safer by ensuring tutors are more open and less judgemental of students' attempts to ask and answer questions; to create more opportunities to confront students' epistemic beliefs; to facilitate group discussions more effectively; to help students to understand better the purpose of assessments and aspects of the teaching approach; etc. etc. in this context are practice improvements. Thus, rather than practice improvements, this section will concentrate on design improvement; that is, changes to the redesigned pedagogy that significantly add, change or remove practices altogether.

In Section 2.1.3.3 constructive alignment is discussed. This is the belief that sound pedagogy is characterised by alignment of learning outcomes, learning activities, and assessments. In this context, Biggs and Tang (2011) would likely argue that the use of self-questions, being a learning activity, should align with the outcomes they seek to support as well as the assessments used to measure them.

However, in opposition to this, Nelson (2018) suggests constructive alignment is itself a significant problem in that constructive alignment is the barrier to teaching creativity. Whilst his writings I think have particular resonance in the fields of the Arts and Humanities, he would likely argue they are relevant to all disciplines.

The key implication from the research in respect of this design principle is not that the idea of constructive alignment is wrong but that the implementation of it needs to differ. In practice, constructive alignment is usually concerned that learning outcomes are objectively measurable and expressed in terms of what the student 'can do' (Skinner, 1953). This research suggests a less simplistic approach is necessary. Instead, and as elaborated in the discussion of the web of ideas in Section 4.7.1.1, 'outcomes' are better conceived as internalising the 'big ideas', ways of thinking, or skills (the real world application of knowledge) that are desired for the students. The learning activities then are those that help students recognise relevant prior knowledge and experience and make sense of the target ideas. This is more clearly a constructivist implementation of the idea of 'constructive alignment' and one not so completely dependent on forms of the immediately assessable and assessed.

Next, a design improvement relates to the unit syllabus. Instead of the unit syllabus conceived as comprising (say) ten chapters from the textbook, it can be conceived as comprising (say) ten 'big ideas', each of which pertain to the solving of a problem type. Each 'big idea' conveys the assumptions and limitations of problem solving methods and hence critical thinking and judgement is at its heart. This leads to another improvement in the design of lectures, i.e. a clearer articulation and use of the big idea to frame lectures (Mitchell, Keast, Panizzon, & Mitchell, 2016) and the organization of the student experience around it. The relationship between Big Ideas and Modelling Ideas will be discussed in depth in Section 7.4.2.4 and discussion of examples of this for two of the cost accounting topics is provided in Appendix N.

The design of tutorials would be improved by the use of a type of question or exercise not currently found in textbooks. This is a deficiency supported by the data[15]. Instead of a predominance of questions that focus on acquisition of declarative and procedural knowledge, better questions would engender recognition of various ways of thinking about an area of accounting given it is not objective and certain. For example, questions could provide problem-related data that may not be used directly in the production of an answer, require justification of choices made in the process of producing an answer, and require students to explain things in their own words.

The previous two design improvement recommendations call for a new generation of textbook or eBook; one that supports better a constructivist conception of learning. This could be custom written for the redesigned unit. A discussion of how cost accounting textbooks might be structured differently around Big Ideas is provided in Appendix O. Alternatively, a potential design improvement is to remove from the syllabus the prescription of a textbook altogether since, as the data showed[16], despite unit guides and instruction in lectures etc. that speak to the contrary, many students are strongly influenced in their interpretation of the unit requirements by the textbook. Although the learning situation would still be 'contaminated' by a variety of traditional cost accounting textbooks, this might enable a more intense focus on the 'big idea' of each week's lecture.

Distancing traditional textbooks from the pedagogy might also help overcome another limitation of the redesigned pedagogy. As part of the lecture redesign, the purpose of many of the lecture slides was to facilitate a conversation about methods of solving a problem. An example of lecture slides designed for this purpose is provided in Appendix 8F. In the traditional pedagogy, lecture slides comprised, in the main, summary notes of the lecture. It is salutary to note at this point that tradition at an earlier point in time reflected the belief that students should learn without the benefit of copies of lecture slides altogether! Nevertheless,

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[15] For example, "The link between the textbook and critical thinking" (SETU, 102).

[16] For example, "… and as the text book is the first thing we look at after the lecture it is hard to know what is really expected of us" (SETU, 73).

the redesign consideration was that many students might object to the significantly different nature of lecture slides and therefore to mitigate that risk a decision was taken to provide a traditional set of content-oriented lecture slides on Moodle as well. These were labelled ‘chapter notes’. However, whatever benefit did arise from that decision was likely offset by students substituting the copies of the lecture slides with the traditional lecture slides rather than use the traditional ones as a complement[17].

As part of the redesign, the self-questioning activity was linked to an assessment. As with the design decision relating to the provision of traditional lecture slides, risk mitigation was the reason for giving this assessment the name ‘Critical Thinking’. In 2011 and 2012 in this business degree course, to establish an assessment based on tutorial preparation activity such as self-questioning was radical. Thus, the risk of concern was that students would react negatively to the novelty of the assessment. However, at the time, and to give expression to the university’s vision of graduates having the attributes of being critical and creative scholars, a learning objective concerning critical thinking was added to all units in the department. Consequently, and to manage the risk, the assessment was linked to this learning objective via the name ‘Critical Thinking’ even though critical inquiry was only one form of self-question it encompassed[18]. Moreover, as highlighted in Section 6.6.3, risk management is a significant factor in students’ willingness or readiness to change epistemic beliefs. If the assessment is not called something sophisticated like ‘critical thinking’ then students may perceive it to be less threatening. Had I continued to coordinate the unit in Semester 2, 2014, I would have changed the name of the assessment to something ‘more ordinary’, such as ‘tutorial preparation’.

Today, the situation is different and this form of assessment is no longer radical. Consequently, the use of the name ‘critical thinking’ may now reinforce the belief that self-questioning is an

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[17] Activity data from Moodle (in particular, the number of Moodle users who viewed lecture slides and chapter notes each week) support the conjecture that traditional lecture slides were heavily relied upon. Although the accuracy of the data may be understated by, for example, students circulating offline downloaded copies, the average number of students who viewed chapter notes each week was 260, compared to the average of 194 who viewed the lecture slides each week.

[18] However, this thesis argues that all types of question raised by a learner in private study arise from learners’ critical review of whether, and how well, something makes sense.

important and normal part of learning, and not only the province of elite and sophisticated learners.

A particularly difficult design challenge relates to two attributes of the two-hour written final exam. The first is the expectation of the professional bodies that a key piece of assessment is invigilated. Written exams completed on mass are a very practicable approach to invigilated assessment. Secondly, whilst reasonably effective for examining acquisition of declarative and procedural knowledge, the written medium is far from ideal for examining a student's 'way of thinking'. Answering a question that sought to examine 'ways of thinking' would not only test a student's ability to articulate and write why they answered in the way they did, but also require a substantial amount of time to write it. I do not attempt to solve this problem in this thesis, only to draw attention to the issue.

Finally, the data show[19] the need for endeavours at unit level to develop students' epistemic beliefs and improve conceptions of accounting to be supported by course-level and even university-level change. As noted in the literature review Section 3.2, a relatively weak focus on intellectual and ethical development persists in accounting courses despite having been vigorously supported long ago by the Accounting Education Change Commission (Francis, Mulder, & Stark, 1995b). It seems that fundamental, sector-wide changes are required if we are to develop the intellectual minds of accounting students and achieve the benefits expected from a liberal education as called for by Wyer (1984) and Sangster (2010), both in accounting, and higher education generally (Dewey, 1914).

Good teaching is characterised by a continuous quest to improve curriculum and pedagogy. In summary, this section points to the potential of a range of changes that might improve the pedagogical redesign of this unit. Whether they do improve the redesign, however, can only be found by trying them out.

[19] For example, "It's actually a bit in isolation, like this teaching method hasn't been used elsewhere. The emphasis that you place on critical thinking, thinking for ourselves that hasn't been in other units" (Lewis, Week 6).

7.4.2 Implications generally

This section discusses a range of observations about the redesigned pedagogy. These were selected because of their potential interest value and relevance to pedagogy more generally.

7.4.2.1 Most student cohorts are diverse

Amongst other data, the tri-modal distribution of responses to the SETU questions demonstrates the heterogeneity of the student cohort. This is arguably one of the most significant implications for pedagogical improvement of the research: that any plan to improve pedagogy must take account of the diversity amongst students.

The data imply some of the important ways in which the student population is diverse. Students reside on a range of continua, some of which are related to each other. One is a continuum concerning their attitudes to, and motivations for, course completion: e.g., students may vary between those who wish to achieve a university degree with the minimum possible effort to those who see the course as an essential step towards achieving their life goals. A second is a continuum concerning their approaches to learning a unit, with some preferring to take surface approaches, others deep, and others strategic (Biggs, 1987a). A third is their epistemic beliefs, including about the unit, with beliefs ranging from absolute to evaluativist (Kuhn, 1991; Kuhn et al., 2000). A fourth concerns English language ability, with students varying between those very adept at explaining their understanding of things verbally and in writing to those who just get by with abilities to hear and read English. These are just a few of the many continua that would apply but another, particularly germane to this section of the thesis, is a continuum in regard to receptivity to change, with students varying between a strong tendency to be a part of something new to those who are strongly averse to any change.

Since student cohorts are diverse, the responses of students to pedagogical innovations will often vary from strongly positive to strongly negative. Given the generally accepted belief that students perform better if student- or learning-centred approaches are taken to pedagogy instead of traditional, teacher-centred approaches, the variability in responses to pedagogical innovations due to cohort diversity suggest, at the extreme of impracticability, that pedagogical innovation ought to be individualised. More practicable, are pedagogical approaches that vary according to streams, such that, for example, students who require additional time to develop further their English language ability or learn study skills more commensurate with the higher education context may have the opportunity to do so. However, whilst many changes are apparent to make the modern university context more inclusive, there is still much about the university context that limits the extent of student-centred approaches.

The consequence of this first observation therefore is that it is not possible to present or discuss a definitive list of implications for improvement. Rather, it is necessary to consider possible improvements as dilemmas, to recognise that they will improve some students' experiences of the pedagogy whilst at the same time detract from it for some others.

7.4.2.2 Aspirational, supported pedagogy is possible

Whilst I have observed pedagogical innovation pursued for its own sake, generally innovation is intended to drive student engagement. Reeve and Tseng (2011) argue there are four components to engagement: behavioural, emotional, cognitive and agentic. Behavioural engagement can be summarised by the question are the students doing what the teacher said to do? Emotional engagement relates to the question are they enjoying or are stimulated by the task? Cognitive engagement relates to whether or not they are thinking deeply. The new contribution of Reeve and Tsang was agentic engagement which relates to whether or not the students feel that they have significant agency in how the lesson proceeds and what the teacher does. Of course there can be no agentic engagement in a classroom where the only discourse is students responding to closed teacher questions and where their answers are immediately evaluated as being right or wrong. Driving the first two types of engagement through pedagogical innovation is, of course, important and can be achieved, for example, with multimedia technologies. For instance, the use of multi-media can drive behavioural engagement by maintaining attention on-task and drive emotional engagement by stimulating enthusiasm and avoiding boredom.

By aspirational pedagogy I refer to pedagogies that aspire to the intellectual development of students, i.e. evaluative views of knowledge (Kuhn, 1991; Kuhn et al., 2000). This research suggests that such pedagogy depends on innovations that drive cognitive and agentic engagement. For instance, the redesigned pedagogy sought to drive cognitive engagement via active, self-regulated learning strategies and drive agentic engagement by inviting students to be part of a lecture conversation, encouraging students to ask questions, communicate what they are thinking, make connections to prior experience, and influence methods of solving problems.

This research shows that aspirational pedagogical innovation is possible despite many systemic factors that mitigate against it such as university business models, course structures, and 12 week semesters. However, pedagogical innovation must be supported. This research shows the importance of support at a range of levels for aspirational pedagogies: the innovator, their teaching team, department/faculty and the university. If universities are to succeed in developing their envisioned graduate attributes, we should expect more, not less, of students. Sometimes this might mean persisting in the face of a vocal, negative student sub-cohort.

I now turn to two particular barriers to aspirational pedagogical innovation that became apparent in this research.

Firstly, 'managerialism' refers to the adoption in public sector organisations, such as universities, of management principles that originated from the private sector on the assumption they are better (Deem & Brehony, 2005). One such practice is the management of individuals' and organizational units' performance via the use of key performance indicators. A common issue with such approaches is that managers 'get what they measure'. This is problematic in the area of pedagogical innovation when the indicators of innovation are not well-specified. Individuals can succeed in this situation by implementing innovation for innovation's sake, or by implementing innovation that drives poor forms of student engagement in learning. This is also problematic when a key performance indicator is expressed in terms of a minimum SETU survey satisfaction score. The risk then is teachers will be negative to authentic pedagogical innovation and remain committed to traditional teaching methods if they believed their SETU scores would be at risk.

Secondly, the research shows that textbooks need to evolve to support better pedagogies that aspire to the intellectual development of students. Many as written today tend to be relics of the behaviourist-learning paradigm, focused on fulfilling the purpose of transmitting declarative and procedural knowledge without sufficient regard to the subjectivity and uncertainty of that knowledge, and others have no learning basis at all underpinning their structure. Even when textbooks fulfil an essential purpose, they ought not to drive the pedagogy, but they should support it. The redesigned pedagogy in this research illustrates how the reading of the relevant textbook chapter need not be one of the first activities a student completes. It illustrates, instead, how the first activities ought to draw attention to the prior experience and/or knowledge upon which learning will be constructed.

Finally, the research suggests a commonly accepted barrier may not be as significant as commonly understood: reliance on large lecture halls need not be a barrier to active learning. Contrary to contemporary trends, there continues to be a place for large lecture theatres because active learning pedagogies can be designed to take place in them.

Clearly, pedagogical approaches that aspire to intellectual development are possible, and there is substantial opportunity for institutions to increase the support provided for them.

7.4.2.3 Intellectual effort

In spite of the data relating to negative reactions, the research confirms that many students do value brainwork, i.e. engaging intellectually to make sense of ideas and the relationships of those ideas with others and their own experience. In the area of cost accounting, this leads to beginning to 'think like an accountant': being skilful by knowing how to apply knowledge in the uncertainty of real world contexts.

This research proposed that skill development need not be left to occur in the latter stages of the process of expertise development. It suggested solid foundational layers of declarative and procedural knowledge need not be laid down first and an advanced training class attended later. Instead, all elements of expertise can be taught holistically and in ways that integrate them. After all, a carpenter does not learn how to swing a hammer only after acquiring a solid base of knowledge about hammers. Another example, and one closer to the level of intellectual skills required of accountancy, is that the web is full of resources for prospective novel writers that are built on the assumption that one needs to get seriously engaged in writing a novel before declarative knowledge about issues such as building tension for the reader can be useful.

Cost information produced by accounting techniques is rarely objective and certain because the means of producing the information has innate limitations and/or requires strong assumptions. Consequently, I argue that cost accounting should not be seen to comprise technical, mechanical procedures, but rather cost accounting should be seen as providing a range of ways of solving a range of different types of problem. Each way of solving a problem requires the use of judgement and critical thought so as to produce relevant and optimally cost-effective information that can be used to aid decision-making. The traditional approach of teaching an aspect of cost accounting is to teach the technique first then follow it, almost as if it were an afterthought, by teaching its limitations and assumptions. Instead, I argue it is better to teach, from the beginning, how critical thought and judgement can be used to identify and apply a variety of methods that minimise or accommodate the effect of the limitations and assumptions. This approach starts with the modelling ideas of the topic and it requires a higher level of intellectual effort on the part of students.

Section 6.8.6 presented data arising from the redesigned pedagogy which showed the degree to which students' attention was directed toward the desired level of understanding, modelling, as opposed to the foundational and relational levels. The question that arose about the effectiveness of the pedagogy remains open since, firstly, the data were collected at a point midway, rather than the end, of the learning process. Secondly, it is not possible to infer whether in paying attention to a relational idea, the student was 'fixated' on it, 'building up' from it in order to develop understanding at the modelling level, or had 'drilled down' into it having previously focused at the modelling level. This is an area for future research.

The use of modelling ideas as the basis for pedagogies designed to facilitate levels of understanding that enable critical thought and judgement accords with the term 'big idea' as used in the following quote in respect of expert knowledge:

> Their knowledge is not simply a list of facts and formulas that are relevant to their domain; instead, their knowledge is organized around core concepts or "big ideas" that guide their thinking about their domains (Bransford et al., 2000, p. 36).

The challenge lies in how to teach for this. The next section explores further the means by which the Web of Ideas can be used to design pedagogies centred on 'big ideas' and educational endeavours generally.

7.4.2.4 The Web of Ideas

As explained in Section 4.7.1.1, in order to make inferences from students' tute-prep questions, the research required a method of defining the elements of the topic content. Moreover, it was necessary that the method defined the elements in a way that was relevant to the pedagogical redesign (as opposed to the academic, textbook description of the content) and articulated the variation in knowledge structure of the elements. The outcome of the method, a web of ideas for a topic, proved successful in its support of the research.

However, other than for this research, the Web of Ideas model fulfils three purposes: a pedagogical design tool, a teaching aid, and a content analytical research tool. The model is a powerful pedagogical design tool because it assists design based on learners' ways of thinking and draws the designer's attention, in particular, to Modelling ways of thinking. Having correspondence to the 'ways of thinking and practising' that Entwistle (2009) observed were the concerns of the best educators in the Enhancing Teaching and Learning research project (ESRC-TLRP, 2016), the Modelling level and therefore its differentiation from the Relational level is often absent from pedagogical design. This level is key to constructivist learning because without it, learners do not fully reconstruct prior knowledge nor effectively make (real world) sense of what they are learning. Moreover, textbooks generally do not treat the Modelling level of 'content' effectively.

Thus, the web of ideas for a topic can be used to design pedagogy (i.e. the nature and sequence of activities) intended to facilitate the understanding of the topic. For example, in van Mourik and Wilkin (2018), the design process involves, firstly, the identification of the big[20]idea(s) and hence way(s) of thinking for a topic. In the web of ideas, this is shown as a modelling idea(s) atop of the related relational and foundational ideas. An effect of this is to omit some content[21] likely to be covered by traditional textbooks. Secondly, the design process in van Mourik and Wilkin involves identification of the key steps by which a student is likely to be helped to shift understandings from the likely extant to the desired understanding. Thirdly, for each step, the facilitating procedures are then designed.

The design of facilitating procedures in van Mourik and Wilkin (2018) for each step is assisted by a set of prompt questions. These have the effect of assisting the designer to think through students' likely current conceptions or relevant experience and the ways in which teaching time and various tools may be used to facilitate construction of students' understanding in relation to that step. Thus, metaphorically, the pedagogical design intends to take the student on a conceptual journey from where they currently are, to where the pedagogical design intends for them to be.

[20] van Mourik and Wilkin (2018) used the term 'key' idea which has similar meaning to 'big' idea. However, the thinking about the significance of big ideas in the design of pedagogy in that paper was less well-developed at the time.

[21] Note, many contemporary writers argue that teaching and learner engagement would be improved if we sought to cover less content.

The web may also assist the design of other pedagogical approaches based on Big Ideas, for example, Mitchell et al. (2016). According to Whiteley (2012),

> Big ideas are the building material of understanding. They can be thought of as the meaningful patterns that enable one to connect the dots of otherwise fragmented knowledge (p. 42).

Although using the term key ideas rather than big ideas, Hume and Berry (2011) noted that

> [key] ideas are full standalone statements, which give a sense of enduring understandings that students need to develop, rather than simply noting down headings, phrases or questions (p. 352).

More recently, Mitchell et al. (2016) conceptualised a big idea as

> a unifying principle that connects and organises a number of smaller ideas or concepts and multiple experiences (p. 5).

Mitchell et al. (2016) cite two roles that make big ideas pedagogically powerful. The first is an integration role, in that big ideas offer direction for teachers to make learning for students more connected. The second is to be generative (Perkins, 1992), which means they are *central* to the subject matter, *accessible* in that they allow and invite demonstrations of students' and teachers' understandings, and *rich* in that they encourage varied extrapolation and connection making. Statements of big ideas provide sufficient depth, significance, and variety of perspectives and thus support students' development of powerful understandings. Perkins suggested that generative topics also helped teachers rethink what they were teaching from different perspectives.

Reflective of "ways of thinking and practising" (Entwistle, 2005; McCune & Hounsell, 2005) in the real world, and hence often capable of expression in intuitive, plain English ways, Modelling Ideas have strong resemblance to big ideas. The specification of a web of ideas for a topic could start with a big idea at the Modelling level. In a similar way in which a big idea may be unpacked to expose constituent ideas, the web of ideas for a topic unpacks a Modelling idea to expose the Relational and Foundational ideas associated with it. Essentially, this then enables a method of designing instruction centred on the big idea(s) of a topic.

Further exploration of big ideas in cost accounting is provided in Appendix N, and the implications for structuring textbooks accordingly is discussed in Appendix O.

The second purpose fulfilled by the model is as a teaching aid. When the model is applied to a topic and a web of ideas produced, the web can be used with students as a tool to assist learning by engaging them in discussion of the purposes of the pedagogy. It can be used also to present graphically the scope of the topic, providing students with a visual picture not only of the ideas they must master but also of ideas that fall short of what is desired. As an example, as well as a Relational idea, a web for an accounting topic is likely to portray a Modelling version of it. In other words, the web would recognise an objective and certain way of thinking about something as well as a way that requires critical thought and judgement. Thus, the difference between the two is made explicit, and students are confronted with a choice: to master the Modelling level or not; to adopt a more sophisticated conception of accounting or not. Awareness of the limitations and assumptions of accounting, and taking account of these, is thus seen to be a core part of the curriculum, taught as core, and not as an advanced level that is to be taught/learnt at a later.

The third purpose fulfilled by the Web of Ideas model relates to research in other contexts. By defining three types of knowledge structure, the web provides a means of analysing topic content so that data describing the different types of idea and the associated process of learning can be analysed. Findings in relation to the learning processes that are most important tend to be domain-dependent and therefore a means of segmenting the domain content is generally necessary. Research of this kind can lead to pedagogical improvement.

7.4.2.5 The types of thinking

As explained in Section 7.2, one of the contributions of this research is the identification of nine types of thinking employed by students when privately studying cost accounting. Moreover, it was argued these are likely to generalise to other settings; particularly other settings in which students study professional disciplines. The list of the nine types originally presented as Table 4-8 was reshown earlier in this chapter.

Firstly, the nine types of thinking can be used in teaching activities to develop metacognitive knowledge. Presentation and discussion of the nine types draws student’s attention to their learning processes in terms of whether their learning processes involve progressively enriching the meanings they have constructed; whether they conceive of their learning process as being a process of ongoing construction compared to alternatives, e.g. single shot absorption. Moreover, students could reflect on the thoughtfulness of their learning process, i.e. the extent to which they employ the different types of thinking in their learning.

The use of the nine types also may draw attention to rich knowledge as something the development of which requires a range of thoughtful activities; that ‘knowing something’ is not to ‘have’ or ‘stored’ something, not even the added ability to retrieve it later. Instead, to build knowledge is about developing personal ways of thinking about something and these involve a mix of different ways of thinking, inclusive of thoughts that clarify, inquire, link, extend and those that are critical. All ways of thinking are essential; none – including critical thinking – is privileged in anyway. Moreover, one type of thinking is not a prerequisite for another.

Secondly, a focus on the types of thinking at play can help drive inquiring mindsets, and engender curiosity amongst students. Thoughtful activity is at the heart of learning, in professional disciplines such as accounting as well as many others. Hence, explicit focus on the role of various types of thinking can stimulate active learning, and shift students’ experience of learning from the uninspiring swotting / absorption of content to an experience that students’ find interesting and self-evidently of value. No longer is the classroom a production line, aiming to produce students who are standardised in the sense they all know the same things in the same ways.

Finally, the types of thinking can inform the design of scaffolds aimed at stimulating them. In particular, question stems can be written that help students generate questions that help them make sense of something, in a way that stimulates the full range of thinking types.

7.4.2.6 Thinking behaviours in conjunction with Web of Ideas

In conjunction with the web of ideas for a particular topic, students could undertake informed self-evaluation of their own and others’ self-questions in terms of Foundational, Relational, and Modelling targets within the web. Thus, they may appreciate better the meaning of the different levels of idea, particularly Relational vs Modelling, and improve their own questioning. Moreover, they can reflect on where their thinking has been directed, whether the more important ideas are being ignored, and or relationships between ideas that are not being thought about. I comment that for this to be an achievable task for most students the examples they are asked to classify would probably need to be ones that the teacher felt were significantly different on the dimension of the three levels.

Analyses of self-questions similar to those presented in Sections 6.8.3 to 6.8.6 inclusive, or other methods, can provide feedback to the teacher about how and where students are directing their attention. Consequently, the teacher can intervene or alter the emphases in the design of future pedagogy.

As examples, it may be discovered that too much, or not enough attention is being paid to students' prior knowledge and experience. Alternatively, it may be discovered that students are adopting lower order thinking types too often, perhaps because they are having difficulty with the language of the topic or context in which it takes place. Again alternatively, it may be seen that students are not being sufficiently analytically critical of the topic; too willing to accept things at face value, and to accept knowledge as 'handed down from experts'.

Another example is the possibility students are not attempting to make sufficient connections between the topic and its application in the real world. Another is that insufficient attention is being paid to modelling ideas: ideas for example, which involve subjectivity and uncertainty and thus require judgement. These insights can lead to the discovery of ideas for improving the way assessments test for judgement and understanding of real world connections.

Finally, another example is that it may be found that a disproportionately high amount of attention is being paid to ideas the teacher knows are relatively unimportant. If the majority of these questions seek clarification then perhaps students are finding something about these particularly difficult. If the majority of questions inquire or are critical, then perhaps, despite the teacher knowing the ideas are relatively unimportant, the students are particularly interested in, or inspired by, them.

Thus, conceptualising knowledge topics as webs of ideas together with conceptualising learning as types of thinking can lead to empirical investigation of the effectiveness of pedagogy: pedagogies designed to help students learn to think like professionals must in their real world contexts.

7.4.2.7 For Higher Education policy

A number of implications for University Education policy arise from the findings from the data presented in Chapter 6 and discussed thus far in Chapter 7. The key finding in this respect is that features of University Education system can reinforce poor epistemic beliefs and oppose pedagogy designed to develop them. In summary, the implications for policy are firstly, that institutions should expect, and accept, that changing and conflicting beliefs will, at times, be reflected in declines in student satisfaction as measured by typical student surveys.

Secondly, institutions can significantly improve outcomes at the unit level of pedagogies redesigned to shift epistemic beliefs by coordinating concurrent pedagogical change across the majority of the units that comprise a course.

Thirdly, the 12 week teaching period of units leads to an intense, high stakes learning environment. This leads to students being risk-averse in their learning and focused in the main on the assessed outcomes. This is often not conducive to their development as intellectuals and students as life-long learners.

Fourthly, there are implications for the marketing of courses comprised of units with pedagogies redesigned to shift epistemic beliefs, the selection of students, and supports provided to help students transition into these courses. There are also significant implications in relation to raising awareness of, and developing, the epistemic beliefs of research-active academics, and ensuring these developments transfer to their teaching practices.

The next chapter presents a conclusion to this thesis.

8 Conclusion

This research concerns an undergraduate, cost accounting, learning situation in which the pedagogy was redesigned with the aspiration to create a setting that engaged students in active learning and problem solving, and promoted the development of students as self-regulating learners. The research context was a learning situation in which the pedagogy was redesigned and the question fundamental to the thesis concerned "how students in the unit … experience the learning situation and why they do so in the way they do" (van Mourik, 2014, p. 3).

As previously discussed in Section 1.4, the redesign aimed to address three concerns with the traditional approach, all of which appeared to be driven by an apparent lack of adequate thinking: in the degree to which students could think about what they learnt and could think in their process of learning.

The first concern was that students appeared to adopt surface learning approaches rather than deep (Marton & Säljö, 1976). In other words, students appeared not to be finding the sense in what they were seeking to learn.

The second concern was that it seemed accounting was perceived by students to be objective and certain, thus they believed problems could be solved by mechanical application of procedures. In contrast, accounting procedures in actuality represent alternative methods of deriving information to support better decision making, and thus the application of accounting techniques involves judgement and critical thinking.

The third concern was the apparent lack of self-direction by students in their learning; the observation for example that students were content to listen to explanation of solutions in tutorials rather than doing pre-work and coming to tutorials with questions they wanted answered.

Each pedagogical concern is associated with a research aim in the design of this thesis. They were:

1. to explore how redesigned pedagogy might promote thinking in the process of sense making;

2. to explore the role of epistemic beliefs in relation to accounting reports and techniques and pedagogy redesigned to develop beliefs about these; and

3. to explore how redesigned pedagogy might promote self-directed learning.

Four research questions are associated with these aims and findings in relation to them were explored in the Discussion Chapter 7. This final chapter firstly, takes a step back with synthesised reflections on the discussions of the individual research questions, secondly summarises the thesis contributions, and thirdly, discusses two directions for future research.

In the light of the discussions of each of the research questions, it is clear students' experience of the redesigned pedagogy depended very much on their beliefs about knowledge and learning (Schommer, 1990), and more particularly about their beliefs about how learning takes place in the university context. These beliefs were shaped by their prior experience of university teaching and secondary education, and what they understood was necessary to be successful in these contexts.

To what extent did the redesigned pedagogy promote the development or restructuring of beliefs about learning and cost accounting and hence students' intellectual development? For many students, the inertia of the status quo of beliefs was difficult to shift in the space of one unit and one semester and the research outlined some of the ways their experience of the higher education system reinforced those beliefs and mitigated their development. The inertia may be especially strong in the accounting context, since many students are attracted to accounting because of their mistaken beliefs about the certainty and source (Schommer, 1990) of accounting knowledge. There are also indications from the research that for some students the redesigned pedagogy was influential. For instance, there was considerable success in getting most students to regularly engage in constructing high order questions, and this suggests that many students responded positively to a pedagogical change – the new requirement to generate questions - before they consciously recognized and accepted the worth of this change. In other words, changes in how they approached their learning were in advance of changes in their beliefs about learning.

As just mentioned, despite a common lack of receptivity to new beliefs, students' experience of the redesigned pedagogy led many to adopt new behaviours that would be consistent with new beliefs, and this appears to be a necessary step in the process of adopting new beliefs. For instance, the response in the form of physical attendance at lectures was very high relative to attendance at traditional accounting lectures and the response in the form of intellectual engagement with the optional pre-lecture and pre-tutorial assessments was also very high.

Moreover, students' experience of the redesigned pedagogy led many to respond by generating an appropriate mix of low and high order questions in preparation for tutorials. This mix of questions reflects thoughtful study; a mix of thinking types aimed at clarifying, connecting, and being critical of what they were studying. Thus, many students' experience of the redesigned pedagogy led them to move away from surface learning and towards deeper study approaches.

In all, these behavioural indications are more positive than the perceptions as indicated by the SETU survey. This is explained in part by the limitations of the survey but also by the findings of previous research that whilst students may recognise the intellectual value of certain pedagogies, they do not then necessarily like them (Gourgey, 2001; White & Gunstone, 1992).

Thus, as shown in Figure 8-1, a cycle is apparent which links the shift in epistemic beliefs desired by pedagogy with student behaviours and perceptions of the pedagogy. Students' experience of pedagogical activities designed to support positive shifts in epistemic beliefs may lead to positive shifts in behaviours but they perceive them negatively. Nevertheless, a positive change in epistemic beliefs may follow which in turn influences how they will experience pedagogy at a subsequent time. However, often, students do not necessarily like activities designed to develop them intellectually, thus for them their perceptions may continue to be negative. Thus, the cycle repeats. Overtime, perhaps, the perceptions turn positive.

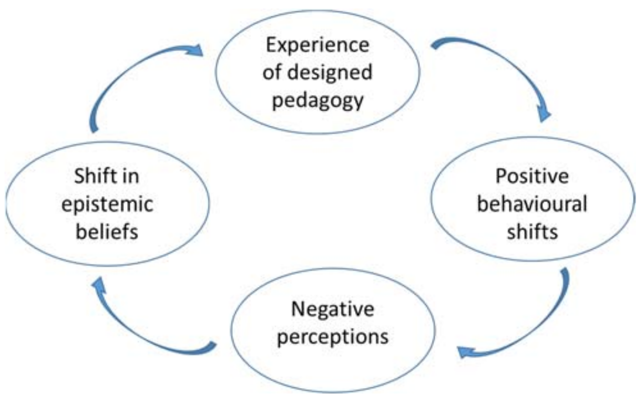

Figure 8-1 Change cycle

Of course, this is not a 'happy cycle' in the sense that although students may experience rewarding behaviours that are linked to positive changes in epistemic beliefs and hence intellectual development, many do not perceive it positively; they are not happy about it. This is the antithesis of the idea that students learn best when they are enjoying the experience; when they are happy. So, by what strategies then, is the cycle broken, or at least, optimised? However this is addressed, it seems probable that an essential component is raising students' awareness of not only the existence of their beliefs in an area that they may never have consciously thought about, but also providing visions of possible trajectories of change. What follows is necessarily speculative at this point in time.

Theoretically, the more often students experience the cycle the more likely they will eventually 'get it'. Thus, one strategy to optimise the cycle may be to design pedagogy so that scopes are small and cycle times short so that students accumulate a volume of experiences relatively quickly. In other words, they are caused to mature as learners quicker.

A second strategy is to focus on the unhappy part of the cycle: perceptions. At university level, this may mean directly confronting and changing students' expectations of university learning so that they come to perceive activities supportive of active learning and shifts in epistemic beliefs more positively.

A third strategy to support the second is to take actions that change the popular perception of universities as places one attends to receive knowledge handed down by experts and perceptions that text books are perfect and complete compilations of the knowledge needed. Many features of university practice continue to reinforce the transmissive paradigm of learning. Instead, universities should be perceived as places one attends in order to think: thinking about the sense of things and about acquiring ways of thinking about them.

This thesis makes a range of scholarly contributions. Firstly, the thesis contributes thinking-centred models of 'knowledge' and 'learning'. Much of the educational literatures makes no, or only weak, connections between knowledge evidenced by having a way of thinking about something, and learning as being a thoughtful activity. As explained in Sections 4.7.1.1 and 7.4.2.4, the Web of Ideas model is a powerful pedagogical tool. The Web of Ideas is distinctive because it assists design of pedagogy based on learners' ways of thinking and draws the designer's attention, in particular, to real world ways of thinking and practising. Importantly, it also provides a means of critical interrogation of curricula and texts: it helps both to look back at what has been done and look forward to how it can be done better.

Secondly, in relation to the curriculum design of cost accounting, this thesis calls for cost accounting to be represented as a set of 'Big Ideas', each encompassing a range of imperfect methods of solving real world business problems. This means accounting is not presented as being objective and certain but, because of the inherent limitations and assumptions of techniques, as something requiring critical thought and judgement. Crucial issues here are to have students recognise the real world necessity of the limitations and assumptions from the beginning of the learning process and to relocate the discussion of these from a minor section at the end of each textbook chapter, or topic, to being the essential context for each topic. Consequently, what might otherwise be perceived as neat techniques and algorithms are now recognised as necessary, overly neat simplifications whose use demands constant interrogation and justification. This pedagogical approach is consistent with the thinking-centred models of knowledge and learning contributed by this research.

Thirdly, as explained in Section 7.2, the thesis contributes to the works of King (1994b); Winne and Hadwin (1998); Wong (1985) by articulating the types of thinking involved in making sense of ideas in private study contexts similar to cost accounting, how they vary with different knowledge structures, and by proposing how they vary in different phases of the process of sense making. The implications of these contributions for giving focus to thinking in practice were explained in Section 7.4.2.5.

Fourthly, the thesis makes a contribution in respect of the discussion in this chapter of the change cycle presented in Figure 8-1. Underpinning this is the exploration of epistemic beliefs, student perceptions and behaviours presented in Chapter 6 and discussed in Chapter 7.

Finally, the thesis illuminates various implications for University Education institutional policies. These are discussed in Section 7.4.2.7 and arise from a key finding that features of the University Education system can reinforce poor epistemic beliefs and oppose pedagogies designed to develop them.

Two broad directions for further research emerge from the research. The first is in respect of the development of epistemic beliefs and in particular, how scaffolding may be designed into pedagogies so as to take account of the evolutionary nature of the development of beliefs and the finding that change in students' epistemic beliefs may lag the positive change in students' learning behaviours. This can extend to consideration of strategies for conditioning institutional environments that are more conducive to the success of such pedagogies.

The second is in respect of thinking-centred approaches to pedagogy and in particular, the empirical validation of the generalisability of the eight types of thinking to other disciplines, the identification of Modelling ideas at topic level and the consequent framing of webs of ideas in various disciplines, and the potential to improve learning generally based on thinking-centred models. This includes ways of improving teaching and the structure of textbooks and online resources that extend the work presented in Appendices F, N, and O.

To conclude the thesis, I return to the forced redesign of this research project. As explained in Section 1.6, an administrative decision disrupted the originally proposed plan to base this research primarily on interview data. Consequently, interview transcripts from the pilot phase were combined with other sources of data, primarily student self-questions, in order to explore the original fundamental question outlined in Section 1.4. The latter source of data presented in Chapter 5 enabled findings about the sense making of students as they grappled with content in their own time and thus made possible another perspective in the exploration of students' responses to the redesigned pedagogy. Thus, ultimately, and happily, the exploration of the fundamental question was enriched by the disruption!

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Appendices

A MUHREC approval

MONASH University

Monash University Human Research Ethics Committee (MUHREC)
Research Office

Human Ethics Certificate of Approval

Date:	**19 April 2013**
Project Number:	**CF13/896 – 2013000422**
Project Title:	**Evaluation of teaching innovations in AFF2391 'Cost Information for Decision Making'**
Chief Investigator:	**Mr Greg van Mourik**
Approved:	**From: 19 April 2013 To: 19 April 2018**

Terms of approval

1. The Chief investigator is responsible for ensuring that permission letters are obtained, if relevant, and a copy forwarded to MUHREC before any data collection can occur at the specified organisation. **Failure to provide permission letters to MUHREC before data collection commences is in breach of the National Statement on Ethical Conduct in Human Research and the Australian Code for the Responsible Conduct of Research.**
2. Approval is only valid whilst you hold a position at Monash University.
3. It is the responsibility of the Chief Investigator to ensure that all investigators are aware of the terms of approval and to ensure the project is conducted as approved by MUHREC.
4. You should notify MUHREC immediately of any serious or unexpected adverse effects on participants or unforeseen events affecting the ethical acceptability of the project.
5. The Explanatory Statement must be on Monash University letterhead and the Monash University complaints clause must contain your project number.
6. **Amendments to the approved project (including changes in personnel):** Requires the submission of a Request for Amendment form to MUHREC and must not begin without written approval from MUHREC. Substantial variations may require a new application.
7. **Future correspondence:** Please quote the project number and project title above in any further correspondence.
8. **Annual reports:** Continued approval of this project is dependent on the submission of an Annual Report. This is determined by the date of your letter of approval.
9. **Final report:** A Final Report should be provided at the conclusion of the project. MUHREC should be notified if the project is discontinued before the expected date of completion.
10. **Monitoring:** Projects may be subject to an audit or any other form of monitoring by MUHREC at any time.
11. **Retention and storage of data:** The Chief Investigator is responsible for the storage and retention of original data pertaining to a project for a minimum period of five years.

Ben Canny

Professor Ben Canny
Chair, MUHREC

cc: Assoc Prof Carla Wilkin

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Figure A-1 Human Ethics Certificate of Approval

B Explanatory Memorandum

A reproduction of the explanatory memorandum provided to students is shown on the next four pages.

24th February 2014

Explanatory Statement

Evaluation of teaching practice in ACF2391

'Cost Information for Decision Making' in 2014

This information sheet is for you to keep.

My name is Greg van Mourik and I am a lecturer in the Department of Accounting and Finance at Monash University. I am undertaking a PhD in Education under the supervision of Dr. Phillip Dawson from the Office of the Pro Vice-Chancellor (Learning and Teaching) and together with my colleagues, I evaluate how ACF2391 is taught each semester in terms of how students experience the learning situation and how well they perform in assessment tasks. As well as the use of data collected in the normal course of administering and managing the unit, it is useful to evaluate teaching practice with information you might choose to provide voluntarily and anonymously via surveys and via face-to-face interviews.

Why were you chosen for this research?

Evaluation of the effectiveness of teaching practice requires information from current and past students of ACF2391. Consequently, as a student enrolled in this unit, you are invited to assist either by responding to a voluntary and anonymous survey or participating in face-to-face interviews.

The aim/purpose of the research

The aim of evaluating current teaching practice in ACF2391 is to improve students' experience of learning and continuously improve teaching so as to help more students achieve their potential in mastering the contents of the unit and their undergraduate course generally. Thus the research may support the wider educational research community through publications. In addition, data collected from face-to-face interviews will be used in the completion of my PhD project.

What does the research involve?

MONASH University

Evaluations of teaching practice involve analysis of data collected in the normal course of teaching and assessing ACF2391, as well as data collected from voluntary and anonymous surveys. These surveys are administered in such a way that you do not have direct contact with either the researchers or teaching staff; i.e. if the survey is administered face-to-face then it will be administered by people not involved in teaching or in the evaluation, or the survey may be administered anonymously through, for example, Moodle.

A small number of students are invited to participate more deeply in the research by participating in up to three face-to-face interviews and completing a second survey. Apart from an interview in which the participation of these students is confirmed and their informed consent is assured, two interviews seek to collect data about their experience of being taught the understanding relevant to two of the three coursework assessment tasks. The third interview, if held, would relate to an instance of academic consultation that takes place in the normal course of the semester.

Possible benefits

In the same way that you, as a current student of ACF2391 are benefitting from past students' responses to surveys and interviews regarding past evaluations of teaching practice, future students of ACF2391 will benefit from improvements in teaching practice identified and implemented from the data you provide this semester.

In addition, students who participate in face-to-face interviews may improve their academic performance as a result of what they learn about themselves through their participation in the research.

How much time will the research take?

Surveys are designed to be completed in a short period of time, typically less than 30 minutes. Interviews typically will be of one hour duration approximately.

Inconvenience/discomfort

No inconvenience or discomfort to you is anticipated by your responses to surveys or participation in the interviews. In the event the interviewer is also a marker of assessments then class registrations will be adjusted so that the interviewer is not an interviewee's tutor. Combined with the fact final exams are blind-marked and failed exams are second-marked by an independent academic, this means the marks given for assessments are neither favourably nor unfavourably influenced by your participation.

Payment

There will not be any payment to you for your assistance with an evaluation of teaching practice.

Consent / withdrawal from the study

Your participation in a survey or interview is voluntary. You are under no obligation to respond to any survey, invitation to attend an interview, or to answer every question. A choice to respond to one survey or to participate in an interview does not compel you to respond to a subsequent survey or interview. Students who participate in interviews will be asked to show their consent by signing a consent form. In regard to anonymous surveys, your consent to us using the responses you provide is implied by having responded to the survey.

This means you can 'withdraw' from further participation by choosing not to respond to subsequent surveys or survey interviews. If you choose not to respond to later surveys, it may not be possible to withdraw your responses to earlier surveys because they were anonymous and thus not able to be identified.

Confidentiality and use of the data

Information collected as part of an evaluation with be kept confidential, stored and managed in the same way as the data collected in the normal course of teaching and assessing ACF2391. Individual comments or responses to a survey question are anonymous, and if used in a publication, will be attributed to a pseudonym, e.g. "Student X said …" and any identifying information will be removed.

Storage of data

Data collected will be stored in accordance with Monash University regulations and kept on University premises, in a locked filing cabinet, for 5 years. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

Results or concerns

If you would like to be informed of the aggregate research findings, or you would like to contact the researchers about any aspect of this study, please contact the Chief Investigator of this project, Mr Greg van Mourik on (03) 9903 1099 or email: Greg.vanMourik@monash.edu.

Contact details of the PhD Supervisor, Dr. Phillip Dawson, are Office of PVC (Learning and Teaching), Room 02, Building C3, Caulfield (*Tel*: +61 3 990 34486, or *Email*: Phillip.dawson@monash.edu).

Any concerns or complaints regarding the conduct of the research should be notified to Executive Officer, Monash University Human Research Ethics Committee (MUHREC), Building 3e Room 111, Research Office, Monash University (*Tel:* +61 3 9905 2052, *Fax:* +61 3 9905 3831 or *Email:* muhrec@monash.edu) citing Project Number CF13/896 – 2013000422.

I thank you ahead of time for your participation.

Kind regards,

Greg van Mourik

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22 November 2019

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Signed: ________________ Date: 2/12/2019

GREG VAN MOURIK
(Print full name and title)

D Explanation and example of a weekly tutorial attendance sheet

Although illustrative of an attendance sheet for a tutorial conducted in Week 12, the example shown in Figure D-1 is consistent with those of earlier weeks. The columns that would normally identify students have been obscured in this example. This attendance sheet would be circulated amongst the students in the class during tutorial time so that they could indicate their attendance at the tutorial and also attend to the information presented on it.

The Critical Thinking assessment required students each week to generate questions whose answers they believed would significantly improve their understanding of aspects of the topic. All questions were posted on a Moodle Discussion forum that was set up for that week, and the question they deemed 'most powerful' was also submitted via Google Forms. The expectation was that students would generate and thus post on the forum more than two questions.

Central to the sheet is the presentation of the powerful questions students submitted for the purpose of that week's Critical Thinking assessment, shown under the column heading "Wk 12 Powerful question" and the number of questions posted on the forum ("# Posts Wk12"). Prior to the tutorial, the tutor would consider both these aspects; indicate the assessment as satisfactory (1), unsatisfactory (0), or requiring discussion (x) in the column headed "Wk 12 Satisfactory etc", and provide feedback (indicated by the handwritten comments).

Continuing the description of the attendance sheet by addressing columns further to the right, the next column headed "Tute 12 attend?" was used to collect student attendance.

The far right three columns provided students with feedback regarding the outcome of the previous week's lecture engagement assessment. As well as reporting the outcome as satisfactory (1) or not (0) in the column headed "Lecture 11 engage", the components of this assessment were also presented so that students would understand the reason for an unsatisfactory engagement and have the opportunity to correct any data errors, e.g. to argue that contrary to the report, they had in fact attended the lecture. In particular, the first component of the engagement assessment was participation in the pre-lecture quiz and this was shown as satisfactory (1), unsatisfactory because of insufficient satisfactory responses to the quiz questions (0), or unsatisfactory because they did not submit (dns) the pre-lecture quiz, under the column headed "Pre-lecture quiz". The second component was lecture attendance and this was shown as attended (1) or not (0) in the column headed "Lecture 11 attend?"

When the one attendance sheet was circulated amongst all of the students in the class, students had limited time to attend to the information and may have had privacy concerns. To address these issues, students were able at any time during the semester to form a small group with other students. Membership of such a group was indicated in the far left column headed "Group ID" and it meant that an attendance sheet tailored to the membership of the group was provided to them and to which they had access for the entire class time. In this example, the three students with a Group ID of 2 would have received an attendance sheet in relation to themselves.

Finally, the second, third and fourth columns provided students with progress information of a semester-to-date kind. The second column showed the cumulative total of weeks in which the student achieved satisfactory lecture engagement assessments and the heading indicated for that week in the semester the maximum number possible.

Similarly, the fourth column showed the cumulative total of weeks in which the student achieved satisfactory critical thinking assessments and the heading indicated for that week in the semester the maximum number possible. The third column provided more detail about this performance by reporting the number of occasions when the student did not submit (dns) a critical thinking assessment.

The entire process of collecting and presenting the data on the attendance sheet was facilitated by technology including the use of spreadsheet macros to pre-fill cells with data where appropriate and format the sheet prior to printing.

Group ID	# satisfactory lecture engagements to wk 11 Max=10	CT # dns @ Wk 11 Max=9	CT # satisfactory @ Wk 11 Max=9	Student ID	First Name	Last Name	Preferred Name	Wk 12 Powerful question	# Posts Wk12	Wk 12 √ Satisfactory Discuss (x) x Unsatisf'y	Tute 12 attend?	Lecture 11 engage	Pre-lecture 11 quiz	Lecture 11 attend?
2	9	1	9				Matt	Without the use of standard costs, budgeting and variance analysis how would a company be most greatly affected? Recall that these are mgmt acctng techniques. Think about the purpose of mgmt acctng.	3	1		1	1	1
2	5	2	6					What other assumptions may be made when making assumptions regarding standard costs? Your question appears to lack careful thought. Please discuss if you wish.	3	0		0	dns	1
2	2	8	2	Content of these shaded cells has been obscured			Dave	#N/A	0	dns		0	dns	0
	4	5	5					when there is a favorable price variance, it may be a blessing for the company to gain more profit, but the quality might be poorer. how does manager weight and consider this situation? Good question, there is not a black + white answer. Make sure you discuss it in your group.	2	1		0	1	0
	9	1	8				Jane	Q21 since efficiency variance = standard price x different in standard and actual labour hours then why don't we use standard labour hour (0.4x10,00 units) in the calculation of DL price variance? Good question, we are measuring the effect of a price difference on what actually happened. Therefore...?	3	1		1	1	1
	10	1	6					1.How trends in variances affect whether a variance is investigated or not? 2.When will managers use currently attainable standard? Fair questions but reading background in textbook would have led to more powerful questions.	0	1		1	1	1

If found, please return to Greg van Mourik, H3.41Allocate+ data as at 16th March

"The quality (i.e. power) of questions developed reflects the **quality of thinking** behind them" (Paul Elder 2006, p119)

Figure D-1 An example of the weekly tutorial attendance sheet

E Example of teaching materials supporting the aspiration to 'think like an accountant'

The distinction between 'knowing' accounting and being able to think like an accountant was a constant theme. For instance, the message was promoted through the slide shown in Figure E-1.

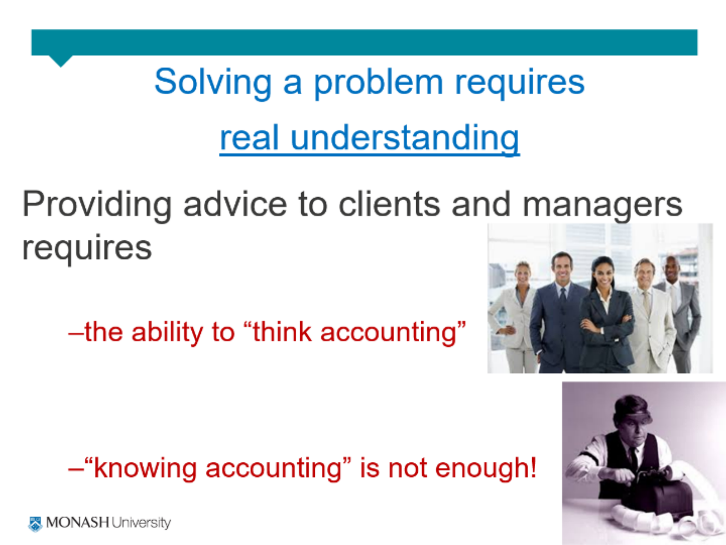
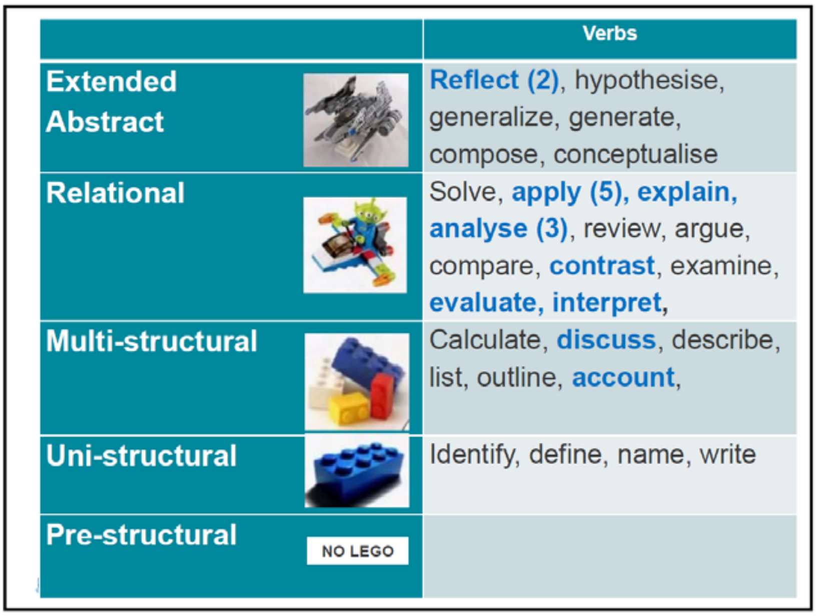


Figure E-1 Example of a slide used to promote 'thinking' cf 'knowing'

The following figures show slides used in lectures to promote further the aspiration of the redesigned pedagogy to help students think like accountants. They explain the assessment standards and how the pedagogy was designed to help them.

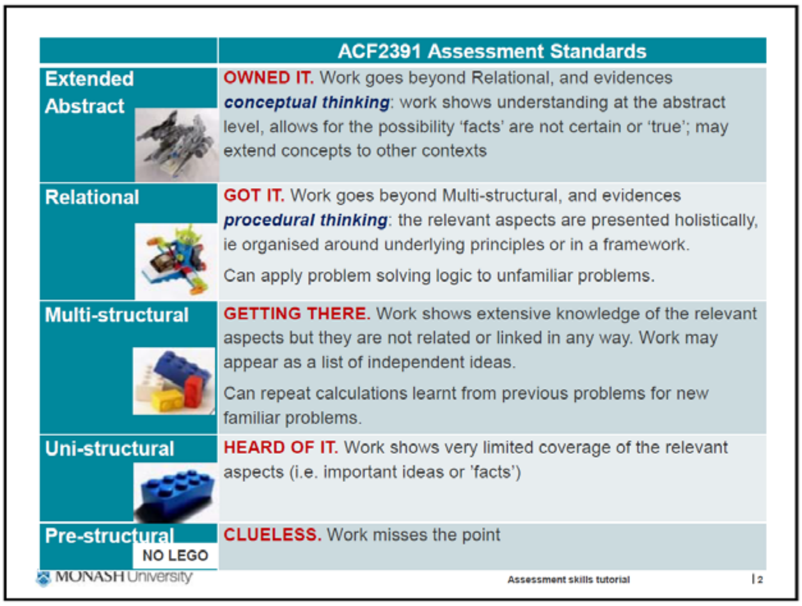
The SOLO Taxonomy (Biggs & Collis, 1982) was used to frame the assessment rubrics in the unit. Anecdotally, higher education academics have suggested the taxonomy is too difficult for undergraduate students but five year old and Year Seven children have been shown capable of explaining levels of understanding in terms of the SOLO taxonomy (Hook, 2012; MMHS Media, 2018). The first slide shown in Figure E-2 reminded students of material used in the Assessment Skills Seminar. At the Seminar, a four minute YouTube® video (Hughes, 2012) was used to introduce SOLO in the context of construction with Lego™ toy bricks. Thus, this slide in reminded students of the YouTube video and the ways in which verbs used in assessment tasks correspond to levels of outcome.



	Verbs
Extended Abstract	Reflect (2), hypothesise, generalize, generate, compose, conceptualise
Relational	Solve, apply (5), explain, analyse (3), review, argue, compare, contrast, examine, evaluate, interpret,
Multi-structural	Calculate, discuss, describe, list, outline, account,
Uni-structural	Identify, define, name, write
Pre-structural NO LEGO	

Figure E-2 SOLO verbs

The next slide shown in Figure E-3 provided descriptions of the assessment standards associated with assessment tasks. Again, the words highlighted in red provided connections to the YouTube® video used at the Seminar. The levels of the taxonomy were also used to distinguish the difference between 'knowing accounting' and beginning to 'think like an accountant' (extended abstract).



	ACF2391 Assessment Standards
Extended Abstract	OWNED IT. Work goes beyond Relational, and evidences ***conceptual thinking***: work shows understanding at the abstract level, allows for the possibility 'facts' are not certain or 'true'; may extend concepts to other contexts
Relational	GOT IT. Work goes beyond Multi-structural, and evidences ***procedural thinking***: the relevant aspects are presented holistically, ie organised around underlying principles or in a framework. Can apply problem solving logic to unfamiliar problems.
Multi-structural	GETTING THERE. Work shows extensive knowledge of the relevant aspects but they are not related or linked in any way. Work may appear as a list of independent ideas. Can repeat calculations learnt from previous problems for new familiar problems.
Uni-structural	HEARD OF IT. Work shows very limited coverage of the relevant aspects (i.e. important ideas or 'facts')
Pre-structural NO LEGO	CLUELESS. Work misses the point

Figure E-3 Assessment standards

The next two slides summarized the ways in which the pedagogy supported both 'knowing accounting' (Figure E-4) and 'thinking like an accountant' (Figure E-5).

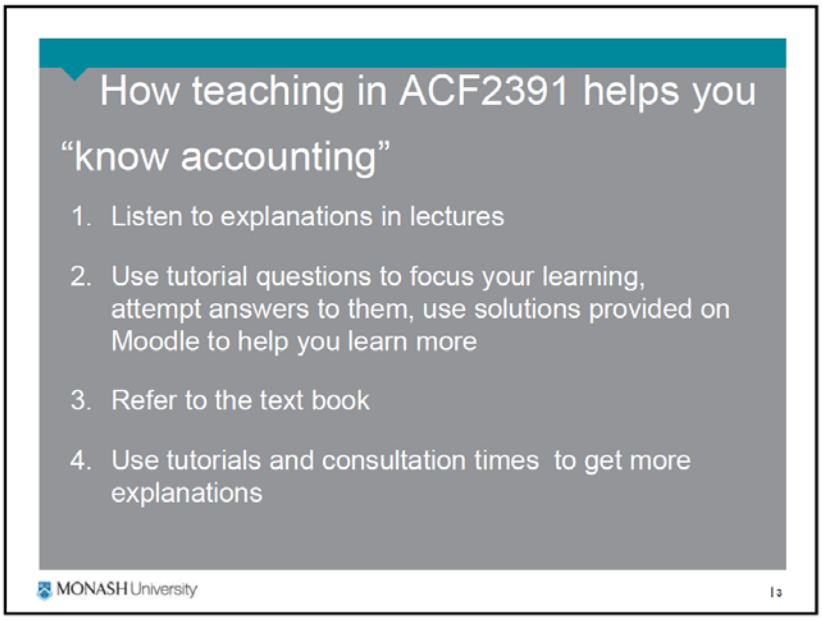


Figure E-4 Pedagogical support to know accounting

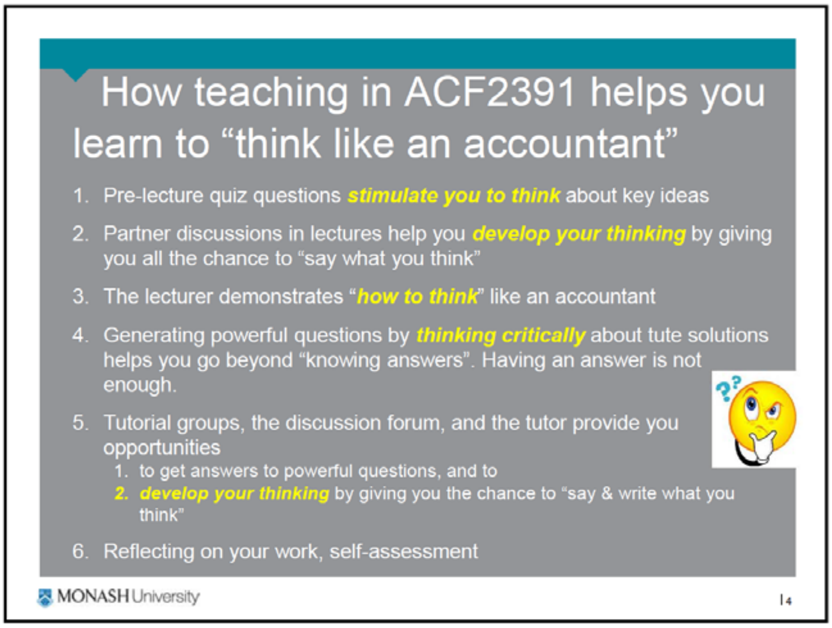


Figure E-5 Pedagogical support to help think like an accountant

The final slide in the set shown in Figure E-6 reinforced the ways in which two assessment tasks, Critical Thinking and Lecture Engagement, aimed to help students learn to think like accountants.

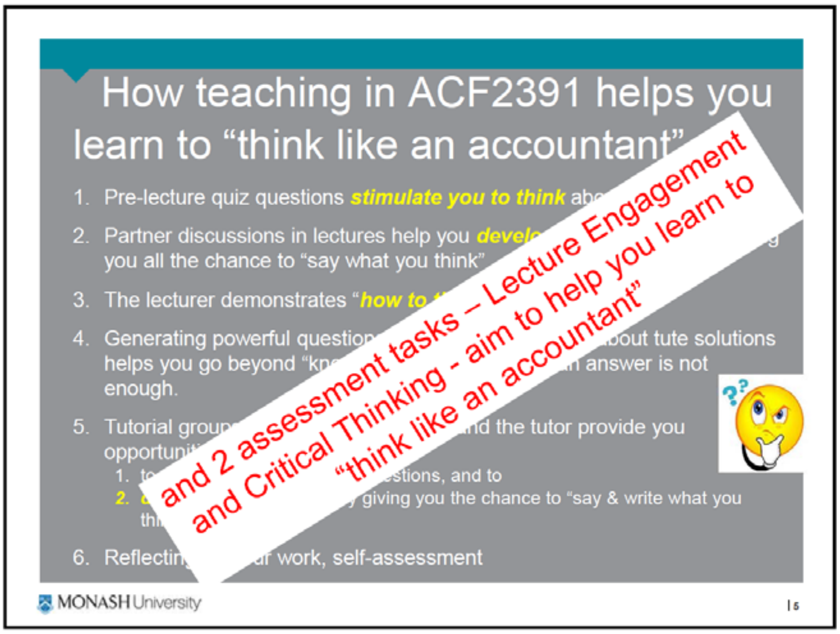


Figure E-6 The purpose of the optional assessments

F Example of a lecture aimed at enabling a lecture as a conversation

The design discussed in this appendix is in contrast to the traditional lecture. Traditionally, students are expected to read the textbook chapter relating to the lecture topic before attending the lecture which then consisted of a presentation and explanation of the chapter content.

In contrast, the lecture design sought to ground the topic content firstly in students' own life experience, and only later in the textbook content. It did this by basing the lecture on methods of solving a problem in a context with which they were likely to be familiar, and using pre-lecture multiple-choice questions to orient students to the lecture, intrigue them, and raise awareness of prior knowledge or relevant life experience. In-lecture poll questions were also used to facilitate dialogue. Post lecture, tutorial exercises would then provide students opportunities to apply similar problem-solving methods in business contexts.

Based in the context of a personal holiday, the Lecture Problem in this example provides the opportunity to ground learning in a context with which students are likely to be familiar. The lecture topic is Cost Estimation and the lecture problem is shown in Figure F-1

ACF2391 Lecture Problem   Week 2

Part 1. Leigh has a problem, she knows she is always short of money and she does not feel in control of it. She bought a car 18 months ago and she thinks the car has something to do with her problem. To regain control, she decides to "get on the front foot" by predicting the costs that will be related to the car in future months.

She suspects there are probably a number of different ways to predict future costs but has chosen to predict future car costs by analysing information about car costs in her past. She has retrieved information from Facebook, diary, credit card statements, cash receipts and other sources and compiled the information in table 1.

TABLE 1	**kilometres travelled**	**car-related cost**
January	350	$130
February	600	$236
March	220	$80
April	700	$245
May	550	$201
June	450	$154
July	300	$103
August	200	$80
September	1,000	$400
October	800	$372
November	650	$257
December	250	$120

Question 1. Next February, she expects to drive 400km. What do you estimate her car-related costs will be in February?

Part 2. Subsequently, Leigh doubted the completeness of the information and thus checked her sources, and compiled new information in table 2.

TABLE 2	**kilometres travelled**	**car-related cost**
January	350	$172
February	600	$187
March	220	$110
April	700	$251
May	550	$233

June	450	$189
July	300	$134
August	200	$110
September	1,000	$350
October	800	$332
November	650	$247
December	250	$135

Question 2. Leigh is particularly concerned about the cost next July when she expects to travel 2,000km. What do you estimate her car-related costs will be next July?

Figure F-1 Example lecture problem

Three of the five questions that makeup the pre-lecture quiz have correct/incorrect answers and the other two ask about students' experience of regression analysis and algebra. The three questions that could be answered incorrectly asked about (i) relevant costs, ii) the assessment skills tutorial conducted in the previous week, and iii) the lecture problem. For a quiz submission to be assessed as 'satisfactory', students had to answer all questions and at least 1 of the first 3 must be correct. Students' responses to these questions were used in the lecture. The pre-lecture quiz questions are shown in Figure F-2.

Pre-lecture multiple choice questions

Q1. How many kilometres does Leigh expect to travel next July?

A. Less than 300 km
B. Between 300 and 500 km
C. Between 500 and 700 km
D. Between 700 and 900 km
E. More than 900 km

Q2. Last week, we took a close look at relevant costs in the tutorial. Which of the following statement(s) in respect of relevant information is (or are) true?

1. Historical information has no value, because it is not relevant

2. Relevant information is information that describes the future

3. Relevant information is information that makes a difference to a decision or choice to be made about the future

A. Only statement 1 is true
B. Only statement 2 is true
C. Only statement 3 is true
D. Only statements 1 & 2 are true
E. Only statements 1 & 3 are true
F. Only statements 2 & 3 are true
G. All statements are true

Q3. What is your experience of using Microsoft Excel to perform regression analysis?

A. I don't know what regression analysis is.
B. I am somewhat familiar with it but don't actually know how to do simple regression analysis.
C. I can do simple regression analysis
D. I can do both simple and multiple regression analysis

Q4. The Week 1 tutorials provided information intended to help you understand the criteria that will be used to assess your work in the three coursework assessment tasks and the final exam this semester. Generally speaking, to pass the unit you will need to demonstrate minimum understanding at which one of the following levels?

A. The pre-structural level
B. The uni-structural level
C. The multi-structural level
D. The relational level
E. The extended abstract level

Q5. How confident are you that you can determine the equation of the straight line that joins two points (x_1, y_1) and (x_2, y_2)? E.g. determine the equation of the line that links the points (5,10) and (8, 20)?

A. I know I can determine the equation because I have worked it out
B. I have not worked out the equation, but I am confident I can
C. I think I knew how to determine the equation in the past, and with help I will remember how to do it again
D. I understand what 'determining the equation' means, but I don't know how to do it
E. I don't understand what you are asking me

Figure F-2 Example pre-lecture quiz questions

The purpose of Q1 was to increase the likelihood students studied the lecture problem before attending the lecture. The lecture was intending to build on knowledge introduced in the previous week and therefore the purpose of Q2 was to remind students of it and check how well it was understood so that remedial explanation could be provided during the lecture if required. The topic drew upon statistical techniques and therefore the purpose of Q3 was to identify the extent to which students were already knowledgeable about regression analysis so that the lecture conversation could be tailored accordingly. The purpose of Q4 was to maintain students' focus on the level of understanding required for success in the unit and motivate engagement in the lecture conversation. Similarly to Q3, the topic content included a cost accounting method which is an adaptation of an algebraic technique and therefore the purpose of Q5 was, during the lecture, to help students recognise this association.

The two in-lecture poll questions provided the means by which feedback about students' solutions to the two parts of the lecture problem could be collected and thus discussed during the lecture. The in-lecture poll questions are shown in Figure F-3. The number ranges used in the various options were selected because they were diagnostic of how students were thinking in the event their responses were poor.

In-lecture Poll questions

POLL #1 What do you estimate Leigh's car costs to be next February, based on 400km?

A. Less than or equal to $100
B. More than $100 but less than or equal to $130
C. More than $130 but less than or equal to $160
D. More than $160 but less than or equal to $200
E. More than $200 but less than or equal to $300
F. More than $300

POLL #2 What do you estimate Leigh's car costs to be next July, based on 2,000km?

A. Less than or equal to $300
B. More than $300 but less than or equal to $350
C. More than $350 but less than or equal to $500
D. More than $500
E. Don't know, or the cost can't be predicted

Figure F-3 Example in-lecture poll questions

An explanation of the slides used in lecture presentation is provided in Table F-1. Note that all slides inclusive of the Wiley logo were provided as instructor resources by the publisher.

Table F-1 Explanation of lecture slides

Slide 1, not shown, was a title slide. The purpose of Slide 2 was to outline the agenda: that it was structured around the two parts of the lecture problem; and highlight the key relevant accounting concepts. This is in contrast to the slide showing the traditional lecture structure shown in Figure F-4.

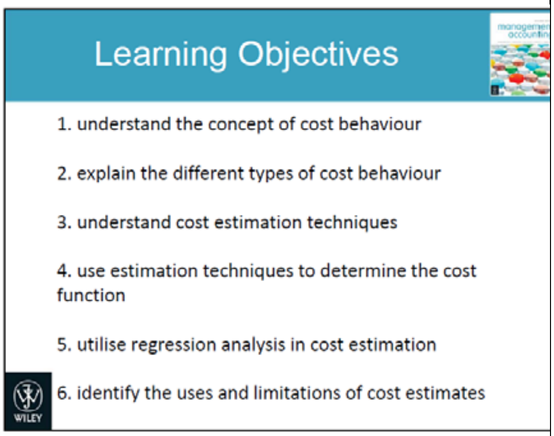
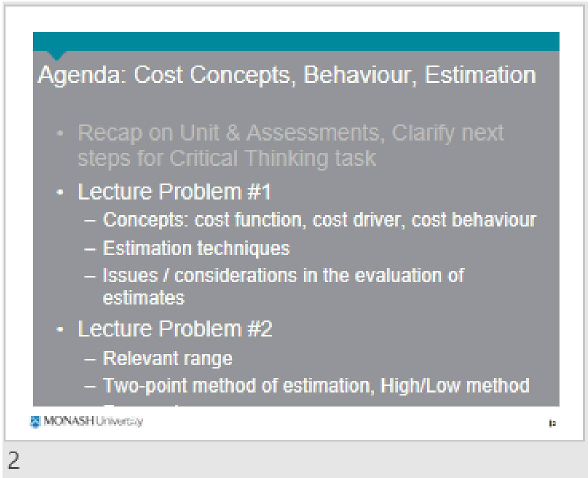
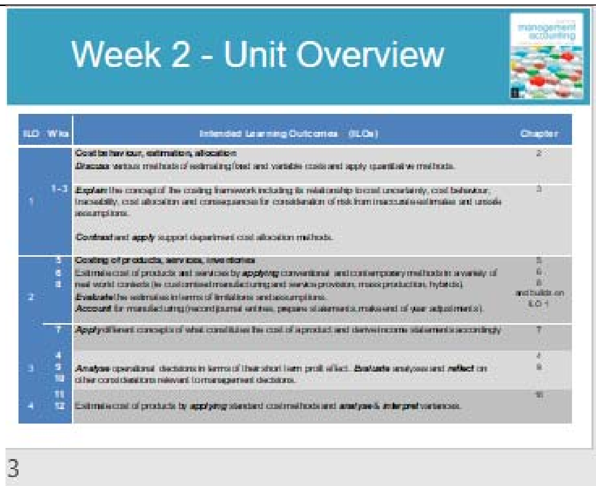


Figure F-4 Traditional lecture structure



The relevant learning outcomes for the topic were communicated via slide 3, which in contrast to the textbook, simplified them and showed how the topics across multiple weeks were related.



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<td>Slides 4 and 5 made passing reference to key accounting concepts that would be ‘discovered’ during the subsequent problem-solving discussion. The inclusion of slides such as these also could convey to students the parts of the textbook that are of greater importance.</td>
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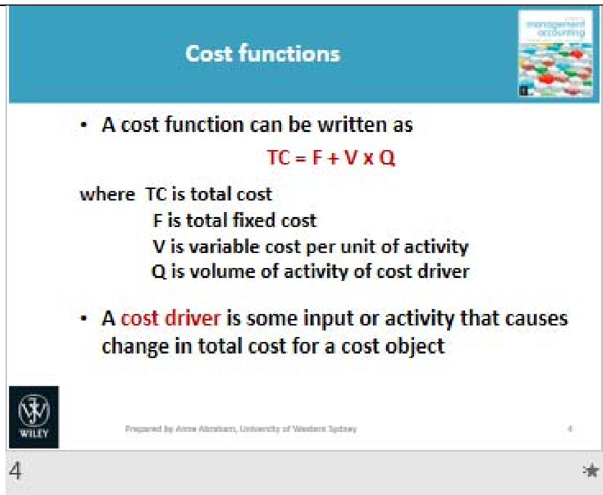

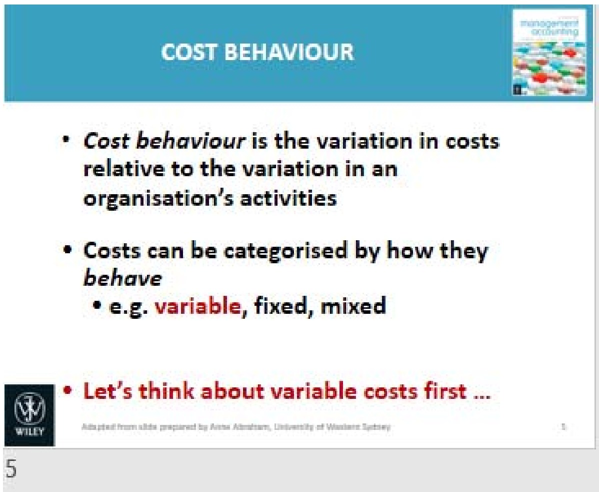

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<td>Slides 6 and 8 reminded students of the problem being discussed, and slide 7 affirmed for the majority of students that they answered the question correctly, probably because they read the problem carefully enough to do so.</td>
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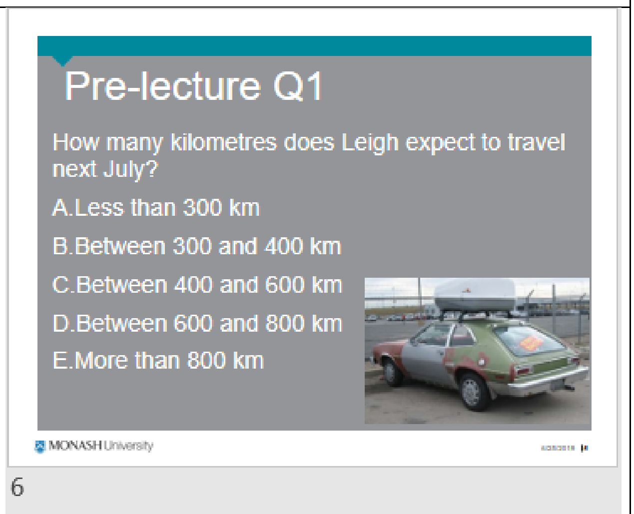

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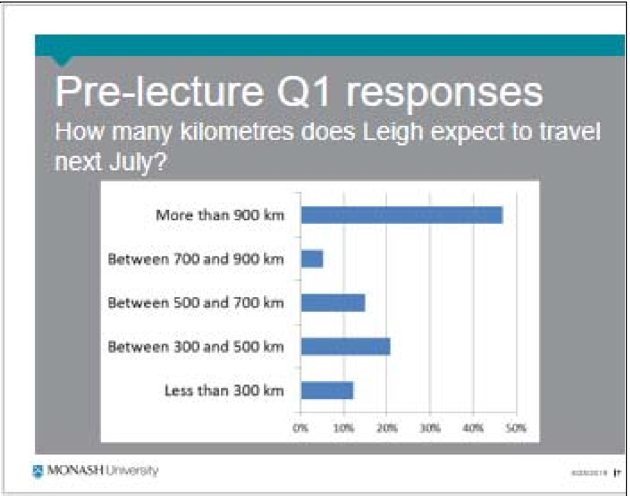

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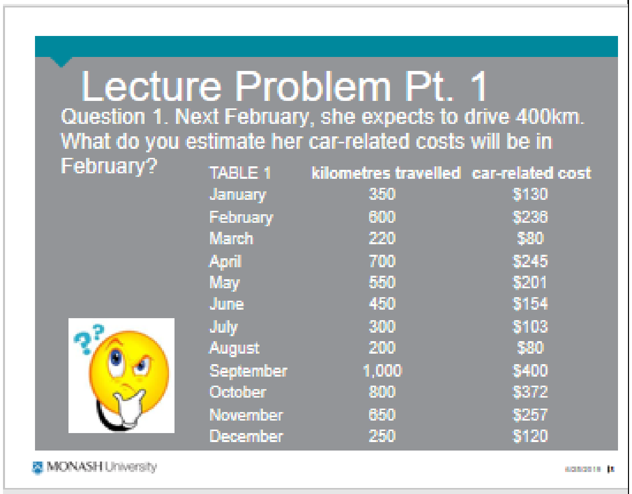

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<td>Slide 9 aimed to facilitate some reflection and discussion about the problem by students in pairs or in small groups. The aims were to gain acknowledgement problems like these are worth solving, that historical data can be useful, and to stimulate students’ existing problem solving ideas relevant to this problem.</td>
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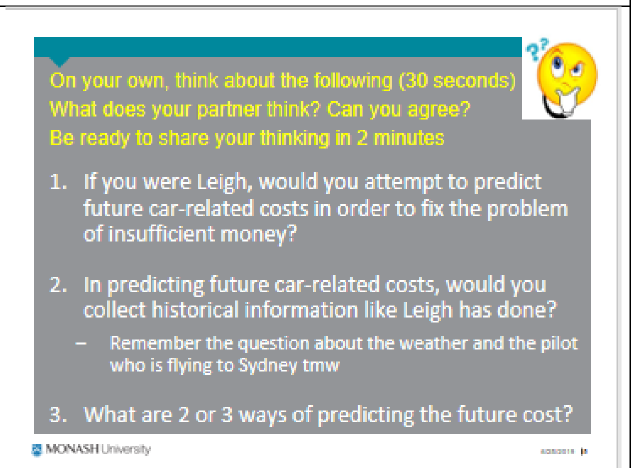

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<td>After the small group discussions, slide 10 facilitated plenary feedback and discussion, with Slides 11 to 14 facilitating connection to the pre-lecture quiz activity and the previous week’s lecture.</td>
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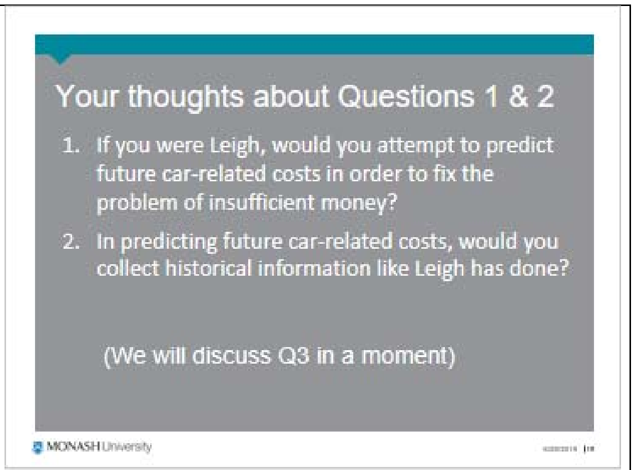

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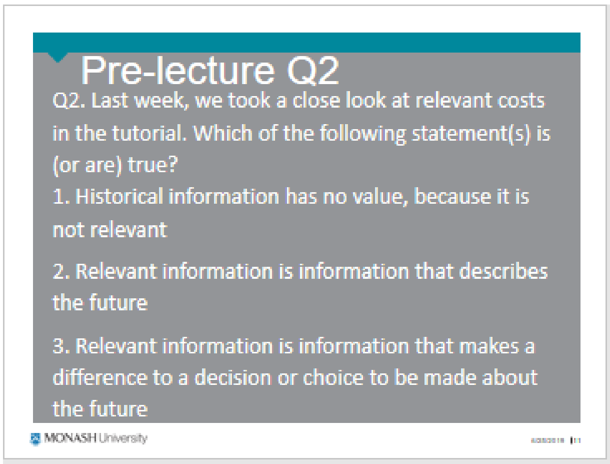

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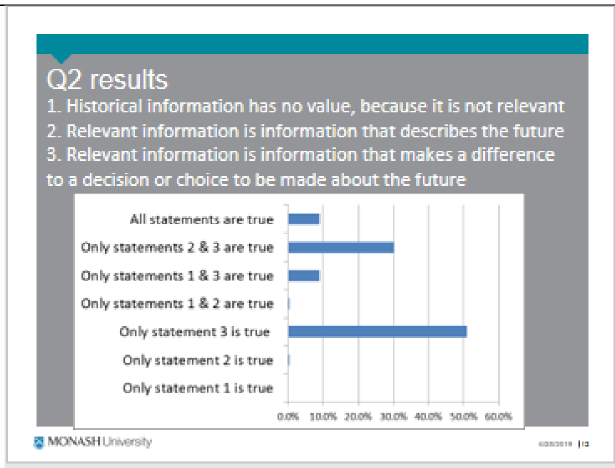

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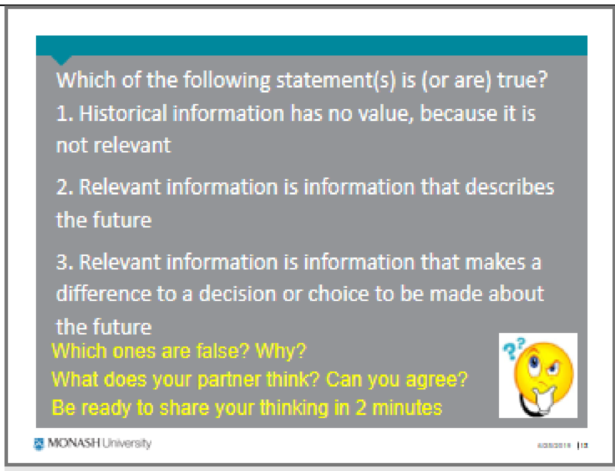

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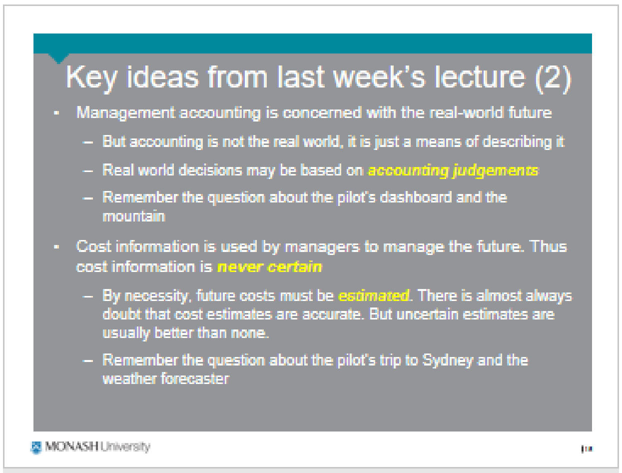
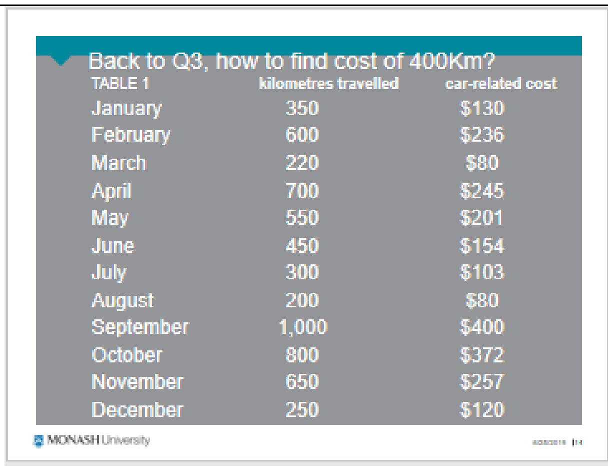


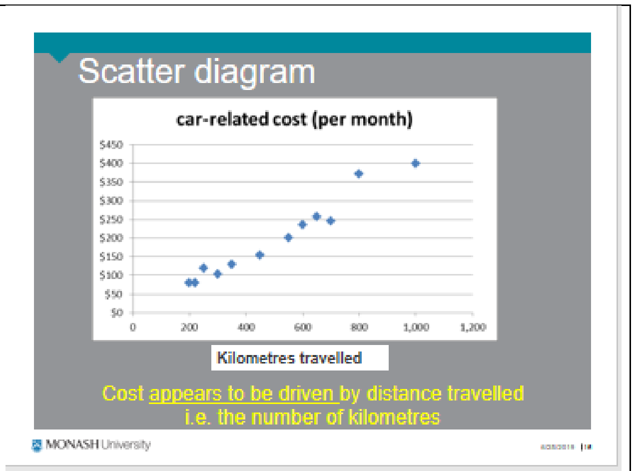
15

The lecture aimed to reinforce the idea that there is more than one method of solving problems and the purpose of slide 14 was to facilitate a conversation based on students' suggestions for how the cost of travelling 400km could be estimated.



14

The purpose of Slides 16 to 18 was to show that visual representations can be useful as well as the idea that costs are 'driven' by particular activities. It did this however, not by framing the conversation in accounting terms, but in 'ordinary' terms with which many students would already have been familiar, i.e. the idea of scatter diagrams.



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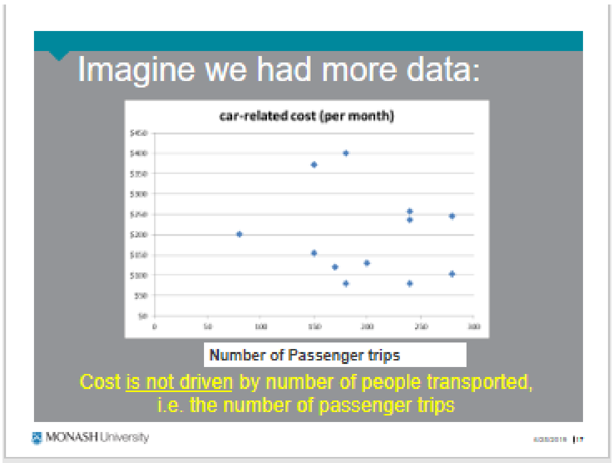

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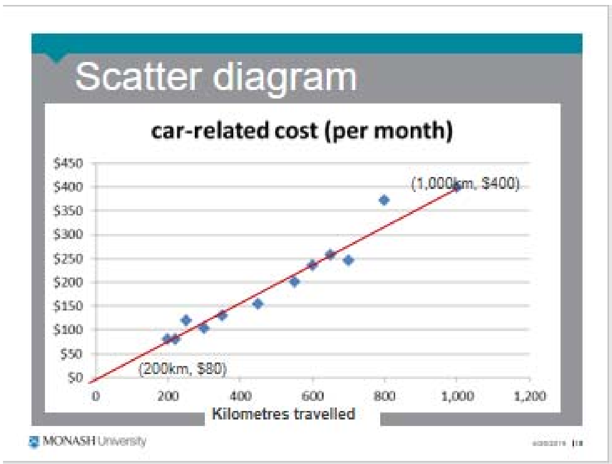
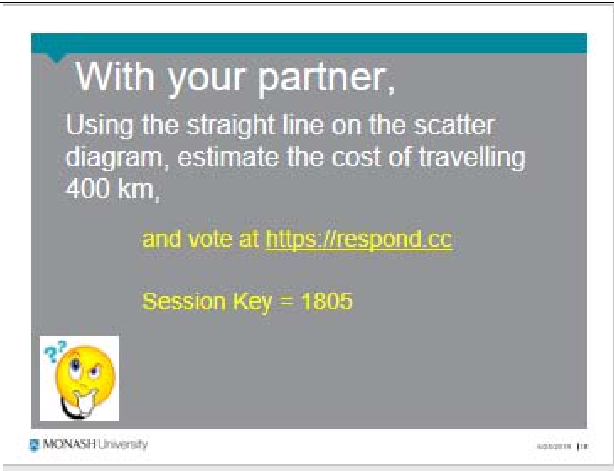


18

The purpose of slides 19 to 21 was to facilitate attempts by students, in small groups, to ‘solve’ the problem in a way of their choosing. Resources available to students during the lecture were however limited, so most students were steered toward deriving an equation for the line joining the two data points highlighted on the scatter diagram. The results were then interpreted in the accounting terms of ‘cost behaviour’ and ‘variable’ costs via slide 22.



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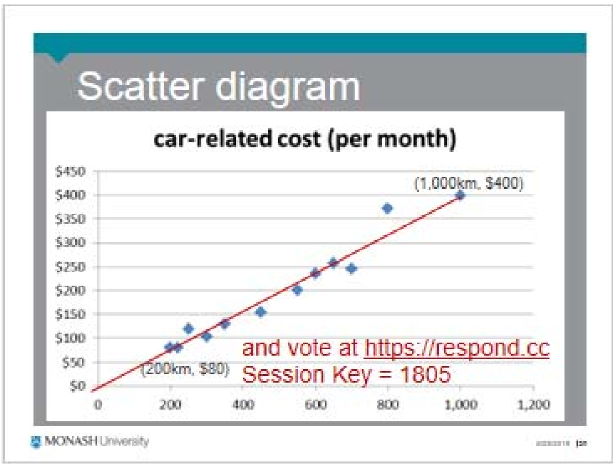

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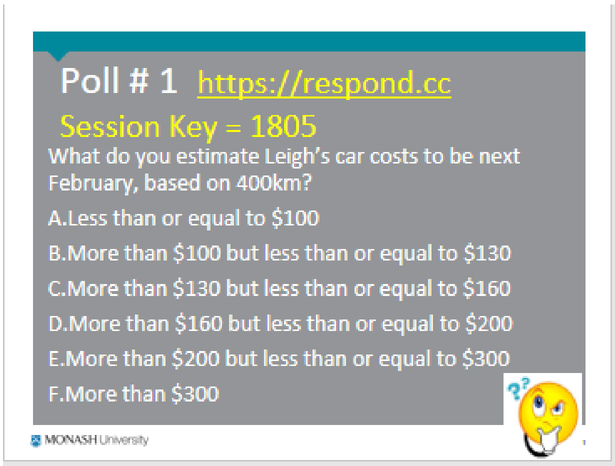

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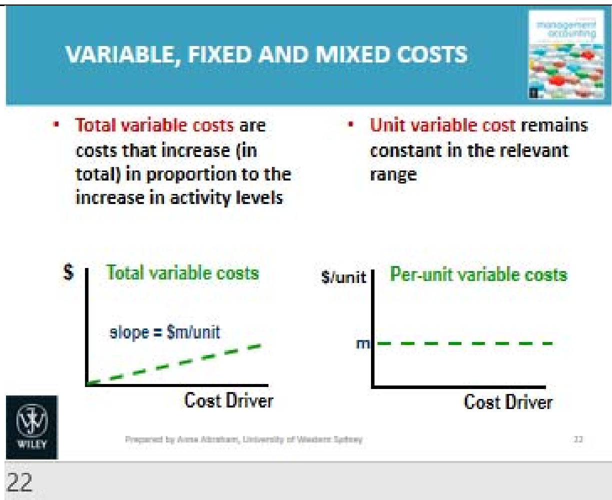

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<td>The purpose of slide 23 was to emphasise the uncertainty of the solution found by students and connect the realization to textbook content via slide 24. The key ideas arising from the first part of the lecture were summarised on slide 25 before proceeding with the second part of the lecture problem.</td>
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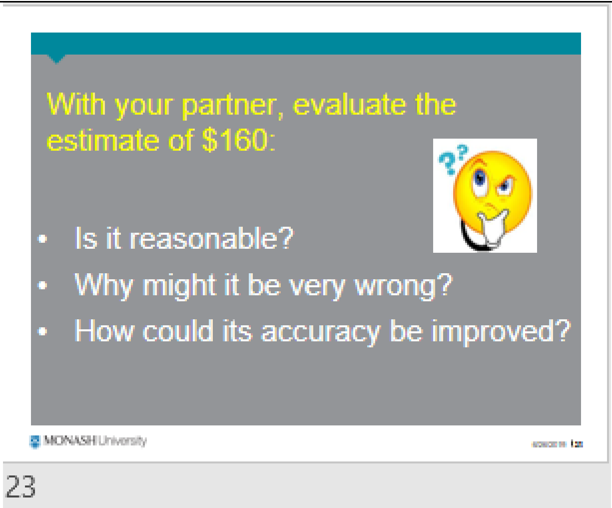

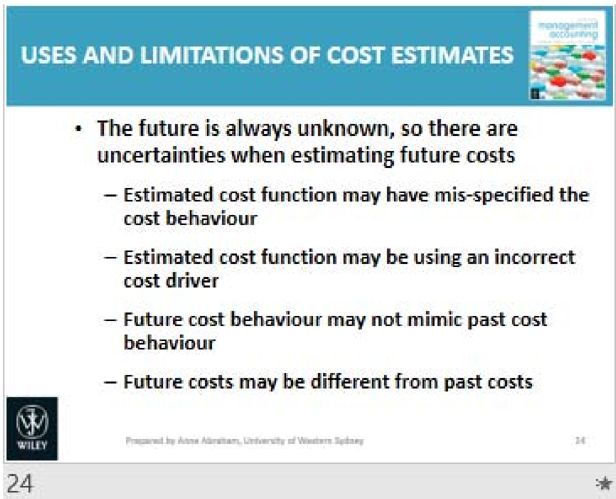

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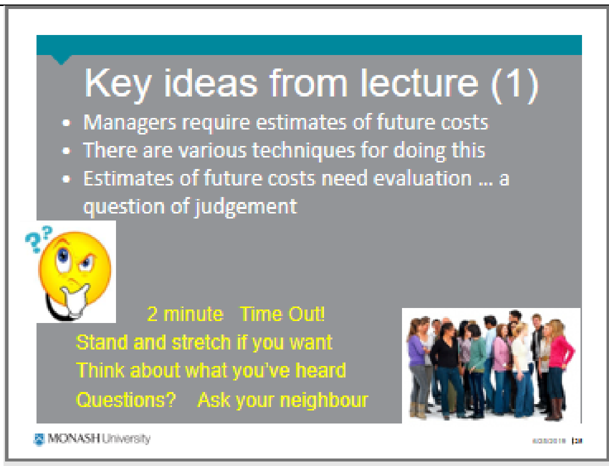
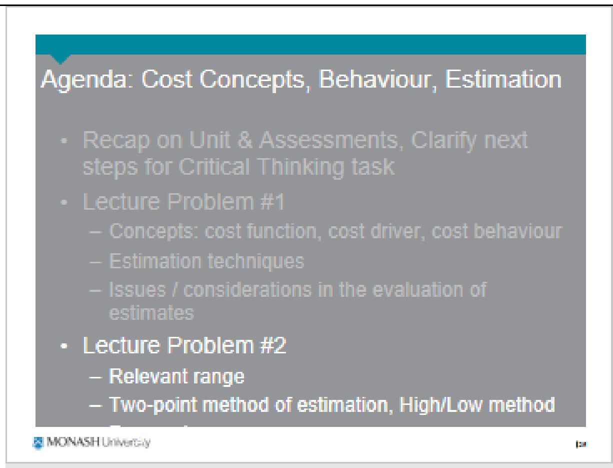


25

Thus in many ways similar to the previous discussion, slides 26 and 27 reminded students of the problem to be solved, and the purpose of slide 28 was to provide some experience of the stimulation of critical appraisal of important ways in which the nature of the two problem parts are different, and the use of small groups as scaffolding support. The emoticon, shown in Figure F-5, was once again used to signal the requirement for original thinking.

Figure F-5 Emoticon used to signal the requirement for original thinking



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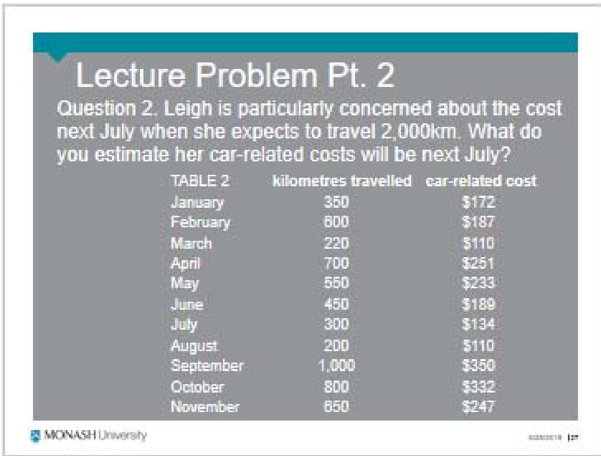

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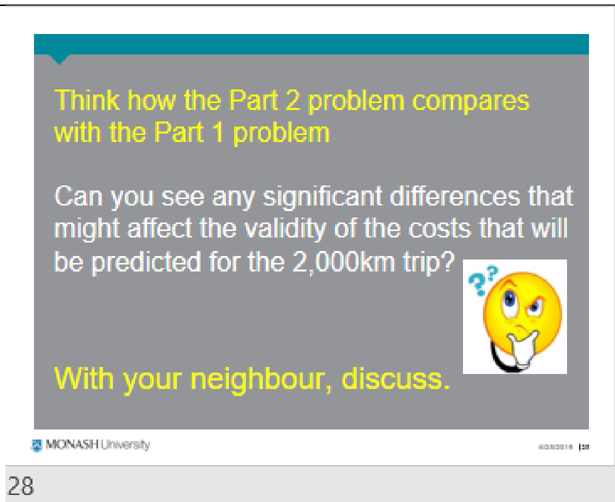
<tr><td></td><td>
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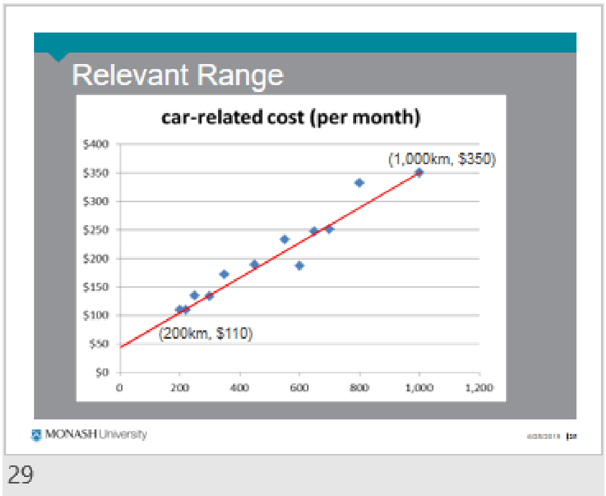
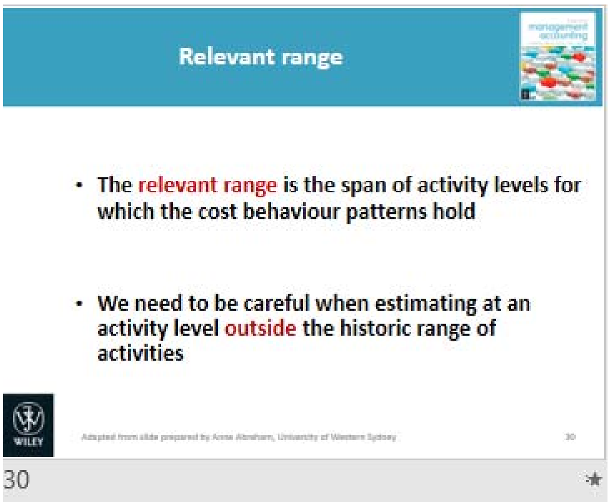
<tr><td>The purpose of slide 29 was to facilitate awareness of the considerations associated with the concern of the problem, 2,000km, being significantly different from the range of historical experience (200km to 1,000km) and then, via slide 30, connecting this idea with accounting terminology and the textbook.</td><td>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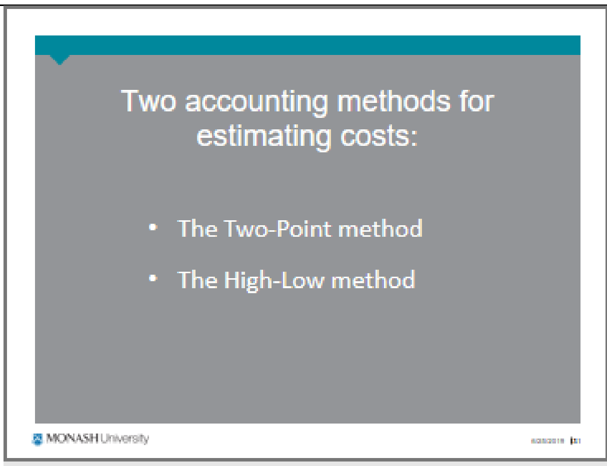
The purpose of slide 31 was to introduce the names of two accounting methods, and to ground these in the likely understanding students had of algebra (slides 32 and 33).



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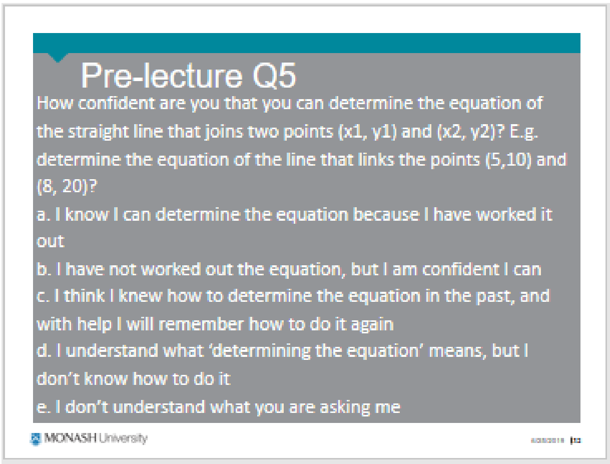

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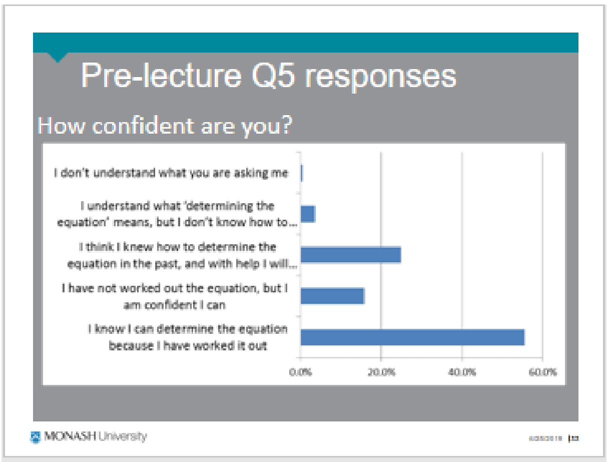
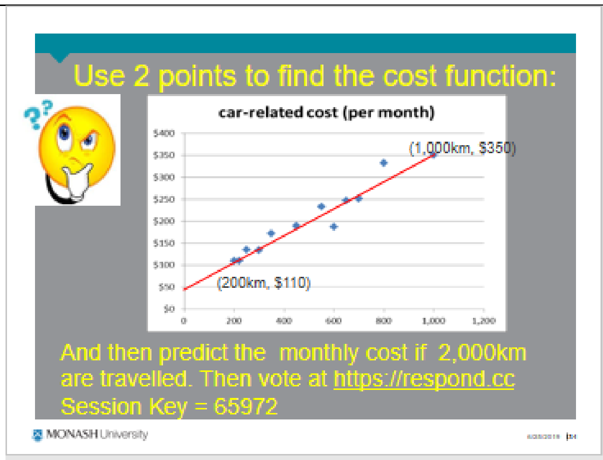
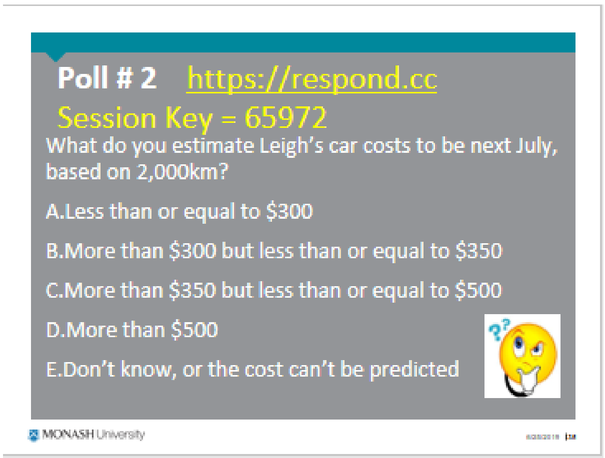
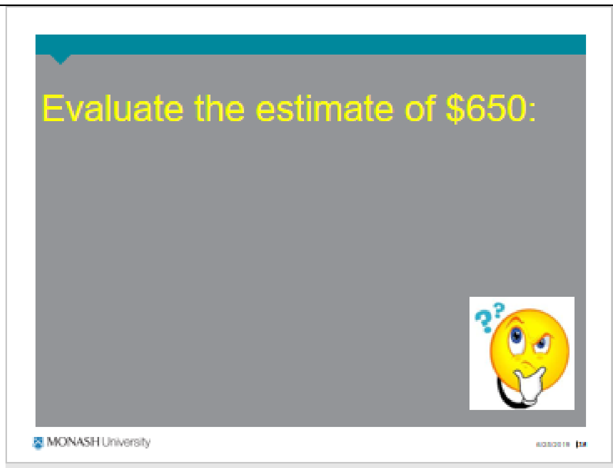
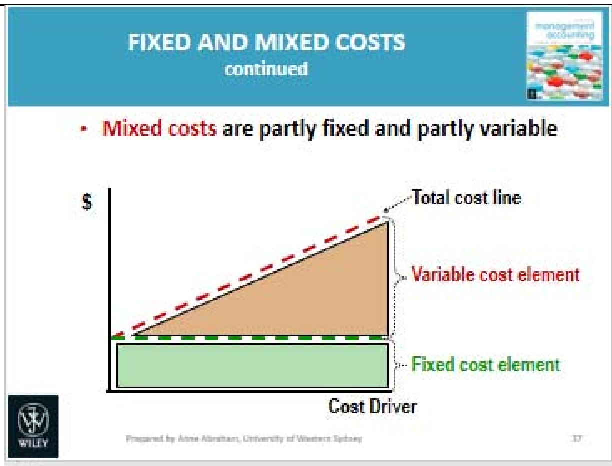


33

Rather than ‘teach’ these accounting methods, the lecture gave students the opportunity to solve it themselves (slides 34 and 35) using prior knowledge, and hopefully diminish the extent to which students were in awe of, or apprehensive about, accounting.	 34  35
The purpose of slide 36, once again, was to reinforce the uncertainty of the answer and facilitate plenary discussion.	 36

The purpose of slides 37 and 38, once again, was to connect the discussion to the textbook, and in particular, the most important concepts in the textbook.



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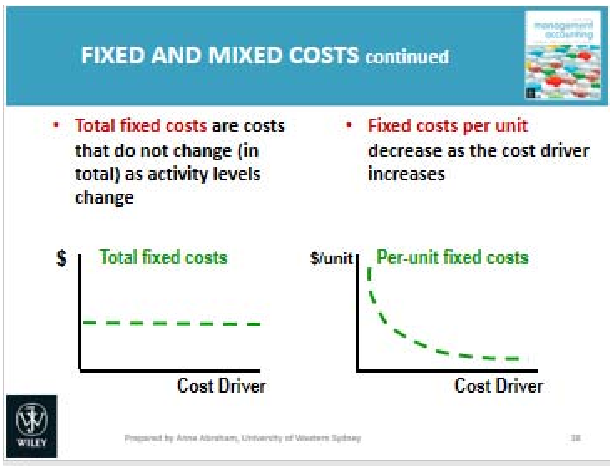
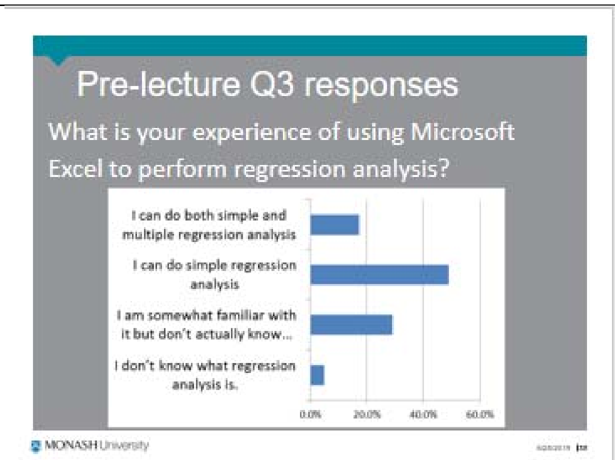


38

The purpose of slides 39 and 40 was to facilitate discussion about the use of regression analysis as an alternative to the methods discussed thus far; once again making the connection to students' likely prior experience in the use of regression analysis.



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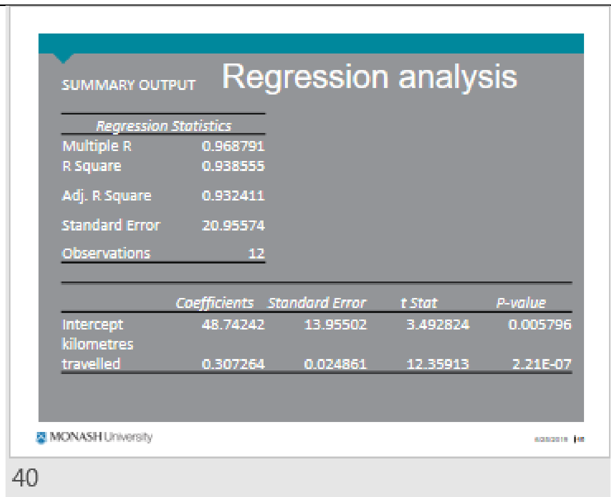
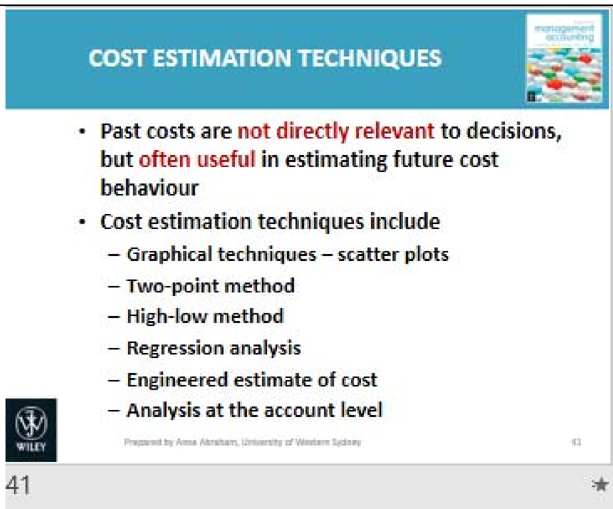
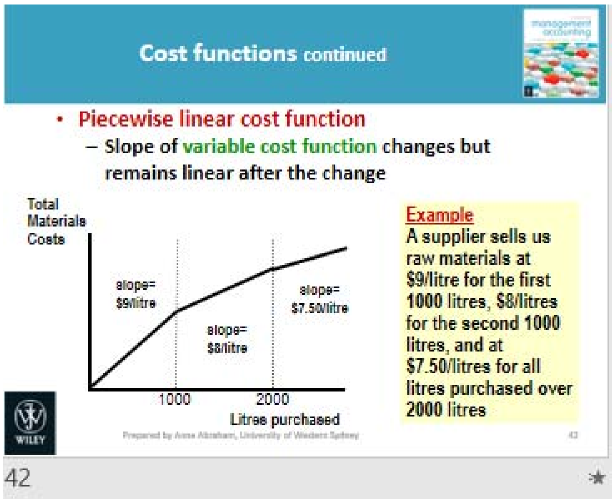
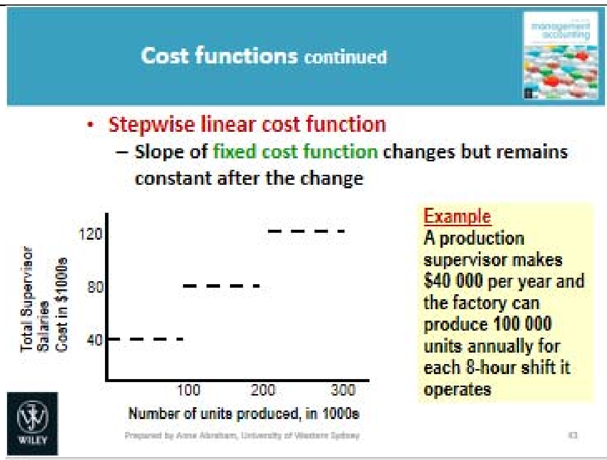


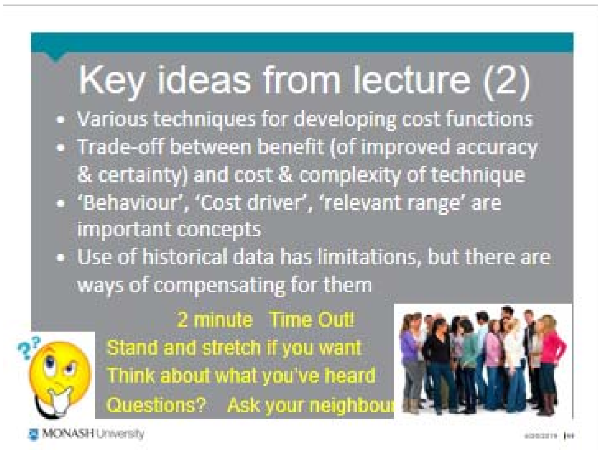
Discussion of slides 41 to 43 ‘mopped up’ the remaining important accounting concepts before summarising the key ideas from the discussion of Part 2 (slide 44) and re-stating the key ideas that emerged from Part 1 (slide 45).



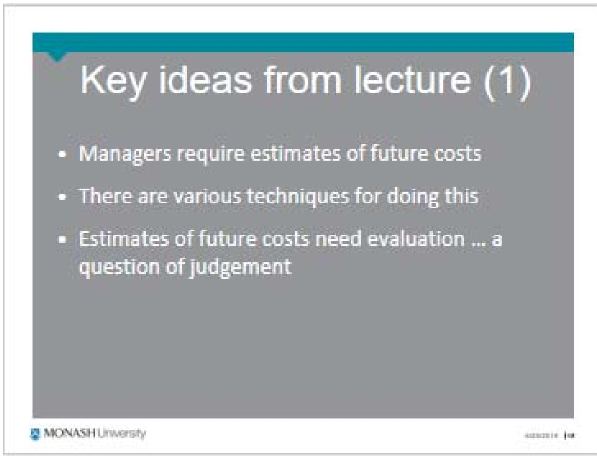



Cost functions continued
• Stepwise linear cost function
– Slope of fixed cost function changes but remains constant after the change
Total Supervisor Salaries Cost in $1000s
120
80
40
100
200
300
Number of units produced, in 1000s
Example
A production supervisor makes $40 000 per year and the factory can produce 100 000 units annually for each 8-hour shift it operates
WILEY

43


Key ideas from lecture (2)
• Various techniques for developing cost functions
• Trade-off between benefit (of improved accuracy & certainty) and cost & complexity of technique
• 'Behaviour', 'Cost driver', 'relevant range' are important concepts
• Use of historical data has limitations, but there are ways of compensating for them
2 minute Time Out!
Stand and stretch if you want
Think about what you've heard
Questions? Ask your neighbour
MONASH University

44


Key ideas from lecture (1)
• Managers require estimates of future costs
• There are various techniques for doing this
• Estimates of future costs need evaluation … a question of judgement
MONASH University

45

G Student interview schedule

	Student Y	Student M	Student L	Student S
Consent interview (Weeks 3 Mon 17th & 4 Mon 24th)	25th March (recorded 5 mins)	19th March (recorded 12 mins)	24th March (recorded 5 mins)	17th March (not recorded)
Consultation interview*				Wk 4 26th March (recorded 125 mins)
LSQ survey completed (Weeks 4 & Week 5 Mon 31st)	2nd April	25th March	26th March	31st March
Task 1 completion (in class time Week 4)	*27th March*	*28th March*	*27th March*	*27th March*
Interview re unit and study methods*				Wk 5 4th April (recorded 55 mins)
TLA interview[22] (Weeks 5-7)	17th April (recorded 38 mins)	Wk 5 4th April (recorded 50 mins)	Wk 6 7th April (recorded 45 mins)	7th April (recorded 95 mins)
Post task 1 interview		11th April (recorded 45 mins)	14th April (recorded 35 mins)	
Coaching re 2nd task*				11th April (not recorded)
Task 2 submission Due 6pm 17th April Week 7	*16th April*	*17th April*	*16th April*	*20th April*
Mid-semester interview re Task 2 & TLAs (weeks 9 &10)		Wk 9 7th May (recorded 45 mins)	Wk10 12th May (recorded 40 mins)	15th May (recorded 70 mins)
Task 3 submission Due 6am Monday 19th May Week 11	*19th May*	*18th May*	*18th May*	*19th May*

[22] Students (except Student L) completed a data collection template prior to interview.

* Indicates additional sessions with Student S in response to her needs.

	Student Y	**Student M**	**Student L**	**Student S**
ETLQ survey completed	20^{th} May	20^{th} May	20^{th} May	21^{st} June
End of semester interview (week after the exam)	31^{st} July (prior DEF exam on 12^{th} Aug) (recorded 30mins)	27^{th} June (recorded 58 mins)	26^{th} June (recorded 55 mins)	23^{rd} June (recorded 136 mins)

H Design of semi-structured interviews

Week 5 interview design

Focus: Outcome of the 1st coursework task

Data collection objectives

data relating specifically to the student's experience of performing the first coursework task and learning the necessary problem solving skills. These data will tend to refer to the student's metacognition in relation to completion of the task;

data relating to the student and the unit generally, such as

- data describing student's experience of the learning situation generally;
- data describing any changes since start of semester in metacognitive knowledge (in particular conceptions of learning & the process of learning); and student's reflection on learning to date.

Pre-interview analysis:

Analysis of student's solution to 1st coursework task against the specification,
Student's responses to Week 1 LSQ and Week 4 ETLQ surveys,
Data such as seminar and tutorial attendance, answers to pre-seminar quiz questions, CT1 assessment submissions (critical thinking questions) that were submitted in Weeks 3 & 4

Interview questions

What is your experience of learning AFF2391 so far this semester? (What do you think of it? How do you feel about it?)

How do you think your preferred language (in case of participants for whom it is not English) and pre-tertiary education has affected your experience of AFF2391?

What was your experience of completing the first Coursework task?

Do you feel that you could have done better?

For each judgement and justification required by a deep approach to the solution, query the student's work:

Why did you perform this step in the way you did?

Point out a "deeper" alternative (if possible) and highlight instances when the student was exposed to related key ideas or ways of thinking. For each instance, ask

What do you think was the point of the exercise in this instance?

What did you learn from it?

Explain the intended point of the exercise and how it was intended to influence the student's understanding or way of thinking.

Can you explain what I said back to me in your own words?

How might this key idea (or way of thinking) have been taught better for you? Why?

Examine next instance.

In Week 1 you said in a survey that your *conception of learning* was "….". Can you elaborate on how you feel about the answer to that question today?

In Week 1 you said in a survey that your conception of the *process of learning* was "….". Can you elaborate on how you feel about the answer to that question today?

In the last few weeks, can you recall times when you thought about how you learn AFF2391, and if so, can you tell me what you were thinking/concluding in those times?

Finish interview by giving student feedback about learning taking into account the pre-interview data analysis.

Consultation interviews (post Week 5)

Focus: An occasion when a student attends consultation. The usual purpose of consultation is to better understand a solution to a tutorial exercise but this interview design could also apply to a review of the outcome of a student's 2nd coursework task.

Data collection primary objective

data relating specifically to the student's experience of performing a task (a tutorial exercise) and the learning of the necessary problem solving skills. These data will tend to refer to the student's metacognition in relation to completion of the task;

Pre-interview analysis:

Week 5 pre-interview analysis and interview data
Data such as seminar and tutorial attendance, answers to pre-seminar quiz questions, CT1 assessment submissions (critical thinking questions) that were submitted in Weeks 5 & onwards; outcome of 2nd and/or 3rd coursework task (if consultation takes place in Week 8 or later).

Consultation

As tutor, assist student to understand the solution to a tutorial exercise, and answer all student's questions.

Data collection interview questions. The following questions will be informed by diagnoses during consultation of the student's misunderstandings and researcher's reflection on how the design of the pedagogy did not address sufficiently well the cause of misunderstandings for that student.

"We have just clarified (an aspect of the thinking required to solve the problem). Do you remember in the seminar we did (a particular learning activity)?"

If answer = no, then ask the same question in relation to other learning activities designed to achieve same or similar purpose (for example, critically thinking about the solution to a tutorial exercise).

If answer = yes, then “what was your experience of that activity?” “What was your ‘take out’ from that activity?” “If we wound back the clock and you were to participate in that activity again, would you respond to the activity differently?”

If answer = yes (because of what the student learnt during consultation), then “how would you have responded differently?

If response reflects a surface response, try again to clarify the desired way of thinking. If successful, ask the question again. If not, the student appears not able to grasp the higher way of thinking, therefore “I think it is important that we discuss this further. Would you like to meet again and talk this through more?”

If response reflects a deep response, “how might the activity have been changed so that you would have learnt what you have just now back then?”

If the answer = no, then “the learning activity was designed to help you learn (describe relevant point) or think this way (describe a way of thinking). Can you see how that is related to what we have clarified just now?”

If the relationship is then understood, re-ask the original question.

If not, then reassure the student that questions about the purpose of learning activities are always welcome; and encourage student to reflect on seminar learning activities before attempting tutorial exercises. Also say “I think it is important that we discuss this further. Would you like to meet again and talk this through more?”

Finish interview by giving student feedback about learning taking into account the pre-interview data analysis.

Week 10 interview design Part 1

Focus: Outcome of the 3rd coursework task

Data collection objectives

data relating specifically to the student's experience of performing the third coursework task and learning the necessary problem solving skills. These data will tend to refer to the student's metacognition in relation to completion of the task;

Pre-interview analysis:

Analysis of student's solution to 3rd Coursework task against the specification,
Outcomes of Week 5 interview and consultation interview(s),
Data such as seminar and tutorial attendance, answers to pre-seminar quiz questions, CT1 assessment submissions (critical thinking questions) that were submitted since Week 5.

Interview questions

What was your experience of completing the third coursework task?

Do you feel that you could have done better?

For each judgement and justification required by a deep approach to the solution, query the student's work:

Why did you perform this step in the way you did?

Point out a "deeper" alternative (if possible) and highlight instances when the student was exposed to related key ideas or ways of thinking. For each instance, ask

What do you think was the point of the exercise in this instance?
What did you learn from it?

Explain the intended point of the exercise and how it was intended to influence the student's understanding or way of thinking.

Can you explain what I said back to me in your own words?
How might this key idea (or way of thinking) have been taught better for you?
Why?

Examine next instance.

Week 10 interview design Part 2

Focus: Week 10 ETLQ survey

Data collection objectives

data describing student's general experience of the learning situation and its relationship with the learning of deep problem solving skills;
data that may explain any changes since start of semester in the use and development of metacognition.

Pre-interview analysis:

Changes in metacognition across the semester as measured by the LSQ and two ETLQ surveys,
Data such as seminar and tutorial attendance, answers to pre-seminar quiz questions, CT1 assessment submissions (critical thinking questions) for each week of the semester as well as outcomes of the three Coursework tasks.

Interview questions

How has your experience of learning AFF2391 changed since the early part of the semester?

How do you think your preferred language (in case of participants for whom it is not English) and pre-tertiary education has affected your experience of AFF2391?

How well do you think you are mastering the unit?

Do you think you could be mastering the unit better?

If answer = yes,

"what would you have done differently?"
"How might changes to the teaching approach have helped you do better?"
For each suggested change, "why do you think that change would have helped?"

If answer = no, are you satisfied with your performance?

Assuming the student did not receive full marks, why do you think you could not have done better?

(If the answers to the questions above do not refer to the use or development of metacognitive strategies, then ask probing questions about the use or development of these.)

In Week 1 you said in a survey that your *conception of learning* was "….". Can you elaborate on how you feel about the answer to that question today? If the conception has changed, then "why has your conception changed?"

In Week 1 you said in a survey that your conception of the *process of learning* was "….". Can you elaborate on how you feel about the answer to that question today? If the conception has changed, then "why has your conception changed?"

In the last few weeks, can you recall times when you thought about how you learn AFF2391, and if so, can you tell me what you were thinking/concluding in those times? How has the frequency of times when you have reflected on how you learn changed compared to previous units? How and why has it changed?

Ask for elaboration of specific answers (selected by exception) given to the Week 10 ETLQ about for example approaches to study, workload, demands of the unit.

Finish interview by giving student feedback about learning taking into account the pre-interview data analysis.

I Ideas and clusters

At the time the clusters were identified for each of the three topics, what later came to be called 'ideas' were referred to as 'concepts', and the different types of concept were thought of as representing levels of understanding or different degrees of conceptual change. In the course of the research, they were later referred to as different types of idea.

Moreover, initially the word 'Procedural' was used instead of 'Relational'. Thus this appendix refers to 'Procedural' and the label 'P' instead of 'Relational' and the label 'R', and variously refers to 'required level of understanding' and 'type of conceptual change' instead of idea type.

I.1 Cost Estimation

Five clusters of ideas were identified and these were labelled Cluster 1 through Cluster 5. They were also coded in terms of the level of understanding required for them, either Procedural (P) or Modelling (M).

Ideas within clusters (component ideas) were labelled with the first letter (or similar) of their names also coded with the level of understanding required for them, either Foundation (F), or Procedural (P).

Idea clusters – Cost Estimation

Cluster 1. The future can be predicted from the past provided the future is consistent with the past. To the extent the future varies, uncertainty arises and judgements are necessary about how predictions based on the past may be adjusted in order to increase confidence in the prediction (M)

Component ideas

Idea code	Idea	Required level of understanding
H	The idea that historic data is useful but not relevant to decision making.	P

Cluster 2. That costs 'behave', meaning that the cost of something is 'driven' by the level of some type of activity, albeit a cost may not be driven by anything at all (i.e. a 'fixed' cost).

Within a relevant range of activity, costs are often treated as varying linearly in response to a change in activity. (P)

<u>Component ideas</u>

Idea code	Idea	Required level of understanding
B	Contextual dependency of a cost's behaviour	F
F	Fixed cost behaviour	F
V	Variable cost behaviour	F
M	Mixed cost behaviour	F
D	Driver	F
L	Linear variation	F
R	Relevant Range	F
C	Combinations of linearity and relevant ranges: piece-wise, step-wise variation	F
O	Other types of variation: curvilinear	F
S	Scatter diagrams - a visual representation of behaviour.	F
CF	Cost function (as an expression of behaviour)	F

Cluster 3. Historical data can be cleansed before use: adjustments can be made for outliers, missing data, misalignments between time periods for which activities and costs are measured, and for other flaws that may be evident in a review of the data (P)

<u>Component ideas</u>

Idea code	Idea	Required level of understanding
O	Outlier	F
M	Missing data	F
T	Mismatched time periods	F

Cluster 4. A variety of methods exist by which cost functions (mathematical equations relating cost to volume of activity) can be estimated from historical data. The choice of method involves a judgement about their relative cost/benefit. (M)

Component clusters and ideas

Idea code	Idea	Required level of understanding
4R	Regression analysis	P
4R1	R^2, closer to 1 the better	F
4R2	Standard error	F
4R3	p-value, good if < 0.05	F
4T	Two-point method	P
4H	High/Low method	P
4O	Account analysis method	P

Cluster 5. Using predictions of level of activity, and by making other judgements about the future, the cost function can be used to predict the driven cost (P)

Component ideas

Idea code	Idea	Required level of understanding
CF	Cost function (as a tool for predicting costs)	F

I.2 Cost Volume Profit

Cluster 1. Decisions about the financial benefit (profit) of performing activities can be assisted by quantifying the relationships between volume of activity, revenue and costs. Doing so requires certain assumptions about the nature of activities, revenues and costs. (M; Q1, Q23c, Q31d & e)

Component Ideas	Idea code	Type of conceptual change F/P/M	Tute exercises
CVP equation where target = breakeven	A*	P	Q25b, Q31a, Q33a
CVP equation where target ≠ breakeven (calculation & graphical representation)	B	P	Q14, Q21, Q33b
Contribution income statement, including CM = R – TVC; P=CM - FC	C	P	Q21
Weighted Average CM as part of CVP calculation	D*	P	Q23a & b
Analysis may require conversion of total variable cost and revenue to per unit variable cost and selling price, and vice versa	E	P	Q16a
The nature of variable and fixed costs	F	F	
Contribution margin (per unit and total)	G	F	Q8, Q14, Q21, Q23
Contribution margin ratio	H		
Linearity assumptions (no change in inventory, constant SP, VCpu, FC and sales mix	I	F	Q5
Breakeven	J	F	
Profit	K	F	
Sales mix	L	F	Q8

* Note: Although shown at the same level, A and D are actually components of B

Cluster 2. Over and above (1), analytical approaches can be adapted to accommodate situations where the usual assumptions about the nature of activities, revenues and costs are unsafe or inappropriate (M)

Component Ideas	Idea code	Type of conceptual change F/P/M	Tute exercises
Sensitivity analysis with CVP	S	P	Q13
CVP spread sheet models	T	P	
Adapting CVP analysis when assumption(s) not valid	U	P	Q16b

Cluster 3. At a particular level of planned activity, cost structure informs decisions about risk. (M)

Component Ideas	Idea code	Type of conceptual change F/P/M	Tute exercises
Application of Margin of Safety concept	A	P	
Calculation of MoS	B	P	Q31c, Q33c
Meaning of MoS	C	B	
Application of Degree of Operating Leverage concept	D	P	
Calculation of DOL	E	P	Q31b, Q33d
Meaning of DOL	F	B	

I.3 Standard Cost Analysis

Cluster 1. Management decision making in operations characterised by repetition can be assisted with use of cost information. (M)

Component Ideas	Idea code	Type of conceptual change F/P/M	Tute exercises
Operations characterised by repetition	R	F	10.1

Cluster 2. Explanations for material variances are found in real world practice and performance evaluated accordingly. (M, 10.13)

Component Ideas	Idea code	Type of conceptual change F/P/M	Tute exercises
Pro-forma explanations for variances must be tested / Investigations are of real world practice	I	F	
Development of standards	D	P	10.5, 10.15
Evaluating performance	E	P	10.5, 10.20(f), 10.27(e)
Pro-forma explanations for variances	X	F	10.17
Performance evaluation	P	F	10.7
Materiality	M	F	

Cluster 3. "Flexing the budget", i.e. determining what the budget would have been if the actual level of activity had been budgeted for (P)

Component Ideas	Idea code	Type of conceptual change F/P/M	Tute exercises
Standard costs (SP & SQ)	S	F	
Flexed budget	F	F	
Budget	B	F	

Cluster 4. "Standard Cost systems" enable the difference (variance) between actual and flexed budget to be broken down into two components: efficiency and price by calculating the standard price for actual quantity used. Pro-forma explanations for efficiency and price variances exist. (P, 10.8, 10.20)

Component Ideas	Idea code	Type of conceptual change F/P/M	Tute exercises
Actual cost (AQ x AP)	A	F	
Standard cost for actual quantity (AQ x SP)	S	F	
Price variance	P	F	
Efficiency variance	E	F	
Distinction between Favourable and Unfavourable variance	F	F	

Cluster 5. General Ledger accounts reflect standard costs (P, 10.10, 10.21, 10.27)

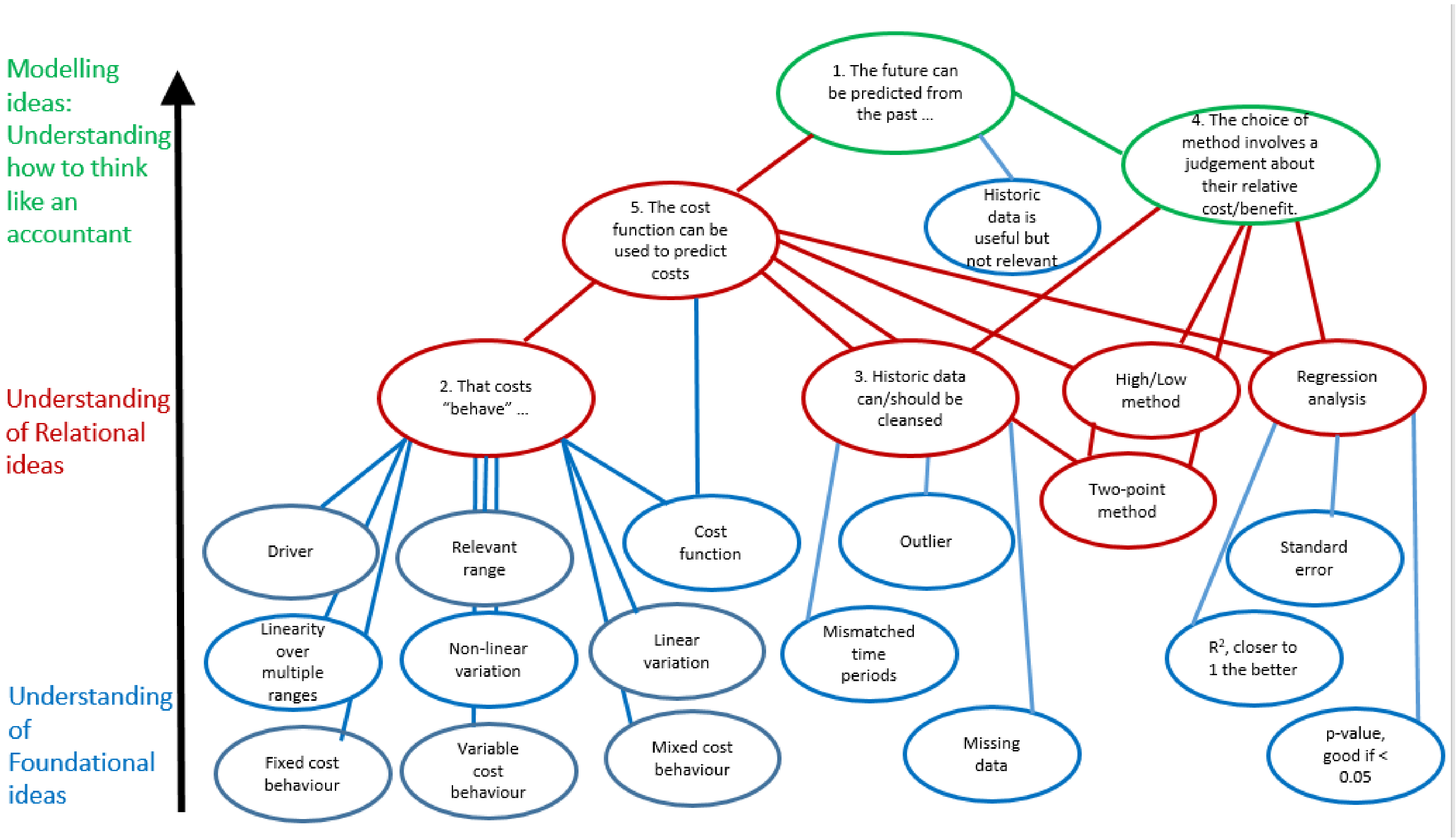
Component Ideas	Idea code	Type of conceptual change F/P/M	Tute exercises
Book keeping role	B	F	10.7
Closing of variance accounts	C	F	

J Webs of Ideas

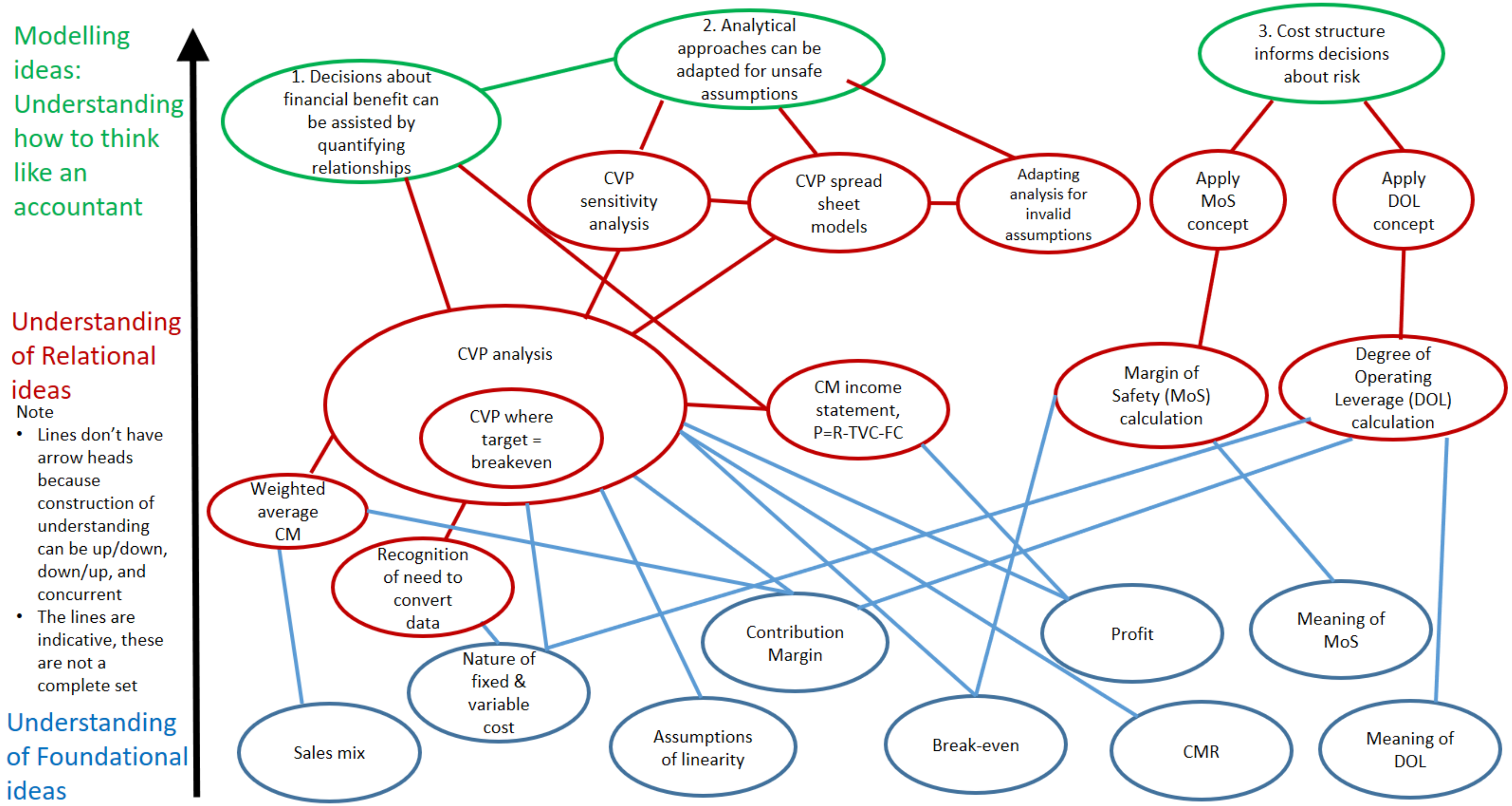
At the time the clusters were identified for each of the three topics, what later came to be called ‘ideas’ were referred to as ‘concepts’, and the different types of concept were thought of as representing levels of understanding or different degrees of conceptual change. In the course of the research, they were later referred to as different types of idea.

Moreover, initially the word ‘Procedural’ was used instead of ‘Relational’. Thus this appendix may refer to ‘Procedural’ and the label ‘P’ instead of ‘Relational’ and the label ‘R’, and variously refers to ‘required level of understanding’ and ‘type of conceptual change’ instead of idea type.

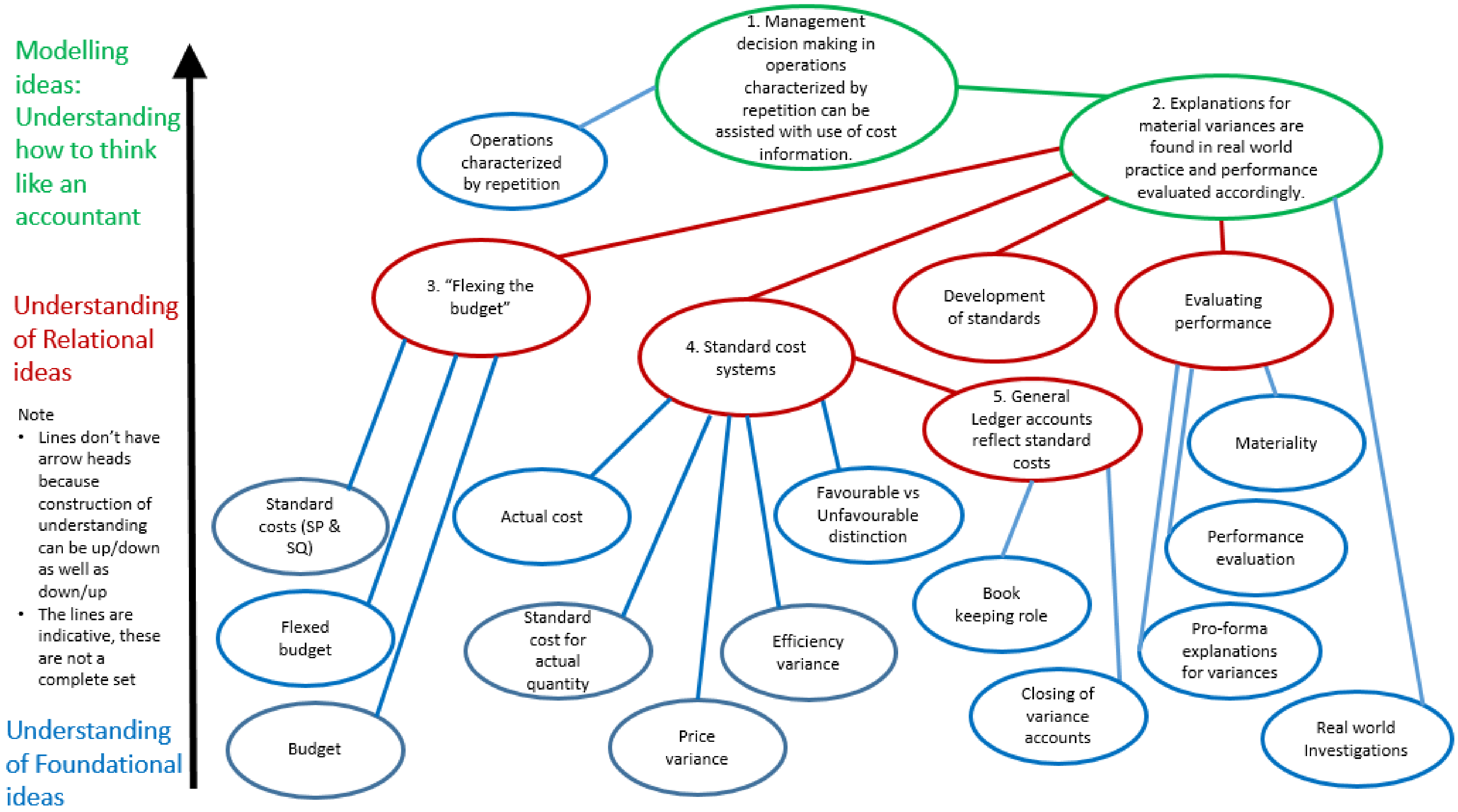
J.1 Cost Estimation



J.2 Cost Volume Profit



J.3 Standard Cost Analysis



K Detailed description of process of inferring mental processes

Following, is a detailed description of the activities that led to the identification of the six types of thinking.

Given the original research questions, the starting point was the aim to find an approach to analysing the data (pre-tute questions) with a view to understanding more about the learning process of students and the use and development of metacognition in that process. One of the early attempts took the conceptual change model (Posner et al., 1982) as revised by Strike and Posner (1992) as its theoretical base. In particular, the framework used the five features of conceptual ecology, these being

1. Anomalies
2. Analogies and metaphors
3. Epistemological commitments
4. Metaphysical beliefs and concepts
5. Other knowledge (including misconceptions)

The theoretical framework was intended to be used to identify two categories of ecology (one consisting of 1, 2, and 5 above) and the other consisting of 3 and 4. The latter category was renamed 'metacognition'. A pilot sample of 25 questions generated by students in the process of learning the topic 'Cost Estimation' was analysed in terms of these two categories using a spreadsheet. For each question, my own interpretations of the sample list of questions were documented in the adjacent column. Subsequently, I recorded my inferences in relation to the student's question in columns headed 'conceptual ecology' and 'metacognition' as well as notes regarding desired vs alternate conceptions.

The outcomes were reviewed with supervisors (11/6/2015) and other perspectives of the data were formulated. These included:

- issues in cost accounting;
- types of insights; as well as ***aspects of metacognition*** in Cost Accounting, these included problems of learning cost accounting, student variation, topic variation, what students attend to or not as important in the topic; and
- features of questions.

The pilot sample of 25 questions was then analysed in terms of the list of Aspects of Metacognition from the 11/6 meeting. In the process, the meanings of items were refined and more items were added to the list. At the time, I was aware that, by adding many items, I diversified beyond the boundaries of 'metacognition'. I then repeated the analysis for the last topic in the semester, Standard Costs.

The findings were compiled in a worksheet that showed the expanded list (still referred to as 'Aspects of Metacognition') in Column A, and in Column D some additional explanation for some of the items was given. The list was ranked roughly in order of what was regarded as increasingly sophisticated metacognitive activity. In Columns B and D were the number of occasions the aspect appeared in the pilot data for the Cost Estimation and Standard Costs topics respectively.

Subsequently the pilot analysis was extended to all 10 topics. The items in the list of questions types that more clearly related to metacognition were identified, and an item added to the list ("Interesting question – may require new classification") which was essentially a flag which identified questions for which further consideration might have helped refine the method. The name of the list was changed from 'aspects of metacognition' to 'types of question'.

The number of times the type of question appeared in each topic was summarised. My impression at the time was the number of times aspects of metacognition could be inferred was small.

The list of question types follows:

Seeking 'neat' answer to closed question
Seeking meaning / clarification of a description, e.g. a written answer to a question – FORM
Seeking explanation of a statement or concept - WHAT?
Exploring the link between ideas from this topic
Seeking reasoning that underlies received information - HOW?
Seeking to link ideas from this topic in new ways
Seeking reasons (purposes) for tools / approaches (links to seeking purposes?)
Linking ideas from this topic to 'real' world, often via constructed scenarios
Recognising limits / apparent inconsistencies in the tools of cost accounting
Seeking reasoning that underlies received information - WHY?

Linking ideas from other topics - in a way that helps/supports learning
Linking ideas from other topics - not language - in a way that interfere in process of learning or create dissonance
Linking ideas from other topics - where language allows idea to interfere in process of learning or create dissonance
Challenging received information - DISPUTE
Seeking to go deeper
Monitoring their own understanding
Recognising limits / apparent inconsistencies in their understandings (not of the tools of cost accounting)
Reflecting on and restructuring prior views
Seeking to interpret at a higher/more conceptual level - ABSTRACTION
Interesting question - may require new classification

This analysis was then reviewed with the primary supervisor and a few potential categories added, as follows:

question shows a dependency on knowing the pattern for calculating an answer
calling for a scenario with different boundary conditions to interrogate an aspect of content
the question draws on recent real world events to challenge received information
creating a new scenario to extend understanding
seeking limits to tools of Cost Accounting

Consideration was given to collapsing and grouping of some categories, attention drawn to instances of differences in understanding (e.g. the meaning of ‘constructing a scenario’), and the need to distinguish inferences about what has been learnt and the metacognition behind the question. Attention was also drawn to whether in considering the meaning of the word ‘metacognition’ in cost accounting, the context is the learning of topics or what Cost Accountants actually do in the profession; the dependency of metacognition on the domain in which it takes place; and alternative ways of indexing questions.

Thus at this point, the way forward in terms of allowing a coherent framework to emerge from the data was not clear. At another meeting with Ian, a key outcome was the advice to ‘enter Dreamworld’ and consider “what do I think is reflective of what I want students to think/know/understand? How do the pre-tute questions relate to them? And what are the implications for teaching?" Accordingly, the aim was to produce original/analytical work in contrast to descriptive work in which metacognition in cost accounting is framed in terms of the literature. Ian also mentioned his paper with Richard Gunstone (1998) as the best he could offer from his own work. It proved to be very useful.

This moment was also significant because it re-introduced into the process work I had been doing prior to March 2015 exploring analytical methods framed in terms of conceptual change. Having read the 1998 book chapter, I was thinking about a method that analysed student data in terms of metacognitive knowledge, awareness and control in the various stages of the process of conceptual change. I thought this analysis would be specific to various big ideas or topics in cost accounting, and thus the findings would relate to metacognition that were domain-specific.

Thus the way forward from the list of 25 action-oriented questions was to consider the thinking or motives that lay behind them, and similarly therefore to infer the types of thinking that might lie behind the student-generated questions themselves. This resulted in an initial list of seven types of thinking.

One of the enhancements that emerged in preparation for a second conference paper was an illustration of each type of thinking. This list was tested theoretically, by attempting to exemplify a question directed at each of the stages of learning from which each type of thinking could be inferred. Ultimately, this evolved in to Table 5-1 but in the process, one of the seven codes ('thinking about prior conceptions') was deleted because it alluded to the first stage of learning. Theoretically, types of thinking are posited as orthogonal with sense-making stage and thus questions reflecting all six ways of thinking could be directed at an idea in any stage.

The six types of thinking that resulted from this process follow and are described in data Chapter 5.

1. Thinking aimed at entrenching/memorising
2. Thinking aimed at monitoring understanding
3. Thinking about implications, connections elsewhere at the conceptual level
4. Thinking about implications, connections elsewhere in terms of application of the conceptual understanding
5. Thinking about, searching for, things that don't seem correct
6. Thinking in relation to perceived exceptions.

L Examination of Coding Consistency

To build confidence in the reasonableness and trustworthiness of the thesis findings regarding mental processes, an exercise was completed in 2016 to examine coding consistency. This appendix presents the working paper that reported the results of the exercise and the consequent proposed actions to improve the validity of the research. Note, the terminology used at the time is reflected in this appendix, not the terminology that was subsequently developed and used throughout the main body of the thesis. For example, instead of 'thinking type', this paper refers to 'MCReg'. The paper is in two sections.

Section 1 explains the background to the consistency checking exercise and reports the outcomes with reference to the original concepts and clusters (Appendix 1) and web (Appendix 2). It also summarises the actions proposed to resolve the inconsistencies.

Section 2 firstly, reports the outcomes of the proposed actions to resolve the inconsistencies. It provides explanations of the resolution for each question (Appendix 3) and the consequent updates to the list of concepts and clusters (Appendix 4) and web (Appendix 5). It provides a graphic that illustrates how a spreadsheet was used to support the consistency checking process (Appendix 6). Finally, it provides a side-by-side comparison (pre- and post-check) of relevant tables.

L.1 Section 1

L.1.1 Background

The first set of data was analysed in November 2015 and related to the topic of Cost Estimation. The data set was small, 26 items, since the analysis was conducted as a pilot study. Each item was a question generated by a student in the process of studying an aspect of the topic and was coded in relation to

> The target concept, and/or cluster (a cluster being a set of related concepts) to which the student's mind was directed. The clusters and concepts for Cost Estimation are shown on last pages herein.
>
> The stage within the process of conceptual change that framed the student's question; e.g. was the question interrogating the target concept itself, recalling prior relevant knowledge, re-evaluating prior knowledge, or was it seeking to extend knowledge

beyond the topic by applying the learning to other contexts or restructuring extant knowledge in other domains

The type of thinking that led to the question. At present, the term "Metacognitive Regulation" is being used interchangeably with "type of thinking".

Thus the plan was to make the analysis of the data relating to Cost Estimation comparable to that of a subsequent topic, Cost Volume Profit Analysis, and increase the number of data items to approximately ninety. This was completed in November 2016, 12 months after the pilot data were coded.

The option of assessing validity by measuring the consistency of the first researcher's analysis with that of a second researcher was not available. Instead, validity was to be assessed on the basis of the consistency in coding by the same researcher, but spaced in time by 12 months.

Analysis was based on the list of concepts and clusters, and the diagrammatic representation of these (the web), as shown later in Appendices 1 and 2 respectively.

L.1.2 Outcomes

Of the 26 data items, coding was completely consistent (i.e. all codes - concept, cluster, CC stage, and MC Reg matched) in only 4 instances.

Of the 22 inconsistencies, most (16) involved mismatches between concept and cluster codes. Of these 16, most (10) involved Cluster 2. In other words, ten items were coded as Cluster 2 or a concept within Cluster 2 in either 2015 or 2016 but not in both years. Five of these 10 involved matches at the Cluster 2 level but mismatches at the concept level, and the other five involved mismatches at the cluster level, i.e. between Cluster 2 and other clusters.

Of the other 6 out of 16 that involved mismatches between concept and cluster codes, one inconsistency was due to the addition of a new concept code in 2016, one involves mismatches of concepts within Cluster 4, and four involve mismatches between Clusters 4 and 5.

When there are inconsistencies in the coding of the concept and/or cluster, it is more likely there will also be inconsistency in the coding of MC Reg. Take for example a question examining relations or connections in some way. If there was inconsistent coding of that question in that in one instance it was coded as pertaining to a cluster, and in the second instance coded as pertaining to a concept within a cluster, the inference from the question in the first instance could be that the student was monitoring their understanding of the cluster as a whole, (Code 2), whereas the inference from the same question in the second instance could be that the student was thinking about the relation of the target to other concepts and/or clusters, Code 3.

Regarding the consistency of coding of MC Reg, 15 of the 22 inconsistencies were associated with inconsistent MC Reg codes. Of these 15, nine (9) were also associated with inconsistencies in the coding of concept and/or cluster. Of the remaining six (6) of these 15, one was also associated with a mismatch in Stage of CC. Coding of Stage of CC was consistent for the other 5: two of these involved Code 99 being used in 2015 to indicate nothing could be inferred about MC Reg but inferences were made in 2016, two involved inconsistency in choice between MC Reg codes 1 (seeking to reproduce/memorise) and 2 (seeking to understand the target), and the last one involved inconsistency in choice between code 2 and code 5 (thinking about things that don't seem correct).

The low level of coding consistency between 2015 and 2016 is disappointing; a bit of a setback. Nevertheless, the knowledge and experience of this suggests actions that can be taken to improve validity as the research proceeds. These actions are discussed in the next section.

L.1.3 Proposed Actions

In summary, the actions to improve validity are:

resolve inconsistencies related to concept/cluster coding and document conclusions;

write more expansive descriptions of the concepts and clusters, especially for Cluster 2. In part, these elaborations can be informed by (1);

incorporate the new concept (1H) in the coding scheme;

confirm/remove the use of MC Reg Code 99; and

resolve inconsistencies related to MC Reg coding and document conclusions.

L.1.4 Appendix 1 Concepts and Clusters – Cost Estimation (as it was prior to the check of coding consistency)

Five clusters of concepts were identified and these were coded with the numbers 1 to 5. They were also coded in terms of the type of conceptual change represented by them, either Procedural (P) or Modelling (M).

Concepts within clusters (component concepts) were coded with the first letter (or similar) of their names also coded with the type of conceptual change represented by them, either Basic (B), or Procedural (P).

Concept clusters – Cost Estimation

1. The future can be predicted from the past provided the future is consistent with the past. To the extent the future varies, uncertainty arises and judgements are necessary about how predictions based on the past may be adjusted in order to increase confidence in the prediction (M)

2. That costs 'behave', meaning that the cost of something is 'driven' by the level of some type of activity, albeit a cost may not be driven by anything at all (i.e. a 'fixed' cost). Within a relevant range of activity, costs are often treated as varying linearly in response to a change in activity. (P)

Component concepts

Concept code	Concept	Type of conceptual change
F	Fixed cost behaviour	B
V	Variable cost behaviour	B
M	Mixed cost behaviour	B
D	Driver	B
L	Linear variation	B
R	Relevant Range	B
C	Combinations of linearity and relevant ranges: piece-wise, step-wise variation	B

O	Other types of variation: curvilinear	B
CF	Cost function (as an expression of behaviour)	B

3. Historical data can be cleansed before use: adjustments can be made for outliers, missing data, misalignments between time periods for which activities and costs are measured, and other flaws that may be evident in a review of the data (P)

<u>Component concepts</u>

Concept code	Concept	Type of conceptual change
O	Outlier	B
M	Missing data	B
T	Mismatched time periods	B

4. A variety of methods exist by which cost functions (mathematical equations relating cost to volume of activity) can be estimated from historical data. The choice of method involves a judgement about their relative cost/benefit. (M)

<u>Component clusters and concepts</u>

4R Regression analysis (P)

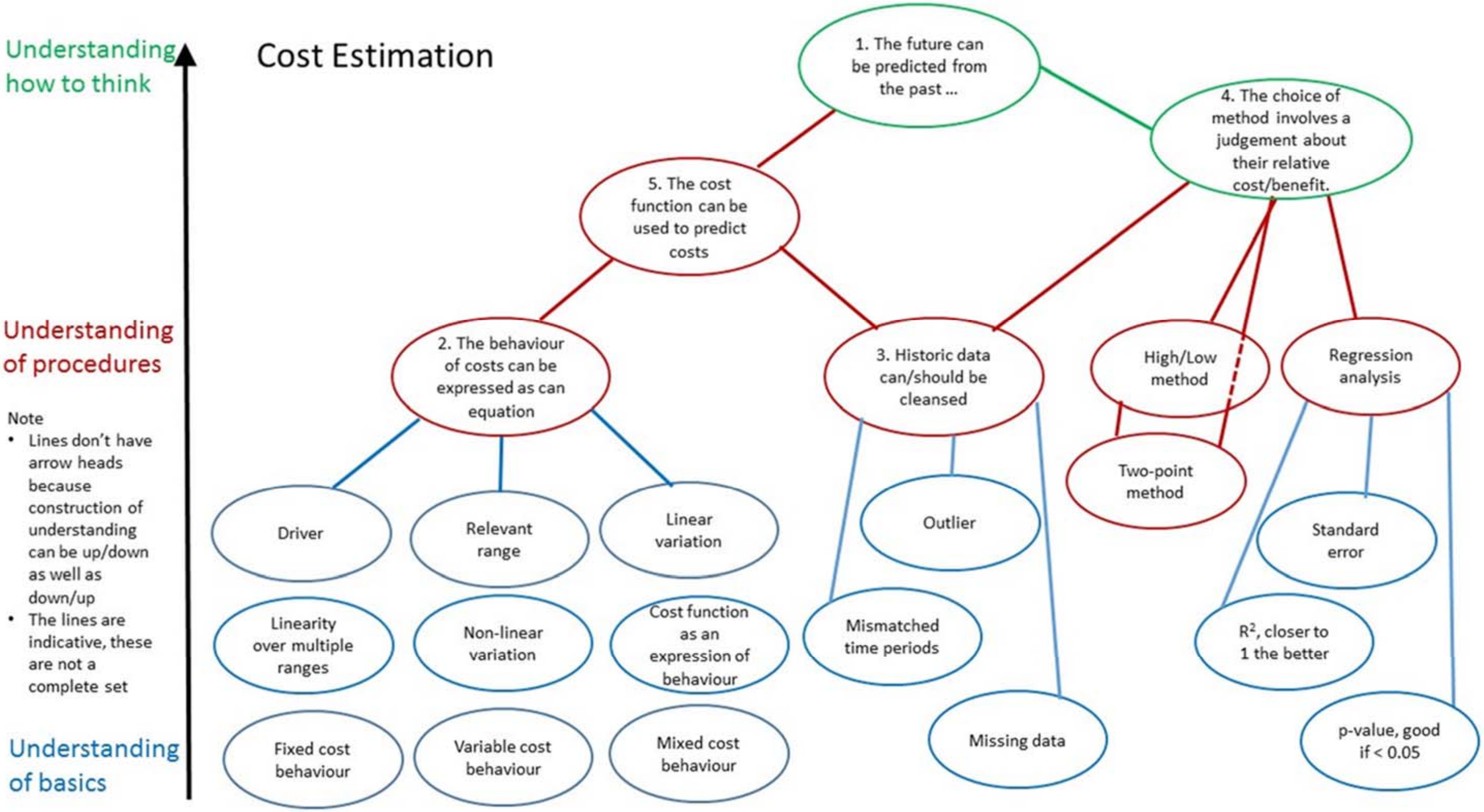
Concept code	Concept	Type of conceptual change
4R1	R^2, closer to 1 the better	B
4R2	Standard error	B
4R3	p-value, good if < 0.05	B

4T Two-point method (P)

4H High/Low method (P)

5. Using predictions of level of activity, and by making other judgements about the future, the cost function can be used to predict the driven cost (P)

L.1.5 Appendix 2 Web of Concepts – Cost Estimation (as it was prior to the check of coding consistency)



L.2 Section 2

Outcomes of proposed actions

The Proposed Actions were:

In summary, the actions to improve validity are:

resolve inconsistencies related to concept/cluster coding and document conclusions;

write more expansive descriptions of the concepts and clusters, especially for Cluster 2. In part, these elaborations can be informed by (1);

incorporate the new concept (1H) in the coding scheme;

confirm/remove the use of MC Reg Code 99; and

resolve inconsistencies related to MC Reg coding and document conclusions.

Some of the inconsistencies were caused by a difference in the original descriptions of Cluster 2 in the concept list (Appendix 1, this document) and in the web diagram (Appendix 2, this document). Both the list and the web have been revised to correct this, as well as to include the new concept from action item 3 above, and to include some additional concepts that were identified when the analysis expanded from 26 to 95 data items.

Detailed explanations for the coding inconsistency for each question and the explanation for why the inconsistency was resolved in the way it was are shown at Appendix 3, as well as the updated list of concepts/clusters (Appendix 4) and the updated web diagram (Appendix 5). At Appendix 6 an overview of the process used for identifying and resolving the coding inconsistencies is described.

In summary, resolution of the inconsistencies result in the following refinements to the descriptions and use of codes:

Cluster 2 is limited to the idea of cost behaviour; not extended to include the idea that, given knowledge of cost behaviour, cost functions can be developed and used to predict future costs;

If a question involves connections to knowledge in a non-accounting domain (e.g. mathematics, econometrics), or application of *what has been learned* to a different problem solving situation (e.g. CVP or greenfield context in case of a Cost estimation question) then code Stage of Conceptual Change as 4 (Reviewing/restructuring other relevant aspects);

MC Reg 99. No longer used since it was found possible to re-code all of them;

MC Reg 1 (thinking aimed at entrenching/memorizing), includes questions which inappropriately presume an absolutist answer, seek to memorise a relevant fact, closed questions, and questions which inappropriately presume objective/definitive answers;

MC Reg 2 (thinking aimed at monitoring understanding) will include questions in contexts provided by the text book; whereas questions in contexts invented by the student are coded as MC Reg 4 (thinking about implications, connections elsewhere in terms of application of the conceptual understanding);

Where there is doubt between Reg 1 and Reg 2, aggravated for example by poor use of English, the benefit will be given to the learning process/student and thus coded MC Reg 2;

MC Reg 3 (thinking about implications, connections elsewhere at the conceptual level) generally includes questions which include phrases such as “what relationship does it have … (to another concept)”

MC Reg 5 (thinking about / searching for things that don’t seem correct) generally include questions containing phrases such as "how is that correct?" and "wouldn't you be able to ... " because they suggest the student is rejecting the given explanation; and questions which appear to challenge the legitimacy of the something presented, e.g. "I question whether…”;

MC Reg 6 (thinking in relation to perceived exceptions) includes questions where the student is challenging the material being studied on the basis of perceiving an exception, whereas if the student asks a question about how an exceptional situation should be handled, then it is coded MC Reg 4 (application);

In questions that are lengthy because a question subsequently links to a second question which tends to elaborate the first, and each question infers different MC Reg codes, the first part of the question will determine the applicable code;

Cluster/concepts: questions that are reflective of 'thinking like an accountant' tend to be directed toward modelling clusters, whereas questions that reflect thinking about the use of a procedure tend to be directed towards procedural concepts/clusters;

To avoid terms having multiple meanings, I will refer to links between concepts within the same cluster as 'relations', and between clusters 'connections'.

In summary, the effect on the findings from the analyses of the pilot data were:

- The revised data has the effect of the distribution of the kind of concepts students were paying attention to skewing further to the left, ie more toward basic concepts and away from procedural and modelling concepts
- Regarding the distribution of the types of thinking students were exhibiting, a slight and similar skew towards codes 1&2 and away from codes 3&4 and codes 5&6 is also evident.

The following table summarises, in total and by type of inconsistency, whether the inconsistency was resolved in favour of the original coding (2015), the later coding (2016) or neither.

With the exception of inconsistencies in the coding of Stage of Conceptual Change, inconsistencies were resolved more often in favour of 2016 than 2015.

Code altered in favour of:	Total Count	Concept	MC Reg	MC Reg but no concept inconsistency	Stage
2015	9	7	4	1	2
2016	12	8	9	4	0
neither	1	1	2	0	0
Total	22	16	15	5	2

L.2.1 Appendix 3 Explanation of resolutions

Following are the detailed explanations for each of the questions for which there was coding inconsistency between 2015 and 2016. In cases where multiple codes were inconsistent, i.e. stage, concept/cluster, and MC Reg, the inconsistencies were resolved in that order. This is because, for example, a change in the coded concept can lead to a change in the coded type of thinking.

Question	Resolution
What percentage of the R-square statistic can be concluded as a minimum value that indicates an explanation of variation between the cost driver and variable?	MC Reg. Coded MC=1 in 2016 because of inference the question assumed an absolutist answer and thus to memorise relevant fact. On reflection, this question is a reasonable one. Closed questions, or questions which presume objective/definitive answers I will code as 1.
In question 2: when the suggested answer says that the several years worth of data won't be useful for decision making, how is that correct? Wouldn't you be able to extrapolote information from the past data to see if there were trends or anything which you could learn from and then apply it to your decision making? Past data could affect what you choose as you learn from the past data right?	MC Reg. Phrases such as "how is that correct?" and "Wouldn't you be able to ... " suggest the student is rejecting the given explanation; therefore code 5 not code 2.
"what is the numerical output of the standard error mean and what relationship does it have to the line of regression analysis."	Concept. Miscode in 2015, clearly question is asking about R2. MC Reg. Miscode in 2015. The question includes the phrase "what relationship does it have (to another concept) and therefore is code 3, not 2.
Is the assumption that, because of winter, July is likely to increase patient visits a relevant one? I tend to agree that more people require health treatment in winter, I question whether or not it is reliable to foresee an increase in patients at this particular clinic	Concept: clearly not 2016/code 2 since question is not about behaviour. It is about reliability of predictions of future activity in the use of such data to predict future costs, thus concept 5. MC Reg. No conflict, but code 5 is correct because student is challenging legitimacy of the method, ie "I question whether ....".

In regards to the answer to question 2.26, how is it that other expenses have decreased so much in comparison to previous months? In the previous 4 months, other expenses have all be over $2000, and the budget for July is $644. This seems like a vast understatement based on the previous trends and data received, especially with a predicted increase of patients coming in. What is the reasoning behind it?	Concept: clearly not 2016/code 2 since question is about predicted future costs; not about behaviour. It is about reliability of predictions of future activity in the use of such data to predict future costs, thus concept 5. MC Reg. No conflict, but code 5 is correct because student is challenging legitimacy of the answer, ie "this seems like a vast understatement ...".
Why is knowledge of an organisation's economic environment and operation important to the analysis of cost behaviour? Also, when referring to this environment and the operation what factors of these two areas constitute the focus of the important knowledge?	Concept: The object of the question is cost behaviour, i.e. "Why is … important to the analysis of cost behaviour", thus concept 2/2015. MC Reg. Not coded in 2015 (code 99). Question seeks to understand what factors constitute an organization's economic environment and operations and why these are important.
Refer to 2.26 salaries are usually fixed but if financial crisis happens and the company cannot pay the salary, how should we determine the salary cost?	Concept: s/b concept 5/2015 since question is asking about the prediction of future costs which involves the use of a cost function. Concept 4 is about the development of the cost function and the methods involved in doing that.
For medical supplies, the number of the patient is uncertain and variable, but if there is no patient, how to determine this part of cost?	Concept: s/b concept 5/2015 since question is asking about the prediction of future costs (medical supplies) when predicted activity level (patients) is zero. This involves the use of a cost function. Concept 4 is about the development of the cost function and the methods involved in doing that. MC Reg. The issue is whether the question is one about understanding a procedural concept (code 2) or about the application of a procedural concept in real life. Since the context of this question is a textbook context, as opposed to a contextual situation a student invents as part of generating a question, I will code this as 2, not 4.

Cost estimation techniques have six method, which method is more accurate to determine the cost function?	MC Reg. Not coded in 2015. As noted earlier, closed questions, and/or questions which presume objective/definitive answers will be coded as 1.
Why to determine the cost function is important?	MC Reg. As per previous comment: Not coded in 2015. As noted earlier, closed questions, and/or questions which presume objective/definitive answers will be coded as 1.
Question 2.1 asks for the TYPE of linear cost function, so should the answer include either piecewise or stepwise linear cost function?	Concept: In both years this question was interpreted to be about links. In 2016, the target was a concept within cluster 2 and its links with other concepts in cluster 2. This was correct. If the 2015 coding of target as being cluster 2 was correct, then the links had to be from cluster 2 to other clusters or their component concepts. This is not the case, so the 2015 coding was wrong. To avoid terms having multiple meanings, I will refer to links between concepts within the same cluster as 'relations', and between clusters 'connections'.
The answer to 2.11 (c) uses two point method to estimate the average cost to produce 15,000 units. One of the disadvantages to two point method is that it mismeasures cost function if the data point is not in relevant range (15,000 is not in relevant range). Can we still use this method to estimate the average cost to produce 15,000 units? If it is the only method, should we state any assumption about the cost?	Concept: Question is about use of cost function (concept 5) not cost behaviour (concept 2) or methods used to develop cost functions (code 4). MC Reg: Not code 6/2015 because the student is not challenging the answer on the basis of perceiving an exception, rather he is asking a question about how an exceptional situation should be handled, i.e. application, thus code 4/2016.
Why is the Critical Thinking and Assessment skills important to the learning of management accounting?	Stage: Stage does not apply to this question, thus delete code assigned in 2015

In the anaswer of Q.25, it defines utilities as fixed cost,but it varies each month, depending on consumption of bills. How do we define whether utilities as fixed cost or variable cost?	Concept: Questions is about more than the fixed cost concept (2016); it is about relations between the concepts of fixed and variable cost within the context of utilities. These concepts are components of Cluster 2, therefore code = cluster 2 as per 2015. MC Reg: The question is not closed or clearly looking for a definitive/definitive answer, therefore not Code 1, but 2 as per 2015.
Why do we hold the assumption that cost behaviour should only be estimated by linear functions, be it algebraically or statistically calculated? Having completed an econometrics major, and being aware of several other modelling techniques, surely other, non-liner and seasonal models could at times reflect the costing scenario more accurately and lead to better, more informed management decisions.	Stage: Student is reviewing/restructuring knowledge in another domain as a result of making sense of cost accounting approaches to estimating cost behaviour, thus CC Stage 4/2015, not stage D/2016. MC Reg. In doing the above, the student is being negatively critical of cost accounting, i.e. "surely other, non-line(a)r and seasonal models could at times reflect the costing scenario more accurately", thus code 5/2015.
In terms of Q2.19 (c) in regards to the use of regression analysis, although the suggested answers states that the use of one would not be useful tool for Sue-ellen to utilise to decide whether to purchase the new plan or not, would it not be the most appropriate cost estimation technique? As the cost function has been developed for her business and would need the best estimation of costs to ultimately make the consequent decision on whether to adopt the new plan or not, wouldn't she need the most accurate estimate as it would give the most faithful representation of the costs that would be incurred compared to that of the high-low method or 2 point method?	Concept: Question is about choice of methods and the need for "most accurate estimate", therefore clearly cluster 4/2015. The question is also more reflective of 'thinking like an accountant' (modelling as per cluster 4) than thinking about the use of a procedure (procedural concept as per cluster 5). MC Reg: Is she rejecting the answer ("although the suggested answers states …" code 5/2016) or thinking about its application in practice ("wouldn't she need the most accurate estimate..." code 4/2015)? The question is lengthy, and the latter comes as a later elaboration of the former statement, thus I will code according to the way the question started, therefore code 5/2016.

(Related to tute qn 2.26 b) Why use the date of june to calculate the cost function of july? Is it because it is the most relevant data? As the question asks to use high-low method, the answer does not use the highest point of utilities to calculate fixed cost, instead it uses june's data. Why it has to be done in that way?	Concept: Clearly question is about the High/Low method and the appropriate use of data points, therefore concept 4H/2016.
In estimating cost for decision making,how to minimize errors so that more accurate cost information can be reflected?	MC Reg: Is it code 1/2015 (earlier I clarified that closed questions, or questions which presume objective/definitive answers would be coded as 1) or is the student genuinely seeking to understand (code 2/ 2016)? Where there's doubt, I will give the student the benefit of it, and thus code this one as 2/2016.
Is the cost driver and cost objective have a positive relationship just like x and y in the mathematics (i.e. y= ax+b)?	Stage: The student is linking desired/target knowledge to concepts/knowledge from outside the domain of accounting, therefore Stage 4/2015, not Stage D/2016. Concept: Clearly, the formula here is being used to refer to cost behaviour (the relationship between activity levels and change in cost) and thus should be coded cluster 2/2016 rather than reflective of a judgement about methods of developing a cost function (cluster 4/2015). MC Reg. Given these adjustments to stage and cluster, the thinking behind the question is straightforwardly seeking to understand the similarities/differences in the concept between domains, therefore code 2.
older and history information is useful for us to predict the future cost, but why it is not relevant to the future cost?	Concept: Inconsistency arose because in 2016 a new target concept was used so that rather than coding the question in terms of the student's thinking as pertaining to Cluster 1 in a holistic sense, it became possible to code the question in terms of the student's thinking about an important aspect of Cluster 1. MC Reg: Given the different definition of target concept, the inference about the type of thinking in respect of it also changed.

Question 2.26 considers utilities a fixed cost despite variations due to seasonal changes. Are there any businesses whose utilities costs could be considered at least partly variable?	Concept: Coding inconsistency arose because question is about cost behaviour (cluster 2) of utilities and whether it is fixed (as it was coded in 2015) or mixed (as it was coded in 2016). Sometimes it is clear in these situations that the target concept is the one first mentioned in the question, but not in this case. Thus better decision in this case is to recognise an additional concept, that being the contextual dependency of a cost's behaviour. MC Reg. A consequence of the change in cluster coding, is that the thinking no longer pertains to an exception, but to understanding the nature of the cluster.
In the topic of stepwise linear cost function, it seems untrue to say that the slope of fixed cost function changes but remains constant after the change. It can be seen from the graph that the fixed cost line in all relevant ranges are horizontal and therefore the slopes should be all 0. The statement should be corrected as 'the fixed cost function changes at some points of time but after the change, it remains constant'.	Clearly the subject of the question is stepwise linear behaviour, therefore concept C/2016, not CF/2015.
Analyse the significance of relevant range in determining cost estimates.	Concept: Clearly the question is about relevant range, hence concept R within cluster 2 (2016), not the cluster in a holistic sense (2015). MC Reg: Question was not coded in 2015 (code 99). The question is not about the application of conceptual understanding (code 4/2016) but conceptual relations with cost estimates (code 3).

L.2.2 *Appendix 4 Concepts and Clusters – Cost Estimation (as it is after the check of coding consistency)*

Changes either marked up or shown in blue.

Five clusters of concepts were identified and these were labelled Cluster 1 through Cluster 5. They were also coded in terms of the type of conceptual change represented by them, either Procedural (P) or Modelling (M).

Concepts within clusters (component concepts) were labelled with the first letter (or similar) of their names also coded with the type of conceptual change represented by them, either Basic (B), or Procedural (P).

<u>Concept clusters – Cost Estimation</u>

Cluster 1. The future can be predicted from the past provided the future is consistent with the past. To the extent the future varies, uncertainty arises and judgements are necessary about how predictions based on the past may be adjusted in order to increase confidence in the prediction (M)

<u>Component concepts</u>

Concept code	Concept	Type of conceptual change
H	The idea that historic data is useful but not relevant to decision making.	B

Cluster 2. That costs ‘behave’, meaning that the cost of something is ‘driven’ by the level of some type of activity, albeit a cost may not be driven by anything at all (i.e. a ‘fixed’ cost). Within a relevant range of activity, costs are often treated as varying linearly in response to a change in activity. (P)

<u>Component concepts</u>

Concept code	Concept	Type of conceptual change
B	Contextual dependency of a cost’s behaviour	B
F	Fixed cost behaviour	B
V	Variable cost behaviour	B
M	Mixed cost behaviour	B
D	Driver	B

L	Linear variation	B
R	Relevant Range	B
C	Combinations of linearity and relevant ranges: piece-wise, step-wise variation	B
O	Other types of variation: curvilinear	B
S	Scatter diagrams - a visual representation of behaviour.	B
CF	Cost function (as an expression of behaviour)	B

Cluster 3. Historical data can be cleansed before use: adjustments can be made for outliers, missing data, misalignments between time periods for which activities and costs are measured, and other flaws that may be evident in a review of the data (P)

<u>Component concepts</u>

Concept code	Concept	Type of conceptual change
O	Outlier	B
M	Missing data	B
T	Mismatched time periods	B

Cluster 4. A variety of methods exist by which cost functions (mathematical equations relating cost to volume of activity) can be estimated from historical data. The choice of method involves a judgement about their relative cost/benefit. (M)

<u>Component clusters and concepts</u>

4R Regression analysis (P)

Concept code	Concept	Type of conceptual change
4R1	R^2, closer to 1 the better	B
4R2	Standard error	B
4R3	p-value, good if < 0.05	B

4T Two-point method (P)

4H High/Low method (P)

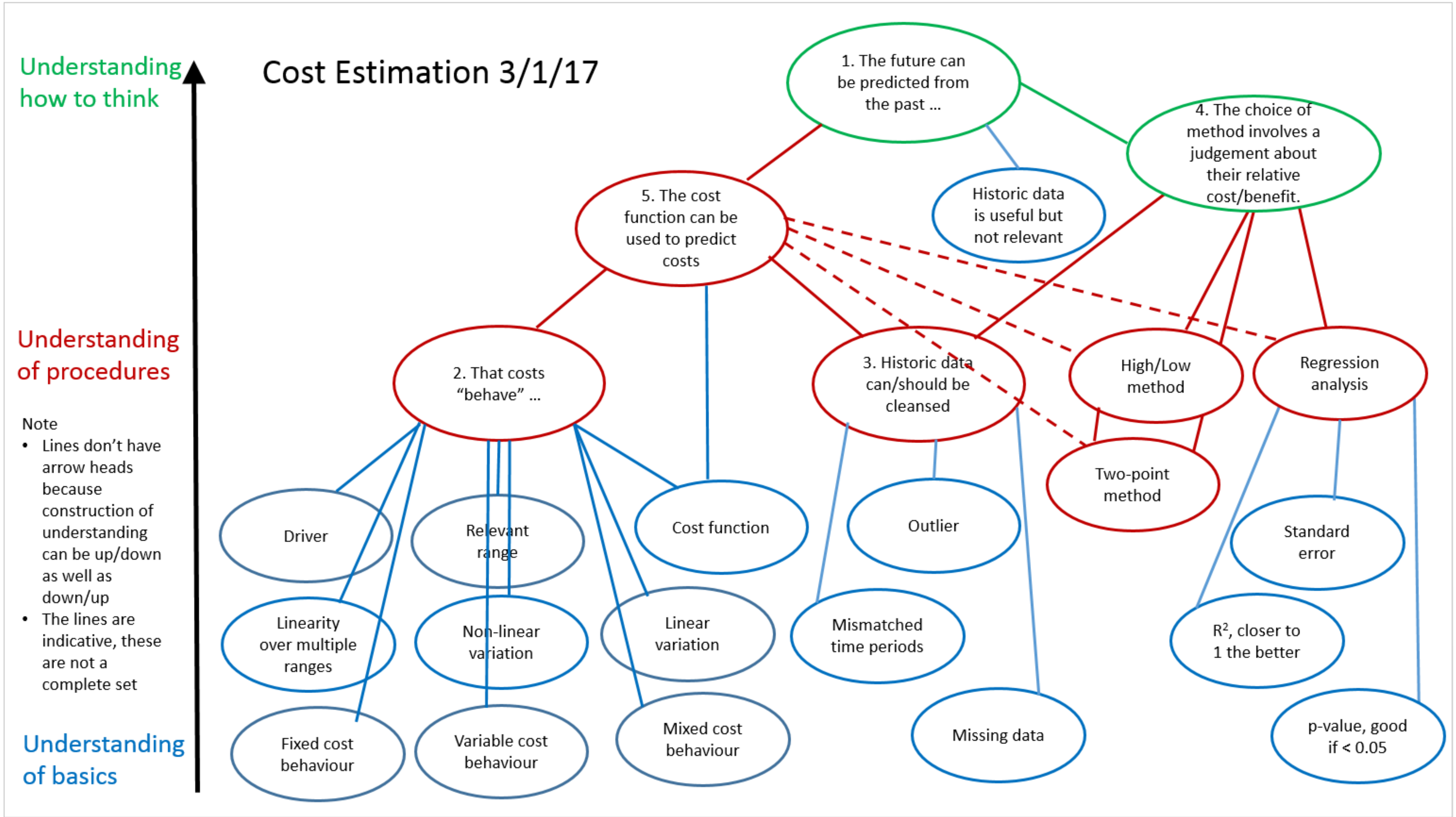
4O Account analysis method (P)

Cluster 5. Using predictions of level of activity, and by making other judgements about the future, the cost function can be used to predict the driven cost (P)

Component concepts

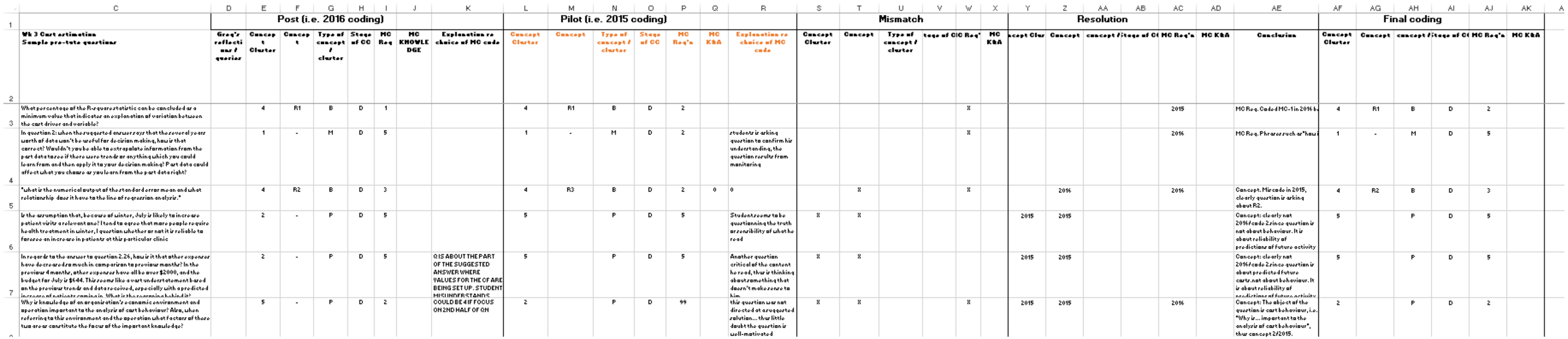
Concept code	Concept	Type of conceptual change
CF	Cost function (as a tool for predicting costs)	B

L.2.3 Appendix 5 Web of Concepts – Cost Estimation (as it is after the check of coding consistency)



L.2.4 *Appendix 6 Process used to identify/resolve inconsistencies:*

A spreadsheet was used to facilitate the process. The following diagram aims to show the structure of the spreadsheet even though the detail is too small to read. The far left hand column contains the data (i.e. students' questions), and the codes assigned in 2016 and 2015 are reported in the next two blocks of columns to the right. The next block of columns flags (with an "X") the existence of mismatches between 2015 and 2016 codings and the next block records how the mismatches were resolved (whether in favour of 2015, 2016, or neither) and the far right column within this block records the explanation for the resolution. The last block of columns (at the far right) reports the final codes for each question.



	C	D	E	F	G	H	I	J	K
1			Post (i.e. 2016 coding)						
2	Wk 3 Cost estimation Sample pre-tute questions	Greg's reflections / queries	Concept Cluster	Concept	Type of concept / cluster	Stage of CC	MC Req	MC KNOWLEDGE	Explanation re choice of MC code
3	What percentage of the R-square statistic can be concluded as a minimum value that indicates an explanation of variation between the cost driver and variable?		4	R1	B	D	1		
4	In question 2: when the suggested answer says that the several years worth of data won't be useful for decision making, how is that correct? Wouldn't you be able to extrapolate information from the past data to see if there were trends or anything which you could learn from and then apply it to your decision making? Past data could affect what you choose or you learn from the past data right?		1	-	M	D	5		
5	"what is the numerical output of the standard error mean and what relationship does it have to the line of regression analysis."		4	R2	B	D	3		
6	Is the assumption that, because of winter, July is likely to increase patient visits a relevant one? I tend to agree that more people require health treatment in winter, I question whether or not it is reliable to foresee an increase in patients at this particular clinic		2	-	P	D	5		
7	In regards to the answer to question 2.26, how is it that other expenses have decreased so much in comparison to previous months? In the previous 4 months, other expenses have all be over $2000, and the budget for July is $644. This seems like a vast understatement based on the previous trends and data received, especially with a predicted increase of patients coming in. What is the reasoning behind it?		2	-	P	D	5		Q IS ABOUT THE PART OF THE SUGGESTED ANSWER WHERE VALUES FOR THE CF ARE BEING SET UP. STUDENT MISUNDERSTANDS
8	Why is knowledge of an organisation's economic environment and operation important to the analysis of cost behaviour? Also, when referring to this environment and the operation what factors of these two areas constitute the focus of the important knowledge?		5	-	P	D	2		COULD BE 4 IF FOCUS ON 2ND HALF OF QN

	L	M	N	O	P	Q	R
1		Pilot (i.e. 2015 coding)					
2	Concept Cluster	Concept	Type of concept / cluster	Stage of CC	MC Req's	MC K&A	Explanation re choice of MC code
3	4	R1	B	D	2		
4	1	-	M	D	2		student is asking question to confirm his understanding, the question results from monitoring
5	4	R3	B	D	2	0	0
6	5		P	D	5		Student seems to be questioning the truth or sensibility of what he read
7	5		P	D	5		Another question critical of the content he read, thus is thinking about something that doesn't make sense to him
8	2		P	D	99		this question was not directed at a suggested solution... thus little doubt the question is well-motivated

	S	T	U	V	W	X
1		Mismatch				
2	Concept Cluster	Concept	Type of concept / cluster	tage of CC	C Req'	MC K&A
3					X	
4					X	
5		X			X	
6	X	X				
7	X	X				
8	X	X			X	

	Y	Z	AA	AB	AC	AD	AE
1		Resolution					
2	cept Clus	Concept	concept /	tage of C	MC Req's	MC K&A	Conclusion
3					2015		MC Req. Coded MC-1 in 2016 b
4					2016		MC Req. Phrases such as "how i
5		2016			2016		Concept. Miscode in 2015, clearly question is asking about R2.
6	2015	2015					Concept: clearly not 2016/code 2 since question is not about behaviour. It is about reliability of predictions of future activity
7	2015	2015					Concept: clearly not 2016/code 2 since question is about predicted future costs, not about behaviour. It is about reliability of predictions of future activity
8	2015	2015			2016		Concept: The object of the question is cost behaviour, i.e. "Why is... important to the analysis of cost behaviour", thus concept 2/2015.

	AF	AG	AH	AI	AJ	AK
1		Final coding				
2	Concept Cluster	Concept	concept /	tage of C	MC Req's	MC K&A
3	4	R1	B	D	2	
4	1	-	M	D	5	
5	4	R2	B	D	3	
6	5		P	D	5	
7	5		P	D	5	
8	2		P	D	2	

M Analyses of observed variation in types of thinking by topic

As reported in Section 5.2.3, this appendix presents analysis of six observations regarding variation in the mix of types of thinking across topics. The analysis show the need for caution when interpreting the percentages because the numbers of questions are small and hence the percentages would change significantly with only a small change in the nature of questions asked. Following are the six observations each accompanied by a detailed analysis.

The high level of Type 6 (12%) thinking, i.e. about perceived exceptions, directed toward modelling ideas (Fig 5.1) was mainly due to CVP.

These 12% equate to 4 questions in CVP, zero in CE and 1 in SCA. The four CVP questions concerned the potential non-applicability of CVP to multi-product operations, perceived non-allowance for theft and discounts, the relevance of volume discounts, and the perceived unsafeness of assumptions. Thus, this observation is sensitive to the small number of questions suggestive of Type 6 thinking. Nevertheless, why CVP attracted thoughts about perceived exceptions whilst the other topics (almost) didn't is an interesting question. The analytical methods of all three topics rely on sets of assumptions, but compared to the other two, perhaps the assumptions of CVP were perceived as unrealistic, or students could not see the usefulness of the technique despite the limitations associated with the assumptions. Consequently, students may have been disposed towards rejecting the value of the idea. If this was the case, then an appropriate pedagogical response would be to better contextualise the introduction of the topic in terms of its assumptions and show how the technique is useful in real world contexts provided critical thought and judgement is applied.

The high level of Type 5 thinking, i.e. about things that don't seem correct (17%, 11%, 6% for CE, CVP and SCA respectively), shown in Fig 6.7 was directed mainly toward relational ideas in CE and modelling ideas in all three.

The actual number of questions interpreted as inferring Type 5 thinking and directed toward Relational ideas was 8, 5, 0 and modelling ideas 2, 4, 3 for CE, CVP and SCA respectively.

The high number directed toward relational ideas within CE appears to be explained by the nature of the topic. Cost estimation involves similar mathematical techniques to those taught in other disciplines and two of the eight questions concern this, and it involves data describing historical trends. Three of the eight questions challenge the reasonableness of those trends. The final two questions asked are not connected to the nature of the topic since they address perceived contradictions with information provided in the text.

Although the percentage of questions suggestive of Type 5 thinking and directed toward modelling ideas appears high, in reality they each equate to only a small number.

The high level of questions suggestive of Type 4 thinking, i.e. thinking about implications in terms of application, directed toward relational ideas (30% in Fig 5.1) is high in all topics but very high in CVP (26%, 39% and 23% for CE, CVP and SCA respectively).

Nine, seventeen, and ten questions directed toward relational ideas for CE, CVP and SCA respectively. Generally, accounting exams tend to test the ability to apply accounting procedures, and thus I think the high level of Type 4 reflects students' concern with wanting to know how to apply the procedure in assessments, in particular the final exam..

The level of questions suggestive of Type 3 thinking, i.e. about the implications at conceptual level, directed toward foundational ideas was similar and quite high in all three topics (24%, 25% and 26% for CE, CVP and SCA respectively in Fig. 5.2), but none were directed toward modelling ideas in CVP.

Eleven, five and six questions suggestive of Type 3 thinking were directed toward foundational ideas. As well as none for CVP, there was only one question in each of the other two topics directed at modelling ideas. A relatively high volume of questions suggestive of Type 3 thinking directed at foundational ideas is to be expected, since typically there are many other ideas in the topic whose interconnections may be thought about. Typically, Modelling ideas within the same topic, in contrast, are few and hence there are fewer opportunities for Type 3 thinking. Instead however, and as was discussed in relation to the previous observation, there are many opportunities to think about how modelling ideas would be applied in practice.

The level of questions suggestive of Type 2 thinking, i.e. concerned with monitoring understanding, of modelling ideas appears to have been much higher in SCA than in the other two topics (11%, 11% and 29% for CE, CVP and SCA respectively in Fig. 5.2).

These percentages equate to 1, 2 and 4 questions directed toward modelling ideas in CE, CVP and SCA respectively. The small number of questions prohibits conclusions about variability between topics.

The level of questions suggestive of Type 1 thinking, i.e. concerned with entrenching/memorising, directed toward modelling ideas was very high in CE and zero in CVP (44%, 0% and 14% for CE, CVP and SCA respectively in Fig. 5.2).

These percentages equate to 4, 0 and 2 questions directed toward modelling ideas in CE, CVP and SCA respectively. The small number of questions prohibits conclusions about variability between topics.

N Big Ideas in cost accounting

Modelling ideas in cost accounting reflect an excellent appreciation of the limitations and assumptions of accounting methods of providing information for decision-making. Modelling ideas therefore convey an appreciation of the fact that cost accounting is not objective nor certain, and therefore, the requirement in accounting performances for critical thinking and hence judgement (van Mourik & Wilkin, 2018).

A form of evidence of understanding of a modelling idea associated with accounting is often the ability to explain it in plain language; i.e. to explain it to a layperson. At the core of such an explanation, in the form of one or two short sentences, is likely to be a statement of a big idea. What follows is discussion of two modelling ideas taken from the Ideas and Clusters for two topics presented in the appendices. Note, the statements of these ideas were crafted for the purpose of this research and as such may be crafted more effectively for the purpose of pedagogy.

N.1 Cost Estimation (from Appendix I.1)

Modelling Idea 1: “The future can be predicted from the past provided the future is consistent with the past. To the extent the future varies, uncertainty arises and judgements are necessary about how predictions based on the past may be adjusted in order to increase confidence in the prediction”.

This statement is significant but apparently underwhelming. If the statement were presented to many accounting students as well as laypersons they would respond that it is obvious; that it does not represent something additional they need to learn; that they are underwhelmed by it. Drilling into this idea in the context of cost accounting uncovers the idea that a trend evident in historic cost data enables predictions of future costs. As an example of the application of the idea, if a historical trend shows the volume of ice cream sold by a vendor rises and falls with increase and decrease respectively in the daily temperature, and we predict tomorrow’s temperature will be hotter than today, then we can predict the volume of ice cream sold tomorrow will increase.

Whilst this appears to be obvious and therefore underwhelming, it is significant pedagogically because it is the fundamental premise of the topic, Cost Estimation. Moreover, it is significant because many students do not realise this even after they finish studying the topic.

This idea is generative for teachers in several ways. It may help them link pedagogy to students' prior experiences and knowledge. For example, they may help students recall how they may have used their prior experience of purchasing car fuel to predict what the cost of the next refuel. The statement of the idea may help them search for examples where the future is and is not consistent with the past and thus discuss how the use of the accounting method might be varied to take account of them. For example, if they know the average weekly cost of train travel this year has been $30 (say 10 trips at $3 each) and they predict their travel patterns will not change next year, then they might predict the average cost next year to be $30. However, if prices next year will not be consistent with the past because the price of a trip will be $3.20, then the method can be varied to take account of that by predicting the cost to be 10 x $3.20, i.e. $32. The statement of the idea may also help them search for examples where cost accounting blunders were made because the consistency of the future with the past was not checked. Moreover, as illustrated by the web of ideas for the topic shown in Appendix J.1, this modelling idea links the procedural and foundational ideas that comprise it and that students may see as separate. Thus, instruction can be designed to help students recognise the connections between the constituent ideas and integrate them. The connections with other modelling ideas, such as the next one, can also be made apparent.

Modelling Idea 2: A variety of methods exists by which cost functions (mathematical equations relating cost to volume of activity) can be estimated from historical data. The choice of method involves a judgement about their relative cost/benefit.

Again, this statement is significant but apparently obvious. Drilling into this idea in the context of cost accounting uncovers the idea that mathematical equations can be derived from historic cost data to describe historical trends and thus be used to predict the future. How well the mathematical equation derived describes the historical trend depends on the amount and quality of the historical data. Generally, the more data that is used, and the more sophisticated the technique, e.g. linear regression versus best guess, the better the equation and hence the prediction. Thus other dimensions to this big idea, is that a choice of techniques may be available; and the more accurate, sophisticated, and costly the technique the better the prediction is likely to be. The method chosen becomes a matter of judgement for management in the real world context in which a solution to the problem of future cost prediction is required.

Again, the idea that choice of methods is determined based on cost benefit would appear obvious. Most students would be aware of the trade-off between costs and benefits in their personal lives. They may have even made judgement based on value for money. For example, about whether the benefits of a more expensive holiday are worthwhile compared to the benefits from a less expensive one. However, the idea is significant in that, despite this, many students do not appreciate that cost/benefit judgements are commonplace in real world businesses even after they finish studying the topic.

N.2 Cost Volume Profit Analysis (from Appendix I.2)

Modelling Idea 1: "Decisions about the financial benefit (profit) of performing activities can be assisted by quantifying the relationships between volume of activity, revenue and costs. Doing so requires certain assumptions about the nature of activities, revenues and costs".

Few students finish studying the topic with this realisation. Yet the idea that the greater the volume of business activity, for example sales, the greater the associated costs and potentially, the greater the profit; profit being the difference between revenue from sales and costs incurred to achieve those sales, would seem obvious. Another dimension to the idea, however, is that if mathematical formulae are to be used to model the costs and revenues and hence profit, then a wide range of assumptions must be made. For example, assumptions that the difference in short term revenues and costs (i.e. short term profit) is a good measure of financial benefit, about the variability of costs, change in inventory levels, the extent to which costs remain fixed, expected selling prices, etc.

Again, this idea is underwhelming because it would seem obvious. However, it is pedagogically significant because, firstly, few students would express this realisation and, secondly, most students do not realise a consequence of modelling activities and costs in any way leads to an outcome that is not certain to be accurate; that it will be as good as the assumptions relied upon.

Modelling Idea 2: "Over and above Modelling Idea (1), analytical approaches can be adapted to accommodate situations where the usual assumptions about the nature of activities, revenues and costs are unsafe or inappropriate".

Again, this idea would seem obvious to many laypersons let alone accounting students. Given the previous idea that the outcome of a model is only as good as the assumptions relied upon, this idea suggests a model's deficiencies can be mitigated by making the model more sophisticated by incorporating more sophisticated assumptions or by using the model in conjunction with other tools. For example, a model may be used in conjunction with sensitivity analysis to discover the extent to which the outcome varies with changes in an assumption. If it were found the outcome is not highly sensitive to a particular assumption, then managers may be justified in relying upon the model to make a judgement. However, this idea is pedagogically significant. Firstly, many students do not realise there is the opportunity to act upon this idea in the real world, and that managers will make decisions in these contexts based on risk. Secondly, it is significant because many academics do not realise it either, and will tell their students at the end of the lesson something like “cost volume profit analysis (this topic) is too simplistic to be useful”!

O Structuring textbooks on the basis of big ideas

The discussion in the thesis about textbooks is coloured by a pre-occupation with traditional hardcopy textbooks. However, the critique is still largely valid of eBooks, and also of multimedia resources provided by publishers in support of their textbooks. Multimedia can make the book easier to interpret, e.g. by using links to entries in a glossary, enable the book to enable the reader to self-test, e.g. by use of interactive exercises such as quizzes, and make the content more engaging and relevant, e.g. by use of multimedia presentations and videos that illustrate content in real world contexts but they are little better than the hardcopy textbook from the perspective of helping the reader construct meaning of ideas.

In accounting textbooks, the discipline content is often supplemented by worked examples. These are designed to assist students apply concepts and become more capable of attacking the related exercises provided at the end of the chapter. The content is often supplemented also by short descriptions of how the concepts are applied in real life. These are usually designed to motivate students by helping them see the real world relevance of what they are learning. Nevertheless, the foundation of textbooks is usually the transmission of discipline content.

Take for example, the first page from a chapter in a typical cost accounting textbook is shown in Figure O-1. The chapter covers Cost Volume Profit (CVP) analysis as well as Relevant Costing but this discussion centres on CVP only.

After the title, the chapter presents ‘learning objectives’ (only the first three apply to CVP) and these are described in accounting terms. Two paragraphs follow that introduce the two sub-topics, but it is the first paragraph, with the exception of its first sentence, that introduces the topic of CVP. In doing so, the first paragraph introduces the topic of CVP with an explanation in terms of discipline concepts except for the closing sentence that explains the topic “helps us make decisions and assess risk, particularly in the context of short-term decisions”.

The chapter is then structured in the sequence of the learning objectives. This is illustrated by the summarised table of contents shown in Figure O-2. Thus, the CVP content is presented as three ‘chunks’ of discipline content, i.e. the behaviour of costs, break-even analysis, and contribution. The content section concludes with a summary, as shown in Figure O-3. The summary presumes the learning objectives would have been achieved and explains how they were.

A textbook chapter structured on the basis of big ideas would start by introducing the two CVP modelling ideas described in Appendix N.2. Metaphorically speaking, the chapter would proceed to 'peel the onion', drilling into the modelling ideas and covering the relational and foundational ideas that comprise the Web of Ideas for the topic.

In contrast to traditional cost accounting textbooks, most of the discipline content could be presented in the context of a real world situation and the decisions managers might have to make that would be assisted by the information provided by accounting methods. Thus the real world relevance of what the student is learning would be more obvious and the context of worked examples richer and more interesting. Moreover, students are more likely to perceive and appreciate the subjectivity and uncertainty of accounting information, which would also be a strong theme in the end-of-chapter exercises and the suggested solutions provided for them.

CHAPTER 9

COST–VOLUME–PROFIT ANALYSIS AND RELEVANT COSTING

LEARNING OBJECTIVES

When you have completed your study of this chapter, you should be able to:

LO1 Distinguish between fixed costs and variable costs, and explain the importance of a detailed understanding of cost behaviour

LO2 Apply the distinction between fixed and variable costs to explain and apply break-even analysis

LO3 Explain and apply the concept of contribution and contribution margin

LO4 Define and distinguish between relevant costs, outlay (historic) costs and opportunity costs

LO5 Explain and apply the concept of relevant costing to a range of decision-making situations.

This is the first chapter that deals with the area known as management accounting. The chapter focuses on two aspects of management accounting that are critical to effective decision making. The first of these concerns the area generally known as cost behaviour, which is basically the relationship between volume of activity, costs and profit. Broadly, costs can be divided between costs that are fixed, relative to the volume of activity, and those that vary with the volume of activity. Some (semi-variable) costs do not fall neatly into these categories, but it is possible to break these down into fixed and variable elements. This split enables us to develop break-even analysis, while a clear understanding of cost behaviour helps us to make decisions and assess risk, particularly in the context of short-term decisions.

The second main area involves a range of possible costs which are (or are not) relevant to different decisions; the term relevant costing is generally applied to the application of these ideas. Not all costs (and revenues) that appear to be linked to a business decision may actually be relevant to it. It is important to distinguish between costs (and revenues) that are relevant and those that are not. Failure to do this can lead to bad decisions being made. The chapter includes a range of decisions that typically need to be made and identifies the appropriate costs to be included.

Figure O-1 Typical introductory page to a textbook chapter[23]

[23] Copyright permission received 22 November, 2019: Atrill, McLaney and Harvey *Accounting for Non-Specialists*, 7th edition, Copyright © 2018, Pearson Australia, page 346.

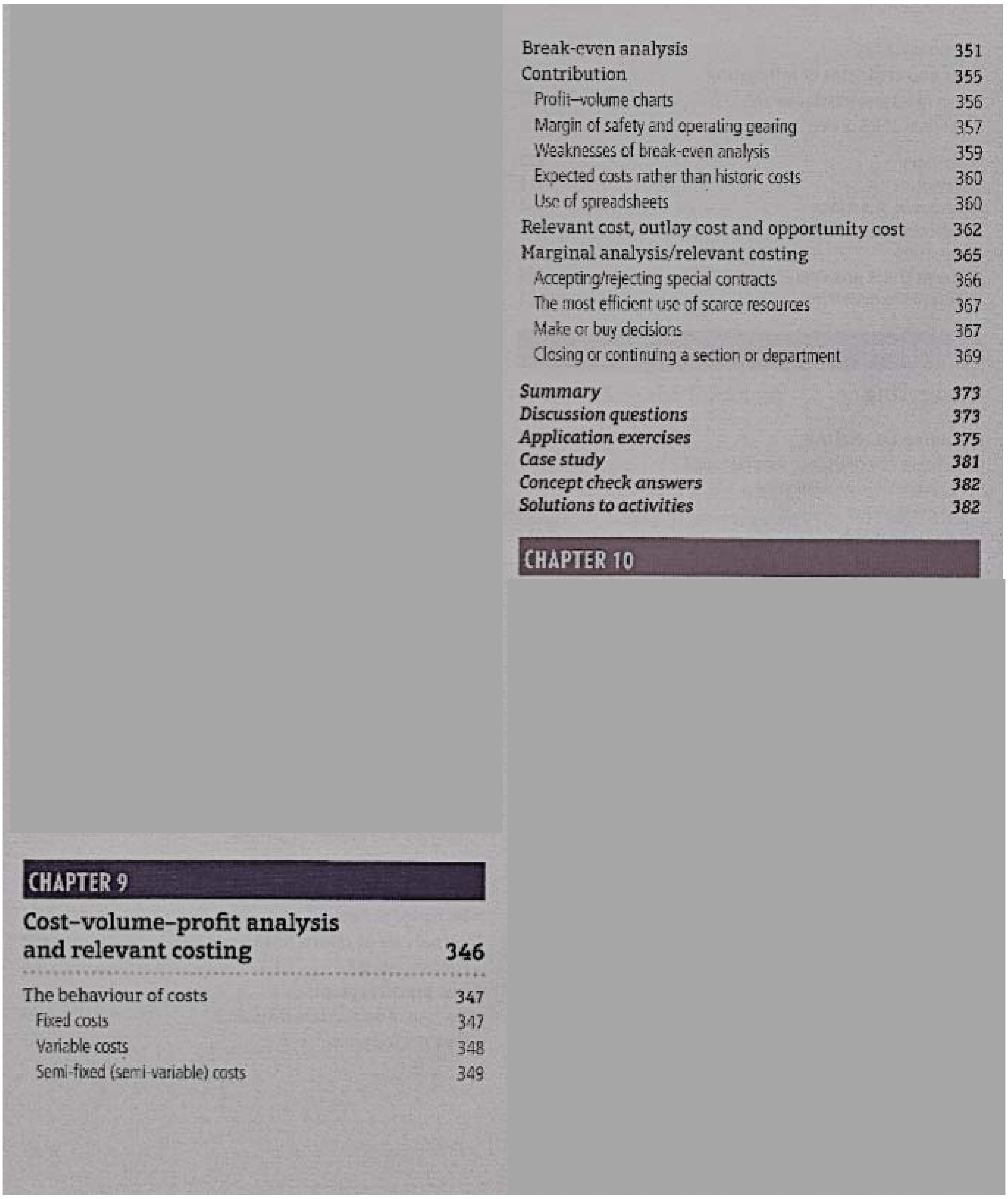


Figure O-2 Typical structure of a textbook chapter[24]

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[24] Copyright permission received 22 November, 2019: Atrill, McLaney and Harvey *Accounting for Non-Specialists*, 7th edition, Copyright © 2018, Pearson Australia, page ix.

SUMMARY

In this chapter we have achieved the following objectives in the way shown.

OBJECTIVE	METHOD ACHIEVED
Distinguish between fixed costs and variable costs, and explain the importance of a detailed understanding of cost behaviour	• Explained the nature of fixed and variable costs • Analysed costs and separated the elements of semi-variable costs into fixed and variable • Identified problems such as non-linearity, stepped costs and multi-product businesses • Illustrated through the chapter the importance of a detailed understanding of cost behaviour
Apply the distinction between fixed and variable costs to explain and apply break-even analysis	• Illustrated and prepared a break-even chart • Calculated a break-even point • Illustrated the uses to which break-even analysis can be put • Illustrated the concept of margin of safety • Explained the concept of operating gearing
Explain and apply the concept of contribution and contribution margin	• Explained and illustrated the concept of contribution • Applied the concept of contribution to specific situations • Identified ways in which spreadsheets can help in decision-making • Used both historic and forecast figures • Illustrated more complex relationships
Define and distinguish between relevant costs, outlay (historic) costs and opportunity costs	• Defined and explained relevant costs and opportunity costs • Illustrated that historic costs are not usually relevant for decision-making • Provided a decision tree to assist in determining relevance

Explain and apply the concept of relevant costing to a range of decision-making situations	• Explained the concept
	• Applied it to a number of situations
	  • special contracts
	  • most efficient use of scarce resources
	  • make or buy decisions
	  • closing or continuing a section or department

Figure O-3 Typical summary of a textbook chapter[25]

[25] Copyright permission received 22 November, 2019: Atrill, McLaney and Harvey *Accounting for Non-Specialists*, 7th edition, Copyright © 2018, Pearson Australia, page 373.