South African Journal of Accounting Research, 2016
Vol. 30, No. 1, 79–95, http://dx.doi.org/10.1080/10291954.2015.1099215

Routledge
Taylor & Francis Group

Knowledge structures and their relevance for teaching and learning in introductory financial accounting[1]

L. Peta Myers*

Department of Accounting, Rhodes University, Grahamstown, South Africa

(*Received 1 February 2015; revised 1 July 2015; accepted 5 July 2015*)

The structure of knowledge within a discipline has implications for the teaching and learning within the discipline. This research examines how the hierarchical knowledge structure found in accounting impacts on the teaching and learning which takes place in the first-semester introductory financial accounting course. Students used online questionnaires and interviews to explain how they engaged with the discipline and describe the difficulties they experienced during the semester. Bernstein's pedagogic device and Maton's Legitimation Code Theory were used to analyse the structure of knowledge within the discipline and as theoretical lenses through which to view these students' perceptions. This research provides a theoretical explanation for the impact that a hierarchical knowledge structure has on teaching and learning within the discipline; how students need to develop a "trained gaze" and thereby gain mastery over the "procedures of investigation" to be able to produce the "legitimate text" required for success in the course. This research also explains why some students experience a "code clash" and the implications this has for their success in the discipline. Other pedagogical difficulties which were experienced by these students, as a result of the hierarchical knowledge structure within the discipline, are also discussed. In addition to providing a better understanding of the phenomena that drive or hinder student learning, which could contribute towards improving pedagogy and hence student learning, theorising these concepts provides a common language to enable more informed debate on these issues.

Keywords: Accounting Education; Introductory Financial Accounting; Knowledge Structures; Constructing Knowledge; Pedagogic Device; Legitimation Code Theory

Introduction

This article is based on aspects of a larger piece of research which investigated the structure of knowledge, and how students constructed knowledge, in the first-semester introductory financial accounting course. The research was undertaken to investigate why some students seem to struggle with the discipline and what could be done to assist these students in successfully completing the course.

The focus of this article, based on the results which emerged from the research, is the implications of the structure of knowledge in accounting for the teaching and learning in a first semester course.

*Email: L.Myers@ru.ac.za

This research was undertaken at a small South African residential university. At this institution, approximately 60% of the students in the introductory financial accounting class have already completed up to three years of accountancy at school level, while the remaining 40% are engaging with the discipline for the first time. These first-time accounting students are referred to as "novice" accounting students in this article. Novice accounting students have little or no prior knowledge of accounting.

From an online questionnaire which was completed by an earlier cohort, approximately 40% of the class were registered for an Accounting 1 credit as these students wished to major in the discipline, with the rest of the class enrolling for the course as it was a prerequisite for their degree (48%) or because they felt it may be a "useful credit" (12%). This means that approximately 60% of the students are registered for the subject for one year only, and may be less inclined to invest the time, energy and effort which is required for successful completion of this first-semester course.

The research was guided by the following questions:

- What type of knowledge structure exists in the introductory financial accounting course?
- How does this influence the teaching and learning which takes place during this first semester?

The purpose of this paper is to:

- provide an improved understanding of the problems students have in successfully completing the first-semester introductory financial accounting course;
- better understand the pedagogical reasons underpinning the teaching and learning activities which take place during this first semester course; and
- provide a common discourse to explain the pedagogic phenomena which are encountered.

The research also revealed additional pedagogical difficulties, some of which are more likely to occur in a discipline with a hierarchical knowledge structure, which these first-year students experienced in constructing knowledge in this discipline and which will be discussed in more detail.

Having a theoretical framework and acquiring a discourse to describe the pedagogical activities illuminated by the research, may assist readers in making "tacit understandings explicit" (Young, 2008, p.48).

In this paper I first introduce the theoretical framework on which this research is based. Thereafter a description of the methods used to analyse the data is provided, together with an explanation of how the research participants were selected and how the interview process was structured. The section that follows looks at the results of the analysis of the structure of knowledge in accounting, and what this means for teaching and learning within the discipline. Finally pedagogical difficulties which were experienced by the participants in this research are discussed.

The following section of the paper introduces Bernstein's (2000) theory of knowledge structures, which provides the framework for the research, explains what this means for the knowledge structure found in introductory financial accounting, and details what the structure of knowledge in the discipline means for teaching and learning in this course.

Analysing the knowledge structure of introductory financial accounting and the implications this has for teaching in the course

In this research project, Bernstein's (2000) pedagogic device was used as a theoretical lens through which to view and better understand some of the pedagogical processes involved in the teaching and learning which need to take place during a first-semester financial accounting course. Maton's (2010) dimension of specialisation, which forms part of the Legitimation Code Theory which expands on Bernstein's (2000) concepts, is used to further illuminate these processes.

The paper will first consider both hierarchical and horizontal knowledge structures and then, given this background, will proceed to an analysis of the structure of knowledge in this introductory financial accounting course.

Bernstein's (2000) pedagogic device and the structure of knowledge

The pedagogic device is used to examine three different fields, or processes, which exist within all disciplines: production, recontextualisation, and reproduction. In these three fields, Bernstein (2000) examines how knowledge in a discipline is firstly *produced* and distributed; how this knowledge is then *recontextualised* through textbooks and the planning of curricula; and finally how this knowledge is *reproduced* through pedagogic practice. It is the field of production which is of particular relevance to understanding knowledge structures.

Bernstein (2000) refers to disciplinary knowledge structures as being either hierarchical or horizontal. A hierarchical knowledge structure consists of a "coherent, explicit and systematically principled structure" (Bernstein, 2000, p. 157), in which knowledge in the discipline is "theory-integrating" (Muller, 2007, p.72). A horizontal knowledge structure, on the other hand, consists of "specialised languages with specialised modes of interrogation" (Bernstein, 2000, p. 157) of the specific discipline, in which knowledge in the discipline is "theory-proliferating" (Muller, 2007, p.72).

Figure 1 illustrates how, in a discipline with a horizontal knowledge structure, as new areas are researched, a new "language" or theory is added to the discipline. This new language is not necessarily based on any previous knowledge or "language".

Figure 2 is an illustration of a hierarchical knowledge structure. The apex of the triangle is where the more abstract, overarching, concepts governing a discipline will be found, while the base of the triangle widens with the increasing knowledge that is incorporated into the discipline.

When the pedagogic device was first introduced by Bernstein (2000), disciplines were regarded as either having a hierarchical knowledge structure, commonly found in the sciences, or a horizontal knowledge structure, commonly found in the humanities. However, knowledge structures are not simply either horizontal or hierarchical, but will be found on a continuum somewhere between the two extremes. The degree of "integratedness" or "subsumability" of a theory can also be described as the degree of "verticality" of the discipline (Muller, 2006, p. 21).

$$L^1\ L^2\ L^3\ L^4\ L^5\ L^6\ L^7\ \ldots\ L^n$$

Figure 1. A horizontal knowledge structure.
Source: Bernstein (1999, p. 162).

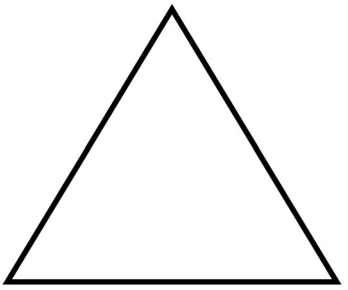

Figure 2. A hierarchical knowledge structure.
Source: Bernstein (1999, p. 162).

A high degree of verticality means that the knowledge structure of the discipline is more hierarchical than horizontal, while a low degree of verticality means that the knowledge structure of the discipline tends to be more horizontal than hierarchical. While it is important to note that knowledge structures in disciplines are not simply either hierarchical or horizontal, these are the terms which will be used predominantly in this paper as they are terms by which the knowledge structures of disciplines seem to have become more commonly understood.

Hierarchical knowledge structure

A "systematically principled structure" in disciplines with a hierarchical knowledge structure means that knowledge in the discipline takes the form of a chain. Each of the links in the chain is related to and builds on the previous link. These links or concepts are best studied in sequence and under the guidance of an expert with the necessary knowledge; a conceptual block at any point in the chain of understanding may mean that the student is unable to progress any further, as learning ceases (Hoadley & Muller, 2009).

This explains why, in a hierarchical knowledge structure, the teaching of introductory concepts is so critical for students and why there is little room to decide which concept is to be taught next. For students who struggle with a concept, or with part of a concept, being able to access advice from an "expert" is useful for helping them to reach the understanding which is so critical to allow them to move on to the next concept. The "expert" could be an academic mentor, a tutor, a friend, or a lecturer. The expert should simply understand and be able to explain the topic

In a "theory-integrating" discipline, students construct new knowledge by building on previous knowledge – the concept of "cumulative learning". It is critical that the foundational concepts are thoroughly understood by students before moving on to the next concept, as these foundational concepts will become the basis for future learning. The future learning, while building on the foundational concepts, is likely to be the next link in the conceptual chain and to become the basis for the following level of learning. In a hierarchical knowledge structure there may not be "large numbers of concepts" but they are all "hierarchically related" (Hoadley & Muller, 2009, p. 75). Existing knowledge is subsumed and extended in the process of developing new knowledge.

Horizontal knowledge structure

New knowledge in a horizontal knowledge structure – a discipline with a low degree of verticality – is likely to result in a new "language" or an additional area of interest being added

to the knowledge base of the discipline. Not understanding one "language" does not mean that any other language will not be understood, as "languages" do not necessarily build on each other (Bernstein, 1999). For example, having a clear understanding of the Anglo Boer War (Second Boer War) of 1899 to 1902 is not essential for understanding the Second World War of 1939 to 1945. In Bernstein's (1999) terms, these are different "languages". New knowledge in a horizontal knowledge structure results in a new theory or a new language to explain the phenomenon and there are not necessarily any links between one theory and the next.

Knowledge Codes and Knower Codes

In a hierarchical knowledge structure, knowledge in the field is what is important, and not the knowledge and experiences that the teacher or the student have had. Maton (2010) calls this a "knowledge code field". "Truth" in a knowledge code field is not generally contested and there is generally one correct answer and one way of reaching an answer (Maton, 2010). A horizontal knowledge structure, where the knowledge and experiences which the teacher or student have had are more valued, is termed a "knower code field" by Maton (2010). In a knower code field, "truth" can be contested and there is not necessarily one correct answer (Maton, 2010). In a knowledge code field with a high degree of verticality, the "truth" is not often contested, while in a knower code field, the "truth" can be contested.

For example, in a question dealing with straight-line depreciation, few teachers at first-year level would disagree that the depreciable amount would exclude any value-added tax figure and any residual amounts. The depreciable amount would be depreciated over the expected useful life of the asset. Given a particular scenario, it would be fair to assume that all Accounting 101 lecturers would expect exactly the same solution or "legitimate text" from their students, with these students using the same or very similar procedures of investigation.

To illustrate the "many truths" which may be found in a knower code, a matter which could feasibly be investigated within a couple of disciplines within the humanities could be as follows: "Discuss your experience of life in South Africa during the 1990s". This discussion would result in a wide range of very different answers depending on the experiences of each student and his or her family. These essays would depend on the experiences of the individual, while the assessment of the text would depend on the student's interpretation of the experience based on the particular theory which was being used. The "legitimate text" offered in response to this question would result in many, varied but all valid, "truths" being offered.

To summarise, in a hierarchical knowledge structure there is one truth and formative concepts are subsumed by any future knowledge: this is a knowledge code. At the extreme opposite is a horizontal knowledge structure where new knowledge can stand independently of existing knowledge, and truth can be contested: this is a knower code.

The paper will now detail the various processes which were followed when undertaking this research.

Research methodology

Data for this paper was drawn from a bigger research project which examined the structure of knowledge and students' construction of knowledge in introductory financial accounting.

The first stage of this research used Bernstein's (2000) pedagogic device and Maton's (2010) Legitimation Code Theory to analyse the structure of knowledge in this semester-

long course and to determine whether the course was more hierarchical or horizontal in nature. The second stage of the research involved understanding the implications that the structure of knowledge in introductory financial accounting has for the teaching and learning which takes place during the course. The third and final stage of this research involved interviewing students to better understand their experiences of teaching and learning during this course.

Interview data was collected from fifteen students who were purposefully selected from a group who had completed an online questionnaire. In this questionnaire students were asked questions about how they had dealt with various aspects of preparing for lectures and tutorials, completing assignments, and revising in the introductory financial accounting course. These students were also asked to indicate if they were interested in being interviewed on the topic.

Potential interview participants were divided into three main academic groups: less successful students (less than 50% in their final semester mark), moderately successful students (a 50–70% semester mark) and very successful students (a semester mark of over 70%). In choosing participants, an attempt was made to ensure diversity in terms of race and gender. Five participants were selected from each of these three academic groups, with care being taken to ensure that there was a relatively even representation amongst the additional groupings of male and female students and black and white students within each group of five participants.

Participants were interviewed using semi-structured interviews to allow for comparisons to be made between student responses. Questions ranged from how they first made sense of topics in the discipline, to enabling and constraining factors they experienced during the semester.

Given the nature of qualitative research, issues of validity, reliability and bias should also be acknowledged. Validity is determined by asking whether the research investigates what it intends to investigate (Hammersley, 1992). Given that the interview questions were structured around the research questions being asked, and that analysing the data obtained during the interviews allowed the research questions to be answered, the research should be valid.

Reliability on the other hand has to do with being able to replicate the results in a similar study (Golafshani, 2003). Given that this is social research, which is conducted in an open system and which cannot be completely controlled (Danermark et al., 2002), it is possible that another researcher may conduct similar research and obtain different results. It is for this reason that qualitative research will seldom make a claim of being applicable to all similar instances, but rather that this is what was revealed in this particular study, in this institution, in this year group, amongst this group of participants.

Having said that, the stumbling blocks which emerged from the interview data had already been identified in other research, as this is what the current research draws on. It is therefore fair to assume that other students, particularly those studying in disciplines with a hierarchical knowledge structure, will experience similar difficulties.

When conducting this research, the issue of bias was also addressed. The following types of bias were identified as possible threats to the validity or reliability of the research:

- Selection bias (Collier & Mahoney, 1996), where a certain type of student would be more prepared to take the time to complete the questionnaire and participate in an interview process. Given the large number of respondents and the purposeful selection from that pool, this should not be a threat to the reliability of this research.

- Response bias (Furnham, 1986), where a participant provides a response they believe the researcher wants to hear. As there were no correct or incorrect responses, this should not be a threat to the reliability of this research.
- Researcher bias (Bailar, Bailey, & Stevens, 1977), where the researcher may have formed preconceived ideas about the participants before interviewing them. This was something the researcher was aware of and was careful to avoid, and should therefore not be a threat to the reliability of this research.

The interview questions were semi-structured, which means that the same initial questions were asked of all participants. This allows for comparison between responses and would have reduced any potential impact that bias may have caused.

Having looked at the theory which guided the research and how the research was undertaken, the paper will now discuss what emerged from the research.

The structure of knowledge in an introductory accounting course

In determining whether this introductory accounting course has a horizontal or hierarchical knowledge structure, it was necessary to analyse whether the discipline was theory-integrating or theory-proliferating and to look at what "truth" and "knowledge" are in the discipline. This was analysed against a backdrop of the theory regarding hierarchical and horizontal knowledge structures which has been presented.

In the introductory financial accounting course, at the workshops which precede the formal teaching programme, students first learn that in every transaction "something gets" (an account is debited) and "something gives" (an account is credited). From understanding this abstract concept, students move on to the double entry system (the total of all debits should always equal the total of all credits in any transaction). Students then progress to understanding the accounting equation (assets = owner's equity + liabilities).

This is the conceptual chain which runs through all transactions in financial accounting, but which is being taught explicitly in this first-semester course. For the first month of this course, given that 40% of the class consists of novice accounting students, students are constantly reminded of these aspects, which are the basis of all financial accounting transactions. There is no other currently acceptable method of recording financial transactions. These form the basis of all financial accounting transactions.

More importantly for these first-year students, these basics are the foundation on which they make decisions about which element (and thereafter which account) needs to be debited and which needs to be credited. (There are five elements in accounting: assets, liabilities, owner's equity, income, and expenses.) Understanding which elements and accounts are to be used and whether they should be debited or credited forms the basis of all accounting transactions which occur. This forms the foundation of the conceptual chain; the knowledge which is subsumed and integrated in all further learning in financial accounting. Having a thorough understanding of debits and credits, and the accounting equation, is therefore essential for success not only in the first-semester course, but also for success in later years in this discipline.

Once the fundamentals of debits and credits have been explained and established, and having been provided with some of the academic discourse required for this course, the next step is to look at even more abstract concepts, found in the theory which is the foundation of the semester course.

In accounting, the abstract concepts found at the apex of the hierarchical knowledge structure triangle would consist of the Conceptual Framework of the International Financial Reporting Standards (IFRS), that is:

- Objectives of Financial Reporting;
- Qualitative Characteristics of useful Financial Information;
- Underlying Assumption;
- Elements of the Financial Statements and Recognition and Measurement of these Elements. (IFRS Foundation, 2012, A14)

As far as these concepts relate to this discussion, the one "truth" in accounting is based on the requirements of the fundamental qualitative characteristics of financial statements: the information should be relevant and should faithfully represent the facts provided. Perhaps more importantly, in terms of the enhancing qualitative characteristics, financial statements need to be comparable across years and from one organisation to another. For financial statements to be comparable and therefore useful to users, there cannot be significantly different interpretations of how these financial statements should be compiled and presented. There needs to be one "truth".

The balances found in all elements of the financial statements are based on the concept of debits and credits. Assets and expenses increase on the debit side and decrease on the credit side, while income, liabilities, and owner's equity increase on the credit side and decrease on the debit side.

During the normal lecture slots in this introductory course, students are first introduced to the conceptual framework, the abstract basis on which all financial accounting recording and measurement decisions are made. Thereafter adjustments are covered, where the students' understanding of debits and credits is tested and income and expenditure figures may need to be adjusted to correctly reflect the income and expenditure for the entity for the period under review, given the accrual basis of accounting.

The topic of inventory is covered next, again based on the foundational concepts of assets and expenses increasing on the debit side and liabilities and income increasing on the credit side, except in this instance going into greater detail regarding the different methods of recording and measuring of inventory. As inventory is returned, or damaged, these figures will again require the concept of "adjustments". This is where the hierarchical knowledge structure triangle widens, as new knowledge is introduced.

Finally bank reconciliations are covered, where again an understanding of the basics of debits and credits is required, but this time with a specific focus on adjusting the business's bank account in the general ledger, to agree with the statement received from the bank. The previously covered topic of "adjustments" forms the basis of bank reconciliations, as students record the relevant differences which exist between the bank account in the general ledger and the bank statement received from the banking institution, adjusting the bank account in the general ledger account where relevant.

In financial accounting, what students are working toward producing is the "truth" or "legitimate text" which should be very similar to, if not exactly the same as, the text provided by another student working through the same assignment. At this first-year level, a different experience and interpretation of the abstract concepts by a student is not likely to be of value.

From the above analysis it seems clear that Introductory Financial Accounting has a hierarchical knowledge structure. It has a "systematically principled structure", is "theory-integrating", and previous knowledge is subsumed in new knowledge. There is one "truth", which means that it is a knowledge code, where mastery over the procedures of investigation is valued.

In a discipline with a hierarchical knowledge structure, as is found in financial accounting, if students do not understand one concept or theory, they will be unlikely to progress

successfully through to the next concept until the initial concept has been thoroughly understood. This inability to progress becomes problematic for the student when trying to make sense of the topic. This is a problem commonly encountered by novice accounting students, as the basic (but abstract) principle of debits and credits needs to be understood at the beginning of the semester as it forms the basis for all future principles and discussions.

Having established that the introductory financial accounting course has a hierarchical knowledge structure and having gained an understanding of what a hierarchical knowledge structure means, the next step is to move on to understanding the implications this has for the learning which needs to take place in the discipline. This article explains what the research revealed about why disciplines with a hierarchical knowledge structure require students to have a specific focus when looking at a scenario and constructing the solution which is required.

Impact of knowledge structures on student learning in introductory financial accounting

The structure of knowledge in this discipline has implications for how students learn within the course. Having looked at hierarchical and horizontal knowledge structures and having shown that financial accounting at this introductory level has a hierarchical knowledge structure, it would be useful to highlight the implications this has for student learning in the discipline.

There is one "truth" in introductory accounting

Students are working towards being able to produce a solution that is acceptable and that meets the standards required by the discipline. This solution or "legitimate text" is any work which the student provides for assessment (Bernstein, 2000). In a hierarchical knowledge structure like that found in introductory financial accounting, this "legitimate text" is the "truth" (Bernstein, 1999) – the one correct solution which is required. There is little room for negotiating what is correct in the solution – there is one "truth" or "legitimate text".

A participant in this study demonstrated an awareness of the concept of there being one "truth" when he spoke about how "the debit side will always equal the credit side … no matter what".

To produce this one "truth", students need to obtain mastery over the "procedures of investigation"

In a discipline with a hierarchical knowledge structure, students will be able to produce this "legitimate text" when they have obtained mastery over the required procedures (Bernstein, 1999). In producing this "legitimate text" in a hierarchical knowledge structure, neither the experiences nor the characteristics nor the interpretation of the student are of much value; what is important is mastery of the "procedures of investigation" (Bernstein, 1999, p. 165), which leads to the "truth" or "legitimate text" which is required.

Those participants in the research who had passed the course exhibited greater metacognition and were very clear on the need for procedures and to obtain mastery over these procedures. A student explained how she made sense of these procedures: "what I did was that I write down almost a recipe for how to do the transaction so I know each step to follow". This participant went on to say: "once I've got [the recipe] and I understand that then I just practise to reinforce that". In saying this, the student is demonstrating how she develops mastery over the procedures of investigation.

Obtaining mastery over the "procedures of investigation" allows students to develop a "trained gaze"

To be able to solve an accounting problem, students need to acquire a specific way of looking at a problem. Bernstein (2000) termed this a "gaze". In a knowledge code field, knowledge of the theory and developing mastery over the "procedures of investigation" generate the gaze. Stated differently, the rules of the discipline (the theory and principles underpinning that topic) determine how students will analyse the information provided and how they will approach solving the problem. This gaze, or focus, in a knowledge code field is called a "trained gaze" (Maton, 2011).

A "trained gaze" is developed through "knowledge of and experiences in the specialised procedures" (Maton, 2011, p. 77). What this means is that a "trained gaze" is obtained by firstly understanding the theory and then working through problems and exercises until a student reaches a point of "expertise". It is through this knowledge of the theory, and having attempted various exercises until a level of expertise is obtained, or the "practise, practise, practise" that lecturers often talk about, that students develop a "trained gaze".

A trained gaze will allow a student to look at a scenario and determine which of the information provided is relevant to the question. It will also allow the student to put the relevant information together in the legitimate text, or format, required for assessment. Developing a trained gaze, which requires gaining mastery over the procedures of investigation, is critical for success in this discipline.

Another participant in the research seemed to understand the value of moving from theory to practice as she would "go through the theory first, then I go through the tuts".

Introductory financial accounting is a "knowledge code field"

In producing "legitimate text" in a hierarchical knowledge structure, neither the experiences nor the characteristics nor the interpretation of the student are of much value: what is important is mastery of the "procedures of investigation" (Bernstein, 1999, p. 165) which lead to the "truth". Educational and intellectual fields with these characteristics are known as "knowledge code" fields (Maton, 2011).

What this means is that in a knowledge code field like accounting, students should be able to read what is "required" in a question and the "trained gaze" which they would have developed would guide them in identifying which of the information in the given scenario is important. This trained gaze would also assist in how they should be constructing the "legitimate text" – the "truth" that is being sought.

The quotes used above were from participants who were successful in this first-semester course and they indicate that these students were aware of the need to understand the one way of determining the one correct solution or "truth" in a question, and the need to obtain mastery over the procedures to get to this "truth".

This research has highlighted the impact that a hierarchical knowledge structure has on learning in introductory financial accounting as students work towards constructing the solution or "legitimate text" required for assessment.

During this first-semester course, students may encounter additional pedagogical stumbling blocks. These potential stumbling blocks are discussed below.

Highlighting possible stumbling blocks

The structure of knowledge in this discipline is likely to result in particular pedagogic difficulties being experienced by students. Where possible, and relevant, students should have

these potential pitfalls pointed out to them so that they are aware of these problematic areas before they encounter them.

The following areas, in particular, became apparent during the research for this study and are discussed in more detail throughout this section:

- The acquisition of *recognition and realisation rules* is important for a student to develop mastery over the procedures of investigation and which in turn will generate the trained gaze necessary for success in a knowledge code field (Bernstein, 2000).
- Struggling with *threshold concepts* may cause a block in learning (Meyer & Land, 2003).
- Developing mastery over the procedures of investigation allows *low-road transfer* to start taking place. Without low-road transfer, constructing the legitimate text required is more cognitively demanding (Salomon & Perkins, 1989).
- *Cognitive overload* occurs when a student attempts to cope with a large amount of cognitively-demanding information, resulting in it being perceived by the student as overwhelming (Miller, 1956; Sweller, 1994).
- Given the concern voiced by so many students about lectures/lecturers proceeding too quickly, it is valuable to look at the *pace of lectures* being a stumbling block, and what students should be aware of in this regard (Hoadley & Muller, 2009).
- Lastly, some students engage with accounting, a knowledge code field, as if they were engaging with a knower code field, which results in a *code clash* (Freebody, Maton, & Martin, 2008).

Illuminating these potentially problematic areas provides students and teachers with a greater awareness of these difficulties, and provides an opportunity for these to be recognised and discussed. This is preferable to having students experience these as an alienating phenomenon which only they are struggling with. It also provides students with some guidance on what can at times be a stressful pedagogical journey.

Acquiring recognition and realisation rules

Acquiring "recognition rules" allows a student to identify when information is relevant in a task, while "realisation rules" are necessary to allow the student to put the answer into the "legitimate text" or correct format required for the successful completion of the task (Bernstein, 2000). Acquiring both recognition and realisation rules (being able to identify what is relevant in a question and being able to put this into the legitimate text required) is a necessary step for students who need to work towards developing mastery over the procedures of investigation and thus develop the trained gaze essential for success in the discipline.

From this research, one of the problems which students face when trying to gain mastery over the accounting procedures, is that they will often watch an "expert" complete an accounting task, be this during lectures or during a tutorial. As the expert goes through the task, students will observe and mentally confirm that they understand what the expert is doing and why. Students will then believe that they too understand how to construct the legitimate text required and that they are now able to complete the same task unaided. However, when these students try to complete the task without guidance, it may sometimes appear too complex and they are unable to produce the same results as the expert.

In this instance, where the student is able to identify which information is relevant for a given scenario, or possibly which accounts are involved in the transaction, the student has started acquiring *recognition rules*. If however the student is not able to put the relevant

information into the legitimate text required, the student has not yet acquired the *realisation rules* needed to construct the legitimate text or solution required. Acquiring recognition rules without realisation rules will not be sufficient for a student to pass this course.

It is only when trying to complete a task without the guidance of an expert that a student will know whether or not he or she has acquired both recognition and realisation rules. Students need to be able to work through and complete a task correctly and without guidance, to prove that they are competent in the task and that they have acquired both recognition and realisation rules necessary for constructing legitimate text.

In demonstrating that he had acquired recognition rules, a participant said, "usually I will look for the keywords in the question". Another shows how she had acquired recognition rules, but not realisation rules: "I understand, but then my problem was application … I would know, but then I wouldn't know that I have to credit this, I have to debit this, I should calculate it in this way, look at this". A participant showed his acquisition of both recognition and realisations rules in saying: "I will identify what [element or account] it is first, then do the calculations, make sure I have included everything that I can find about that and then I will answer the question".

Threshold concepts

When studying, students may be faced with a "threshold concept", where a student has a cognitive block in relation to a particular concept and needs to access "a new and previously inaccessible way of thinking about something" in order to understand the concept (Meyer & Land, 2003, p. 1). When the student develops this understanding, he or she will experience a "transformed internal view of [the] subject matter" and will find it hard to understand why other students struggle with the concept (Meyer & Land, 2003, p. 3).

This experience is often described by students as being a "light-bulb moment" or when "something just clicked". A participant in the research spoke about there being a "wall" and how it was different being on the other side of the wall, but for now she was "in there"; she had passed through the wall and obtained the understanding she needed. For a participant who spoke about being stuck on that threshold concept, it was a matter of "if I don't understand something I can't move on so I stay there until I understand it". Other participants spoke about needing to "break through that wall" and then "that light would just click [on]".

Teachers will attempt to illuminate threshold concepts to students through examples or through trying to explain the same concept in a different way. For some students this will be the catalyst for the light-bulb moment. For other students it is when going through the concept on their own again and again that eventually it makes sense, while for others still, it will be listening to peers explaining the concept in a completely different manner. Whatever it is that allows the student to shift from not understanding to understanding the concept only makes sense after serious cognitive engagement on the part of the student. Once grasped, it is difficult for the student to understand how it was ever possible to have not understood the concept.

It is for this reason that teachers sometimes find it very difficult to understand why students struggle with concepts. Teachers often had to deal with these threshold concepts such a long time ago that this understanding has now become automated for them, and thus it is difficult for them to understand why students struggle with a concept and how challenging it was to initially understand it.

In a discipline with a hierarchical knowledge structure, it is necessary for some tasks to become automated, and for these not to require significant cognitive effort from the student. This has to do with low-road transfer.

Low-road transfer

In low-road transfer there is "an automatic transfer of highly practised skills" (Salomon & Perkins, 1989, p. 118). This is also referred to by Sweller (1994) as "automatic processing". Having made sense of the abstract concept of debits and credits, which is such a foundational principle for accounting, and having spent many hours working on different examples, experts do not have to contemplate basic transactions. The use of debits and credits, and very often thinking about which accounts need to be debited and which accounts need to be credited, has become automated – low-road transfer is now taking place.

However, the process of deciding whether to debit or credit an account is initially very challenging for novice accounting students. These students need to consciously consider these abstract terms and how they need to use the figures provided in the question. The opposite of low-road transfer, i.e., high-road transfer, is where there are "consciously formed abstractions" (Salomon & Perkins, 1989, p. 118). Novice accounting students need to consciously contemplate which element is involved in the transaction, then contemplate whether the element is increasing or decreasing and how this influences whether the account should be debited or credited. This is cognitively demanding work, and those novice accounting students who participated in this research commented that watching peers who had taken accountancy at school for three years who did not need to contemplate the detail of a journal entry which was required in a transaction, while they struggled with the basics, made them feel "stupid".

"Low-road transfer" or "automatic processing" over "highly-practised skills" starts taking place as students develop mastery over the procedures of investigation. These students no longer have to consciously contemplate which elements are involved in basic transactions and whether an account needs to be debited or credited. From this research, it seems that if a novice student is particularly diligent and works consistently during the first term, by the beginning of the second term the student should be *starting* to access low-road transfer.

A participant in the research spoke about how he would work consistently, so that the work would "not be forgotten, because it is effortlessly repeated in my brain". Effortlessly repeating a concept means that the student is accessing low-road transfer and is able to use cognitive functioning for more demanding concepts. Another student showed he was accessing low-road transfer when he said: "most of the time you can do it in your head quite quickly instead of writing it out". This participant did not need to contemplate what needed to be debited or credited, as this thinking had become automated. Another participant also exhibited having accessed low-road transfer when she said: "if you have got some understanding you will be thinking fast and writing fast".

Closely linked to a threshold concept is the concept of cognitive overload, where too much information confronts a student, resulting in a mental "shutting down" on the part of the student.

Cognitive overload

During lectures, students may become overwhelmed with the many new concepts they are trying to understand and make sense of. If they are faced with too many of these concepts at once, this may result in a "cognitive overload" (Sweller, 1994). In terms of Miller's (1956) Law, people are able to remember seven (plus or minus two) one-dimensional pieces of information. Anything in excess of this and cognitive overload is likely to be the result.

When students reach a point of "cognitive overload", too much information is being presented to them. If they have not yet developed a "trained gaze" which helps to filter this

information into what is relevant and what is not relevant to the transaction at hand, and if they have not yet have obtained mastery over the procedures to the level required for "low-road transfer" to take place, they may experience an overload of seemingly unrelated information. In low-road transfer students are able to utilise the information required using less "working memory", therefore freeing up this capacity for other functions (Sweller, 1994, p. 299).

A participant in the research spoke about how if the lecture became too complicated "an initial response was to kind of just shut yourself off, and say oh, I don't know what's going on". Another spoke about how she experienced cognitive overload: "I was confused. I would go into the lecture knowing something and thinking that I understand it and halfway through the lecture I am blank and stressed". Both of these students were novice accounting students, and both continued attending lectures as there would be something to "grab" that would stay with the student "forever" which made these stressful experiences valuable. Another participant, who had taken accounting at school, spoke about lectures being "too condensed because we learn a lot in lectures". This is another example of there being too many concepts and students struggling with cognitive overload.

As some processes start becoming automated, these would not need to be consciously contemplated and cognitive functioning would be freed up to allow other intellectually demanding information to be processed.

Linked to both low-road transfer and cognitive overload is students' perceptions of the speed at which lectures progress.

Pace of lectures

Students, particularly those who are new to accounting, will often comment that the lectures are too fast and that they cannot keep up. Participants in this research spoke about the pace of lectures being, "very fast", "extremely fast", "a bit quick, because … there is a lot … to learn". Participants also spoke about being "stressed" and "bewildered" as a result of the pace of lectures.

From this research it emerged that when students felt that the lectures were moving too quickly, this was because they were struggling to understand the concepts, while the pace of lectures felt far more reasonable when the concepts were understood. As explained by a participant, "with new concepts I often find it a bit fast, then obviously when I understand it, it seems like we are going at a normal pace, it's just when it's all new it seems very fast". The pace of the lecture may appear too fast as students have not yet acquired low-road transfer over the basic transactions and are still needing to consciously contemplate these aspects of a question.

While it is essential to ensure that lectures are at a pace that is accessible to most students, it is important for students to know that the reason why the lecture sometimes feels fast and that they do not understand a concept is that they have not acquired mastery over the procedures, which means that they have not yet been able to access low-road transfer. Students need to invest the time required to allow this understanding to develop and to develop this mastery over and automation of basic tasks.

This means that when a student feels that lectures are progressing too quickly, in addition to conveying this to the lecturer, students also need to put in additional time to develop not only the theoretical understanding but also to develop mastery over the procedures of investigation that are required for the topic.

The final problem which this research revealed deals more with a lack of congruence between the time, energy and type of learning a student invests in a discipline, and what

the student needs to invest to successfully construct knowledge in a discipline. This has to do with there being a "code clash".

Code clash

It has already been mentioned that accounting is a knowledge code field. Acquiring knowledge of the discipline and developing mastery over the procedures of investigation are both important for generating the trained gaze necessary for success in the discipline.

When a student's approach to learning is so much at odds with the type of learning that is required in a discipline, this is termed a "code clash" (Freebody et al., 2008, p. 194). Lucas and Mladenovic (2004) refer to this as a clash "where a student shows a non-congruent, or problematic, form of learning engagement" (p. 404).

From this research, some students appear to approach the discipline feeling that their experiences, or a different method of dealing with an accounting problem, should have value and they would like to have these taken into consideration in the assessment process. They may believe that they have a new and innovative way of looking at accounting and that this should be valued. One participant expressed how he felt that there should be space for him to produce work in the manner he believed it should be done, that he did not like the "textbook approach of doing things". Another spoke about how he "was more into words and essays and stuff". A participant explained how in order to revise for a test, she would just read through the textbook and try to understand, that she did not "get into the practical side".

These students did not understand the importance of becoming skilled in the procedures of investigation, in finding the "one truth", but thought it was sufficient to simply read through a textbook and that this would provide the learning and understanding which they required. None of these students passed the semester as there was a clash between what they were prepared to invest in the course and what the course required of them. These students seemed to have more of a knower code approach to learning.

For students to be successful in accounting they need to recognise, and be competent at, what is valued as "knowledge" in the discipline.

Being aware of these potential problems will allow both student and teacher to recognise when these problems occur, to understand why they are occurring, and to be aware of what needs to happen to resolve them.

Conclusion

The structure of knowledge in a given discipline has an impact on how teachers teach and how students learn within the discipline. Having an understanding of the structure of knowledge, particularly in a discipline with a hierarchical knowledge structure, is a valuable guide to knowing why teaching and learning activities should be planned in a certain sequence.

Financial accounting is a hierarchical knowledge structure with a high degree of verticality. To succeed in a discipline with a high degree of verticality requires a student to acquire recognition and realisation rules and to develop mastery over the "procedures of investigation"; this will allow a "trained gaze" to be generated. This trained gaze develops and expands as the student progresses through the course and becomes skilled in the various procedures.

On this journey of understanding in a discipline where cumulative learning forms the basis of successful student learning, there are various potential problems that students could experience.

These include the struggle to acquire both recognition rules and realisation rules; the inability to make a breakthrough with threshold concepts; not understanding the importance of practising an example until low-road transfer can be accessed; struggling with cognitive overload; feeling that the pace of the lecture is too fast when insufficient time has been invested in practising and understanding the topic; and not engaging with the discipline in the manner required, causing a code clash.

This article is of value to teachers in disciplines with a hierarchical knowledge structure, in particular those who teach introductory courses, in better understanding the reasons behind the teaching and learning activities planned in their course. Teachers will also benefit from understanding some of the obstacles students face when trying to construct knowledge in these disciplines. An improved understanding of the pedagogical purpose behind these activities and in being aware of potential problems, will aid teachers in assisting their students in being successful in their discipline. This article will also provide teachers with a common language to discuss the phenomena which they observe in the classroom.

Acknowledgements

Thank you to Professor Lilla Stack, Professor Lynn Quinn, and Dr Jo-Anne Vorster, who provided guidance and feedback on earlier versions of this paper. A heartfelt thank you to my mother, Rowena Essex-Clark, who is my greatest fan and who read through this paper innumerable times.

Disclosure statement

No potential conflict of interest was reported by the author.

Note

1. An earlier draft of this article was presented at the SAAA teaching and learning mini-conference held in Cape Town in Deecmber 2014.

ORCID

L. Peta Myers http://orcid.org/0000-0002-6676-5239

References

Bailar, B., Bailey, L., & Stevens, J. (1977). Measures of Interviewer Bias and Variance. *JMR, Journal of Marketing Research*, *14*(3), 337–343. http://dx.doi.org/10.2307/3150772

Bernstein, B. (1999). Vertical and horizontal discourse: An essay. *British Journal of Sociology of Education*, *20*, 157–173. http://dx.doi.org/10.1080/01425699995380

Bernstein, B. (2000). *Pedagogy, symbolic control, and identity: Theory, research, critique* (Rev. ed.). Lanham, MD: Rowman & Littlefield.

Collier, D., & Mahoney, J. (1996). Insights and Pitfalls: Selection Bias in Qualitative Research. *World Politics*, *49*(1), 56–91. http://dx.doi.org/10.1353/wp.1996.0023

Danermark, B., Ekstrom, M., Jakobsen, L., & Karlsson, J. C. (2002). *Explaining society: critical realism in the social sciences*. New York: Routledge.

Freebody, M., Maton, K., & Martin, J. R. (2008). Talk, text, and knowledge in cumulative, integrated learning: A response to "intellectual challenge". *Australian Journal of Language and Literacy*, *31*, 188–201.

Furnham, A. (1986). Response bias, social desirability and dissimulation. *Personality and Individual Differences*, *7*(3), 385–400. http://dx.doi.org/10.1016/0191-8869(86)90014-0

Golafshani, N. (2003). Understanding Reliability and Validity in Qualitative Reserach. *Qualitative Report*, *8*(4), 597–607.

Hammersley, M. (1992). *What's Wrong With Ethnography?: Methodological Explorations*. New York: Routledge.

Hoadley, U., & Muller, J. (2009). Codes, pedagogy and knowledge: Advances in Bernsteinian sociology of education. In M. W. Apple, S. J. Ball, & L. Armando Gandin (Eds.), *The Routledge international handbook of the sociology of education* (pp. 69–78). New York: Routledge.

IFRS Foundation. (2012). *A guide through International Financial Reporting Standards - Part A*. London: IFRS Foundation.

Lucas, U., & Mladenovic, R. (2004). Approaches to learning in accounting education. *Accounting Education*, *13*, 399–407. http://dx.doi.org/10.1080/0963928042000306783

Maton, K. (2010). Canons and progress in the arts and humanities: Knowers and gazes. In K. Maton & R. Moore (Eds.), *Social realism, knowledge and the society of education: Coalitions of the mind* (pp. 154–178). London: Continuum.

Maton, K. (2011). Theories and things: The semantics of disciplinarity. In F. Christie & K. Maton (Eds.), *Disciplinarity: Functional linguistics and sociological perspectives* (pp. 62–84). London: Continuum.

Meyer, J. H. F., & Land, R. (2003). Threshold concepts and troublesome knowledge: Linkages to ways of thinking and practising within the disciplines. In C. Rust (Ed.), *Improving student learning: Theory and Practice Ten Years On*. Oxford: OCSLD.

Meyer, J. H. F., & Land, R. (2006). *Overcoming barriers to student understanding: Threshold concepts and troublesome knowledge* (pp. 1–12). Oxford: Taylor & Francis.

Miller, G. A. (1956). The magical number seven, plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, *63*, 81–97. http://dx.doi.org/10.1037/h0043158

Muller, J. (2006). On the shoulders of giants: Verticality of knowledge and the school curriculum. In R. Moore, M. Arnot, J. Beck, & H. Daniels (Eds.), *Knowledge, power and educational reform: Applying the sociology of Basil Bernstein* (pp. 11–27). Abingdon: Taylor & Francis.

Muller, J. (2007). On splitting hairs: Hierarchy, knowledge and the school curriculum. In F. Christie & J. R. Martin (Eds.), *Language, knowledge and pedagogy: Functional linguistic and sociological perspectives* (pp. 65–86). London: Continuum.

Salomon, G., & Perkins, D. N. (1989). Rocky roads to transfer: Rethinking mechanism of a neglected phenomenon. *Educational Psychologist*, *24*, 113–142. http://dx.doi.org/10.1207/s15326985ep2402_1

Sweller, J. (1994). Cognitive load theory, learning difficulty, and instructional design. *Learning and Instruction*, *4*, 295–312. http://dx.doi.org/10.1016/0959-4752(94)90003-5

Young, S. F. (2008). Theoretical frameworks and models of learning: Tools for developing conceptions of teaching and learning. *International Journal for Academic Development*, *13*, 41–49. http://dx.doi.org/10.1080/13601440701860243