

**FACTORS AFFECTING CONSTRUCTION OF NOTES BY
STUDENTS IN A FIRST YEAR BIOLOGY CLASS**

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DECLARATION

I declare that this thesis is my own, unaided work. It has not been submitted before for any degree or examination in any other University, nor has it been prepared under the aegis or with the assistance of any other body or organisation or person outside the University of the Witwatersrand, Johannesburg.



Shalini Dukhan, 14 October 2014

ABSTRACT

Research investigations indicate that note-taking and note-making are related to academic performance. This study investigated four factors, in a first-year biology course at a South African University, that influence student note-making practices, and determined whether the quality of notes is related to their approach to learning and their academic performance. The factors that were assessed included: the impact of social and cultural capital of first and second generation students on their expectations of the University academic environment; the students' experience with their construction of notes at school; the level of detail on slides provided by lecturers, the access that students had to slides on the intranet, and the influence of English as a first or second language. The study commenced at the beginning of semester two 2009 and ended after semester one 2011. Student questionnaires, interviews of students and lecturers, assessment of notes made, and test and examination results were interrogated and sample lectures were video-recorded. The study identified that the students' high school experience in constructing notes provided the platform for these practices when they entered University. Second-generation students had a more accurate expectation of their ownership for their notes and learning in first year, and of the grades that they received compared to the expectations held by first generation students. Additionally data analysis lead to the inference that self-regulated students, who personalised their notes, performed better than the underprepared students, who learnt solely from the lecturers' slides; but this statement is not a blanket generalisation. Two lecturers from each semester were interviewed before they commenced lecturing, and one each of their lectures was video-recorded for analysis with student notes. Findings indicated that the amount of detail that lecturers provided on presentation slides stemmed from their conception of the students' role in learning. When skeletal lecture slides (i.e. slides containing only keywords or key points) were presented then students perceived that they needed to take ownership in constructing their notes, whereas when slides appeared to be detailed they saw them as a 'complete' set of notes, and reported being less attentive in class. In both cases students hardly noted any information other than that presented on the slides. Students had access to slides on the intranet in the first semester of each year, but not in the second semester. Although students reported that they were more attentive in class when they did not have access to slides on the intranet, there was only a slight difference in the students' grades between semesters. In the first study cohort (i.e. 2009), first-language students performed better than second-language students, but performance evened out when an intervention, which used writing as a means to promote critical thinking, was provided in 2010 and 2011. The findings presented in this study would be useful to lecturers who wish to understand how students' use and reconstruct their class notes during the process of learning. The findings could also be of benefit to student support programmes that seek a practical tool (the writing intervention) to deepen the students' approach to their learning.

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CHAPTER 1:

INTRODUCTION

1.1 Background

The grades which students achieve when they enter University have been a well-entrenched concern over many decades; this is clear from the multitude of studies on first-year academic performance, and include investigations by Crawford (1925), MacDonald (2000), McKenzie & Schweitzer (2001), Rees & Wilkinson (2008) and Stewart, Lam, Betson, Wong and Wong (1999). Research studies show that one well-established factor closely related to student learning and academic performance is the students' ability to construct their own notes (Carrier, 1983; Ganske, 1981; Howe, 1970; Johnson, 1924; Laidlaw, Skok & McLaughlin, 1993; Makany, Kemp & Dror, 2009; Narjaikaew, Emarat & Cowie, 2009; Palmatier, 1971; Pauk, 1978; Schultz & Di Vesta, 1972; Titsworth, 2001; Weener, 1974). Students usually use notes to study for assessments, and many research findings (e.g. studies by Baker & Lombardi, 1985; Crawford, 1925; DiVesta & Gray, 1972; Kiewra, 1984a; Titsworth & Kiewra, 2004) show that the quality and/or quantity of notes that pupils make is related to the marks that they achieve.

First years do not enter University as blank slates. They are likely to have expectations of their role in taking and making their notes; established expectations of the level of assistance their instructors will provide in constructing a good set of notes; and are likely to have reached some level of skill in note-taking and note-making prior to their entry into first year.

1.1.1 The importance of making a good set of notes

Regardless of the different situations in which notes are made, the common underlying factor is that notes are usually made to be read (Kneale, 1998). Thus, notes act as a reminder of content that was previously encountered.

The construction of a good set of notes is particularly important in an academic situation because students usually regard this material as the primary source of information for their tests and examinations. It is therefore necessary for students to construct a good set of notes that is clear and has structure. Key points and sufficient supportive detail should be provided so that the notes are understandable to anyone who reads them for the first time (Williams & Eggert, 2002).

In order to make a good set of notes at University, students are required to listen, cognitively process, and capture material during the lectures ('note-taking'). They also need to read and supplement their class notes ('note-making'), so that they are able to mould these notes according to their comprehension. During the note-making process students deepen their understanding by adding information to their notes from other resources. Thus, there are two stages in the construction of a good set of notes, viz. note-taking followed by note-making (Kiewra, 2002; Van Meter, Yoko & Pressley, 1994; Williams & Eggert, 2002).

While the literature has clearly shown the relationship of the students' construction of notes to academic performance, the present study looks at the factors that influence the students' note-taking and note-making practice in their first year of study at University. Namely, the level of social and cultural capital that the first or second generation students have; the students' background experiences in note-taking and note-making at school; the influence of English as a first or second language; their expectation of their ownership in constructing their own notes at University; and their expectation of their lecturers' role in providing them with written material. Each of these factors will be discussed below.

1.1.2 The influence of social and cultural capital on first and second-generation students' anticipated and actual assessment marks in first-year biology

Social capital, described in section 1.3.1, refers to the knowledge that people have access to as a result of the community with which they associate. In this study, social capital implies that first generation students i.e. those who have no sibling experience of University, might not have access to the different learning approaches that first-generation students who do have siblings with University experience, and second generation students, have. In this study therefore social capital refers to the relationship that exists between the student and a) sibling/s and/or b) parent/s who attended University, and what that relationship may mean for the student in terms of learning practices.

Cultural capital, also described in section 1.3.1, is defined as the skill, nature and expertise available as a resource from the larger community to which the student belongs. In this research study, cultural capital refers to the experience that students gain from their community regarding the academic rigour of the University academic environment. Cultural capital is therefore based on parental-expertise, family status and association with other members in the community, and/or experience of the University system. Institutional cultural capital is also accounted for in this definition (Slonimsky & Shalem, 2006).

Since the abolishment of Apartheid more students from former-black disadvantaged schools have the opportunity to attend University: these first years are often ‘first-generation’ students. The families of these students lack experience and knowledge of the demands and challenges that exist within the University academic and social environment. This lack of experience could impact on the students’ preparedness for university, and thus could influence the learning approaches and grades students achieve. This lack of experience is taken into consideration as an additional framework in considering the link between notes and academic performance. The influence of social and cultural capital on the grades that first and second generation students expected to achieve, compared to the grades that they actually achieved in their first-year, is presented in Chapter 2. In the consideration of the impact of social capital, a further distinction was made: i.e. between first-generation students with, and those without, sibling experience of University. The purpose was to investigate the nuances of influence of access to social and cultural capital, as this was likely to determine the level of support they would have had in their transition into first year. This was deemed especially important in the South African context of this study because of the number of first-generation students who have recently gained access into University.

1.1.3 The influence of school experience in subsequent note-taking and note-making practice

Students enter University with differing levels of experience and skills in constructing their own notes. The students’ prior experience of taking and making notes at school is likely to dictate their expectations, sense of responsibility, and proficiency in accomplishing these tasks in their first year of undergraduate study. Their school experience provides the platform or pool of resources that they draw from when they have to construct notes independently in first year. However, there is usually a stark contrast in the level of responsibility required for construction of notes at school compared with University. At school it is mainly the teachers who are responsible for providing learners with the material which they are expected to learn (MacDonald, 2000). At University students have to take on the responsibility of constructing their own notes - according to their understanding and within the context of the material provided during the lecture (Bharuthram, 2012; Isaacs, 1994; MacDonald, 2000). The latter situation is often new territory that must be navigated, and lack of knowledge on how to do this may prove problematic. The Council for Higher Education (CHE) in South Africa acknowledges that the students’ schooling experience

influences their epistemological access (Slonimsky & Shalem, 2006) and thus their chances of success at University, and that current schooling does not prepare students adequately for success in tertiary education (CHE report, 2007, 2013). South Africa's history of Apartheid makes this issue an even more pressing one.

Apartheid policies created the development of two types of schools i.e. 'disadvantaged' schools associated with the Bantu education system – and meant for 'blacks', and 'advantaged' schools for whites. The main distinction between the different types of schools was varied access to resources. When Apartheid was abolished in 1994 the government set out to decrease the differential in the type of education and the resources that schools received. However, the reality of the situation is that, mainly due to socio-economic reasons, the majority of black learners still attend public, state-funded schools which are still severely under-resourced (Bharuthram, 2012; CHE report, 2013; Parkinson, 2000). The availability of funding is closely linked to the learning experience because it impacts on the ability to employ qualified teachers; access to proper classrooms; books; and technology (Baloro, 2000; Christie & Collins, 1982; Fiske & Ladd, 2004; Kaburise, 2000; Setati, 2002). At the former 'black' disadvantaged schools the limited access to resources usually leads to 'talk and chalk' teaching. Learners at well-resourced schools are more likely to have the additional experience of using technology such as computers and the internet and of being taught with the use of visual tools like PowerPoint slides: these learning aids are meant to assist learners to access difficult concepts. This means that learners who have had the opportunity to interact with a range of resources at school have a better understanding, and more practical experience, of how these resources can be used to extend their class notes, with the aim of deepening their comprehension of concepts. In contrast, it can be assumed that learners who had access only to material provided by the teachers during the lessons will not have developed the same range of skills and/or understand the value of a personalised set of notes.

The CHE (2013) reported that, as a result of the lack of access to resources at the former 'black' disadvantaged schools, learners from these schools typically focus on verbatim reproduction of content, and place more emphasis on the learning of examples rather than learning principles and the connections between them. It thus becomes evident that the school experience at highly resourced schools should enable learners attending these schools to have had a learning experience that is a closer reflection of the University academic environment (CHE report, 2013). Therefore, it could be expected that the independent and

self-regulated role that students are expected to take on at University, and the ownership and responsibility that they need to develop for their learning and academic success may be easier to access for learners from an advantaged school background, but may be a new experience for those with a disadvantaged school experience.

1.1.4 The influence of the medium of instruction on first and second-language English students' learning and academic performance

A factor that complicates the South African educational landscape is that, during the Apartheid era, language was used as a vehicle to create and uphold racial segregation (Bharuthram, 2012; Fiske & Ladd, 2004). Historically, unlike at the advantaged schools, learners at the former 'black' disadvantaged schools were taught only a basic level of English (Fiske & Ladd, 2004). Although the medium of instruction is meant to be English from Grade 5 onwards (Bharuthram, 2012; Parkinson, 2000; Rollnick, 2000) there are still former-black schools where teaching is mostly in the home language up to school-leaving level (Rollnick, 2000). Considering that the medium of instruction at most South African universities is English, this places second-language students, who have had minimal exposure to English, at a higher risk of failure. These students are likely to find meaning-making during the lectures more challenging than do first-language English students. This subsequently means that they may also experience difficulty in constructing in-depth sets of notes during classes. Therefore, instead of focusing on developing a depth of comprehension and filling in knowledge gaps in their class notes they might be focusing on the development of foundation concepts. Hence, since these students are generally more likely to lack content knowledge they also experience more problems with interpreting and answering assessment questions satisfactorily.

Some studies (e.g. Rollnick, 2000) have shown that teachers alternate between their home language and English (i.e. code-switching) at some schools. Teachers do this so that they can make complex concepts more understandable to learners. The learning context at University is thus different from the experiences at school. In this regard, second-language students in first-year biology have to decode English and biology vocabulary independently in order to make meaning of the content that they are taught. Therefore, during note-taking these students could be focused more on noting new definitions than on understanding concepts and capturing the main ideas and supportive detail provided during the lecture. Subsequently, the note-making process may be less productive for second-language students

compared to first-language students, because this is likely to be the first time they would be expected to make meaning of the content that is taught during lectures.

Thus, language can be viewed as an important factor which dictates the amount of attention students can place on noting content, and on the level of meaning that they are able to extract during lectures. In the classroom, students who focus mainly on capturing material may not have sufficient time to form connections between new knowledge and their prior understanding of content. This results in a lowered capacity on the generative-learning ability during the note-making stage.

1.1.5 The relevance of the processes of note-taking and note-making to learning

‘Generative learning’ refers to the formation of connections between the new information that students receive and their prior understanding of related content (Peper & Mayer, 1978, 1986). When students learn to revoice their thoughts through their writing, this process can help them to identify the gaps in their understanding (Tierney, Soter, O’Flahavan, & McGinley, 1989). Therefore a personalised set of notes may be indicative of generative learning. Making good, personalised notes (note-making) usually requires paraphrasing and organisation of knowledge according to what was known and understood previously (Davis & Hult, 1997; Peper & Mayer, 1978). Thus, during note-making, the writing process can influence the generative learning process.

Note-taking depends largely on the capacity of the working memory. Working memory is used to store and comprehend information (Cohn, Cohn & Bradley, 1995; Makany et al., 2009). During lectures effective note-takers store and manipulate information while listening to and processing this content (Kiewra & Benton, 1988; Makany et al., 2009). Much experience and practice is required before students are able to both take down and process content at this level during class. The level of appropriate background knowledge influences the quality of students’ notes as well.

The balance between working memory and generative learning influences the quality of notes and the level of comprehension that occurs in the classroom. Researchers such as Kiewra, DuBois, Christian, McShane, Meyerhoffer and Roskelley (1991), Makany et al. (2009), Pauk (1979) and Stefanou, Hoffman and Vielee (2008) argue that since the demand on working memory is high during lectures, little generative learning occurs. This is because students would have to expend more effort in listening and capturing content during the lectures than

on thinking about and personalising the information that is noted (Morgan, Lilley & Boreham, 1988). Therefore, more generative learning occurs during the subsequent process of note-making which generally takes place after lectures than during note-taking (Pauk, 1979; Peper & Mayer, 1978; Van Meter et al., 1994).

1.1.6 The students as the central figure in charge of their learning

Although the influence of the schooling environment has been shown to play a large role in shaping the students' approach to learning in studies such as that by MacDonald (2000), the regulatory ability of these individuals is seen as central to their academic success. Moreover, when learners move from school into University they are expected to become self-directed and independent in their learning approach (Krause & Coates, 2008). According to Marton and Säljö (1976) and Entwistle and Entwistle (1991), the major distinction in the approach to learning is based on whether there is memorisation or transformation of knowledge. While a surface learning approach (Marton & Säljö, 1976) refers to learning with the motive of memorising facts in anticipation of their use at a later stage, deep learning occurs when students instead try to make sense of what is learnt. Students who engage in deep learning usually make a conscious effort to understand and make connections between new and prior knowledge (Marton & Säljö, 1976; Rust, 2002; Wilding & Hayes, 1992). A signifier that learning has occurred is when there is a move from a state of confusion to one of insight; i.e. when the meaning of a topic or concept becomes clear (Entwistle & Entwistle, 1991). In order to attain a level of understanding, students need to actively engage with lecture material, and need to see how this fits into their prior understanding of related content. When they lack a framework relating to new content they are likely to find difficulty in understanding concepts. In this situation, however, they develop a framework for their understanding as they make sense of the new information (Entwistle & Entwistle, 1991). Therefore, as Entwistle and Entwistle note, the type of learning strategy that students use determines their level of academic success.

There are some students who take ownership for their own learning, in other words who self-regulate their learning, whereas there are other students who believe that the teachers are responsible for their learning. The students' cognitive development, and their choice of learning approach, is influenced by their ability to self-regulate (Zimmerman & Schunk, 2001) their learning. Self-regulated students are more likely to take charge of constructing and personalising their notes because they see themselves as being responsible for their

learning. These individuals are more likely to attempt to find in-depth meaning of the particular content during the note-making stage. This is because during the stage of note-making (as opposed to note-taking) they have sufficient opportunity to engage in generative learning. Underprepared or less-self regulated students usually have the impression that learning is the responsibility of the teachers and that the majority of their learning occurs within the classroom (Zimmerman & Schunk, 2001). Therefore underprepared students might consider that the lecturers' slides or handouts contain all the content that they are required to 'know'. In this study it is proposed that to the self-regulated student, note-making is a vehicle used in the 'process' of learning, while for the underprepared student, notes taken in class, or slides posted on the learning management system (i.e. on the University intranet), are the 'product' that needs to be learnt. Therefore, since self-regulated students are more likely to use strategies that are more closely aligned to the University's expectation of the independent and self-directed role of undergraduates, they have a better chance of being successful academically (Fraser & Killen, 2005).

While many students apply self-regulated learning strategies which include behaviours that are aimed at acquiring particular skills or knowledge, self-regulated students are (a) more conscious of the relationship between their learning processes and learning outcomes, and (b) use their learning process to achieve their academic goals (Zimmerman & Schunk, 2001). In this study self-regulation theory (Zimmerman & Schunk, 2001) is used as the conceptual framework because the way in which students capture material, revise and expand on their class notes depends on their level of self-regulation. This practice in note-taking and note-making determines the depth of their learning and their subsequent academic performance.

1.1.7 The influence of the lecturer's practice on students' expectations and practice in constructing notes

As much as this study views students as being central to their learning, it should be acknowledged that there is a dynamic interaction existing between the lecturers and the students. This interaction is likely to influence the students' level of active engagement, and consequently the quantity and quality of notes that they make; the quality of their learning; and their subsequent academic performance. Therefore, even though it is important for students to understand the importance of self-regulation and independent learning within the University academic environment, it is equally important that lecturers provide students with

clear and explicit goals, and make obvious their expectations of student achievements (Fraser & Killen, 2005).

Lecturers generally expect students to become critical thinkers, who are independent and self-regulated (Brinkworth, McCann, Matthews & Nordstrom, 2009), which implies that lecturers assume that students have thought about their role within the academic environment at University. Nevertheless, a study has shown that first-year students are not usually aware of the lecturers' expectations of them, and in light of this might attribute their poor performance to the lecturers (Fraser & Killen, 2005).

The factors that students have identified as lecturer-related factors that influence their note-taking style include: lecturer style; pace; organisation of lecture content; provision of topic outlines or overviews prior to the lecture; well-structured and easy-to-follow hand-outs (Van Meter et al., 1994). Additionally, several studies, such as ones by Kiewra (1989), Kiewra, DuBois, Christensen, Kim & Lindberg, (1989) and Castelló and Monereo (2005), have shown that students can be **taught** to construct good quality notes. However it seems that the relationship between note-taking and note-making and learning is not always understood by lecturing staff (Palmatier & Bennett, 1974). University lecturers seem to assume that students either have the necessary skill to construct a good set of notes, and know what the processes of note-taking and note-making entail, or that they learn this skill by means of trial and error (MacDonald, 2000; Van der Meer, 2012). Therefore, as much as lectures may use signposts to highlight important concepts or main points, if students do not recognise or understand these cues then the construction of notes would symbolise a mere recording of facts without necessarily actively processing the meaning or significance of the content (Van der Meer, 2012). This makes it important to determine the extent to which the lecturers' practice influences the students' note-taking and note-making expectations and practice. And subsequently whether there is thus any relationship between lecturer practice and academic performance of first years. This is therefore another factor investigated in this study.

1.1.8 The context of my study

This study is primarily aimed at determining what factors influence note-taking and note-making in the context of first year in a University biology class. It is aimed at the level of the individual and at the macro level, and sets out to determine which of the factors influencing the process of the construction of notes is connected to student academic performance. When students enter University, they have to contend with various factors that influence their

learning and academic performance at the macro level. For example, they usually are required to become acquainted with a magnitude of unfamiliar media and apparatus within a short space of time. There are additional learning stresses that students need to become familiar with when they enter University. They are required to skim and scan textbooks and other sources of information, such as the internet, to supplement the information provided by the lecturer. Nevertheless, while this is usually new to students, they are provided with little guidance.

Factors at the individual level that influence student performance include prior knowledge relevant to the course they study at University (Yilmaz, 2008); their language ability (Storch, 2009), particularly with reference to home language versus the language of instruction (Dunkel, 1988). Compounding the latter factor, the language of science is different from the language of everyday life with its own distinctive vocabulary (Duran, Dugan & Weffer, 1988), and many words have different meanings when used in science, for example the word 'cell'. Notwithstanding these factors, at University there are greater demands on generative abilities such as the ability to listen and compile notes at the same time (Carrier, 1983; Stefanou et al., 2008) particularly because it is the norm in the Introductory Life Sciences course at the South African University where this study was conducted, and only few handouts are provided by the lecturers.

1.2 Focus and Significance Of This Study

This study contributes to literature which highlights that the students' construction of their notes enhances their active engagement and deepens their critical thinking. The intention was that the results from this study would provide a pro-active and practical approach that lecturers could use to show students what self-regulatory and self-directed practices entail.

1.2.1 The problem statement

First-year lecturers in the Introductory Life Sciences course at a South African University were concerned that students seemed to be actively involved and engaged during lectures only when noting information presented on slides. In contrast, when lecturers were providing explanations and elaborating on the details of work being covered, students sat listening passively despite this material being crucial to their conceptual understanding. It was felt that the lecturers' concerns might have reflected a general concern about the academic preparedness of students entering their first year at University.

In South Africa, as part of the drive for transformation and equity in education, universities are accepting students from a wider range of backgrounds and socio-economic groups than before. This means that a greater number of students have access to University than in the past, which has resulted in an extremely high undergraduate intake (MacDonald, 2000). However, in South Africa, only one in four students completes their higher qualification in the regulated time (e.g. 3- and 4- year degrees), while 55% of the students who enter University drop out during their undergraduate years (CHE report, 2013). This is a waste of finances and resources. For students, this is also a disempowering experience. Furthermore, considering the skills shortage in South Africa, the attrition rate, and in particular the underperformance of students in first year, is particularly concerning.

As a result of the different types of schools in South Africa, students enter University with a range of learning experiences. While the school environment of some learners enables the development of more self-regulated approaches to learning, other individuals are exposed to the teachers taking on the responsibility for the students' learning. Therefore, whereas some students have been directly involved in constructing their notes according to their understanding, others have notes provided by the teachers which they then rote-learn. The students' experience at school might influence their expectation and approach in their first-year environment at University. This study sets out to investigate the factors that influence the quality of notes that students make when they enter university.

1.2.2 The purpose statement

The note-taking and note-making practices of students have been shown to impact on academic performance (Bonner & Holliday, 2006; Di Vesta & Gray, 1972, 1973; Kiewra, 2002; Kiewra et al., 1991). Therefore, it is important to investigate the factors that influence the first-year students' ownership and practices in taking and making their notes. It is possible to identify and compare the strategies used by self-regulated and underprepared students to construct their notes. Consequently, the quality of these notes and their relationship to performance can also be established in this context, resulting in recommendations for pedagogic practice and skills training for students.

In light of this, the purpose of this study was to investigate the factors that influence the note-taking and note-making expectations and practices of students in their first year, whether their expectations and practices changed as they gained experience within this new academic

environment; and the extent to which the construction of their notes influenced their academic performance in the Introductory Life Sciences course at a South African University. There was also a focus on the extent to which the lecturers' practice in providing access to their slides on the learning management system impacted on the students' construction of their notes (and consequently, their academic performance). The relationship between the quantity of material that the lecturer provided on their slides was also investigated in relation to the quality of notes that students constructed, and to their grades.

1.2.3 The research questions

The main research question was:

Considering that the link between the construction of notes and academic performance has been well-established, what factors influence the students' construction of their notes?

The following sub-questions were used to answer the main research question:

- 1) To what extent does the students' expectation of how they will perform align with their actual grades received in semester 1 and 2 in first year?
- 2) To what extent does the students' practice of constructing notes at school influence their expectations and practices of this task in first year?
- 3) What connections exist between the students' expectations of the learning environment and their practices in constructing notes in their first year?
- 4) What changes, if any, occur in the students' expectations and practices of constructing their notes as they gain experience of the university academic environment?
- 5) To what extent do the provision of lecture slides, and the level of detail on these slides, influence the ways in which students construct their notes?
- 6) In relation to the lecturers' practice of making slides, and the students' expectations and practice, as noted in points 1-5 above, can any conclusions be drawn about these factors and the students' academic performance?

1.3 Overarching Framework For This Study

Constructivist theory is used as a framework to explain how the students' note-taking and note-making practice is shaped by their family background, school experience and the University academic environment. Piaget's cognitive development theory is used to explain how the type of notes produced by students can be an indicator of the level of self-regulation and the depth of meaning that they might have developed. Social-constructivist theories on learning, and in particular Vygotsky's 'tools and signs' (Vygotsky, 1987a, b) and Piaget's cognitive developmental theory (Piaget, 1964, 1968) also underpin this research.

Social interactions play a large role in the development of self-regulation. Language (or speech) is the means by which adults (or society) are able to pass information onto children, and is therefore seen as a powerful **tool** in the intellectual development of children (Vygotsky, 1978; Vygotsky, 1987a). As development occurs, children do not simply increase the vocabulary that they have learnt within their communities. Rather, they grow to voluntarily and critically make decisions and solve problems by means of speech (Vygotsky, 1987a). Within the context of this study, the students' ability to effectively use the lecturers' slides to make a good set of notes is dependant on a number of factors: one vital factor is the native language of students.

The sections that follow provide first a summary of the influence of social interactions on the development of children, as defined by Vygotsky's and Piaget's constructivist theories, and then explain the significance of these theories to the aim of this study.

1.3.1 The role of society and the individual in the student's development of learning

Vygotsky emphasised the influence of social interactions on children's cognitive development. He explained how social interactions enable children to achieve a greater depth of understanding than they could on their own. The current study looks at how social interactions with family, and the interactions within the school and first-year academic environment, influence the development of the students' levels of expertise in taking and making their own notes.

Vygotsky's theory states that there are three types of interactions that facilitate learning: the first is by imitation of the behaviour observed within the social environment; the second by the mediation of an instructor; and the third is by collaboration with peers (Vygotsky, 1978). Vygotsky (1978, 1987a, b) referred to the use of 'psychological tools' and 'signs' in the

development of learning. According to him (Vygotsky, 1978, 1987a and b), in the same way that a physical tool is able to assist someone in performing a function or meeting an aim, a psychological tool is able to assist in developing mental constructs. Psychological tools allow society to share skills, knowledge and beliefs in an external manner, as in the form of books (Stetsenko, 2004). These tools therefore allow us to interact and change our external world in some way. In other words, while the physical tool helps to shape the physical world, the psychological tool helps to shape people's cognition. An example of a psychological tool is a motivational book. The book is written to provide insight and inspiration to people, and therefore has the potential to re-shape way in which the readers think.

Within the family environment, the cultural and social capital that children have can be regarded as psychological tools. Cultural capital is the knowledge that children can access as part of the larger community to which they belong (Zweigenhaft, 1993), and social capital is the knowledge that is available to children as a result of family expertise and experience (Bourdieu, 1985 cited in Portes 1998¹). In the current study, the notes which teachers make available to students, and the books and technology which students have access to within the school environment are also considered psychological tools. In first year, lecturers usually use speech in the form of written words (e.g. presentation slides), and also use verbal speech as a way of providing information. These forms of speech are meant to shape the students' understanding of concepts. In the case of this study, the lecturers' slides and explanations are considered a psychological tool. Therefore the lecturers' slides provide key biological aspects that students should focus on, but also provide first-years with cues to the depth of understanding that they are expected to achieve. Students generally use the lecturers' slides in their construction of notes, and/or in their process of learning, thus the lecturers' slides are thought to guide the students' thinking (i.e. the slides are an external aid used to shape the students' knowledge).

As Vygotsky explains, signs, in contrast to tools, are formed as a result of a self-regulated, self-directed internal activity, and are generated as part of a higher learning function. The development of a sign is based on the learner's past experience. This experience or skill comes from the learner's observations of - and interactions with - society (Vygotsky, 1987b).

¹ When I wrote and published chapter 2 as a paper I was unable to track down Bourdieu (1985) as cited in Portes (1998), but later after completing more reading on types of capital I found that my study is more in line with social capital as defined by Coleman (1988). Coleman's definition of social capital lies within the context of human capital, and this definition is therefore more applicable to my study than is Bourdieu's definition of social capital.

Therefore, signs are not present at the beginning of the development of speech; rather signs develop as the development of the child's speech matures (Vygotsky, 1987b). During the initial years children's learning is largely influenced by the environment, but once children have developed their approach to learning they are able to have more control over the development of their learning, and this leads to the development of higher mental functions (Vygotsky, 1978). An example of a sign is a knot on a handkerchief to remind the person to do something (Vygotsky, 1978). This knot only has significance to the person who tied it, but has no significance to anyone else. Therefore the knot is an internal reminder to the person involved, and so signs are aimed at shaping the individual's thinking. In this study the notes that students construct are considered a 'sign'. These notes are meant to be a reminder to the student of the concepts that were covered in class. These notes represent an internal reminder that students then use to shape their comprehension. As much as lecturers can shape the way in which information is presented to students, the final responsibility for constructing the 'sign' and thus for learning the material lies with the students.

In this study, lecturer slides represent psychological tools and students' notes represent signs, and both are used to investigate how note-taking and note-making is associated with the depth of understanding and subsequent student performance. This is explained further in the sections that follow.

1.3.2 The significance of Vygotsky's 'tools' and 'signs' to note-taking and note-making in the process of learning

During the lecture, lecturers usually provide a visual presentation ('tool') consisting of mostly key words, main points, and/or diagrams. The content in the presentations is then extended by the verbal explanations of lecturers. The presentation therefore generally acts as a guide to the content that lecturers expect students to understand and learn, and that could later be examined. For this study it was necessary to determine 1) how students expected to use these slides to make meaning of lecture content and, 2) the extent to which the lecturers' slides influenced the students' construction of their notes. As noted, the level of support that teachers at school provide in the construction of students' notes is likely to determine the students' expectation, level of skill, and practice in taking and making notes at University. In other words, depending on their practice at school, students could choose to use the lecturers' slides (the 'tools') as guidelines to extend their notes ('signs'), or, they might use the slides simply as 'the' product that needs to be studied.

In this study, it was assumed that class notes and revised notes are influenced by the social environment of the lecture room. This is because they are constructed according to the material that the lecturers explain in class and the points on their teaching slides. Based on the literature, it was also assumed that the students' reviewing and revising of their class notes (during the process of note-making) was the stage at which generative learning occurs. Therefore, a restructuring of class notes (for instance in the form of a matrix, a flowchart or paraphrased notes) could provide the cue that generative learning had occurred. Since self-regulated students are more motivated to take responsibility for taking and making their own notes (Zimmerman & Schunk, 2001), their notes then are likely to give evidence of higher mental function. These students are also usually ones who have more cultural capital, and therefore have a better understanding of their role within the University academic environment. If however the notes that students learn from for assessments is a close replica of the lecturers' slides then this likely means that students have not given critical thought to the content provided. These students generally memorise the content without finding the meaning of the content – i.e. they have not engaged in higher mental functioning. While revised notes could be a 'sign' of the internal expression of the students' understanding, underprepared students are usually more reliant on receiving assistance from the lecturer, and are less likely to modify the notes provided by the lecturer or the notes taken in class.

Thus, if students re-write the notes in their own words, this process of paraphrasing notes was taken to be evidence that critical thought had occurred. This is because the words that students choose to use in their notes carries a personal meaning of their understanding of the content based on the level of relevant prior knowledge that they have on the topic. And, since notes are a form of external memory storage (Kobayashi, 2006; Rickards & Friedman, 1978; Stahl, King & Henk, 1991) this means that students can use their personalised or revised notes as a way to remember, or to find the gaps in their understanding, and thereby increase their depth of comprehension. Here, the students' notes represent a 'sign' which can be used to analyse the process and depth of their learning.

1.3.3 Speech and learning

According to Vygotsky, children's interaction with their environment and their development of mental functions occurs largely by means of speech. Thus, in terms of the current study, words are in the form of written text (i.e. the lecturers' slides and the students' notes); in a verbal form (i.e. the lecturers' explanations of content during class); and in the form of

thought (i.e. inner thought as students' attempt to make meaning of the content that is presented). Hence, words (or speech) are important at an 'interpersonal' and 'intrapersonal' level (Vygotsky, 1978; Vygotsky, 1987a, b). When speech is used for communication between lecturers and students then it has an interpersonal function, but has an intrapersonal function when it is used for the self (i.e. in note-making). Thus, inner speech is for the individual whereas external speech is for communication with others (Vygotsky, 1987b). Vygotsky (1987b) claimed that speech is the fundamental *vehicle* that allows higher cognitive processing to occur, and is not simply an accompaniment to the development of cognitive function, thus within the context of the present study speech is the means by which understanding of content would develop.

Vygotsky (1987a) explains that thought is developed and expressed by means of language and speech, and the meaning of words underpins thought and speech. The meaning that words carry is developed within the social environment of children. The development of the children's cognition is based on the development of words and speech. The development of speech (and thus thought) thus occurs at an interpersonal level, and then intrapersonally (i.e. in the act of thinking). Vygotsky explains that the meanings of words are developed in society, and then accessed, internalised and used by children in communication with others and within themselves. As children develop they attempt to communicate with society. Vygotsky (1987a) refers to baby babble as being representative of an oral gesture. As children begin to understand speech, they learn words that they have heard from others. Once children realise that there are different words attached to different things they develop the drive to increase the number of words that they are able to say, so that they can communicate their meaning more effectively (Vygotsky, 1978; Vygotsky 1987b). Through children's own initiative they try to learn the meanings that are attached to specific objects (Vygotsky, 1987b). Speech now has an intellectual meaning to children, and at this point Vygotsky claims (1978, 1987) the development of speech and cognition converge.

Children's grasp of speech increases as they mature, leading to the development of egocentric speech (Vygotsky, 1962, 1987a). Egocentric speech can be defined as internal speech that is expressed externally. It can be thought of as 'thinking aloud' (Vygotsky, 1987b). In the early years of development, egocentric speech provides the 'mechanism' for children to think, i.e. when children are faced with a problem they tend to speak aloud about their actions as they attempt to solve the problem (Van der Veer & Valsiner, 1994; Vygotsky 1987b). Van der Veer and Valsiner (1994) also report that egocentric speech is important to problem-

solving, i.e. when children are stopped from speaking they face difficulty in finding a solution and sometimes give up solving the problem. As children mature egocentric speech turns to internal speech or thought (Van der Veer & Valsiner, 1994; Vygotsky, 1962, 1978, 1987a and b). The move from external to internal speech in problem-solving is viewed as a move from elementary to higher mental functions (Vygotsky, 1962, 1987a). When children start to use higher mental functions speech acts as a guide, and dominates the way in which children carry out the action (Vygotsky, 1978, 1987). Speech is seen as a psychological tool that mediates thinking (Vygotsky, 1987; Moll, 2001). Speech can thus be seen as an aid to the development of cognition (Vygotsky, 1962). Therefore within the context of this study it is proposed that the students' comprehension of the words that the lecturers use impact on the depth of meaning they are able to establish in class; and this level of understanding in turn influences the depth of notes that students take and make.

Much cognitive processing occurs at the interpersonal level before children learn to process information at the intrapersonal level, i.e. before the process of internalisation occurs (Vygotsky, 1987b). Generally the development of internal meaning is the last stage of development in the move from inter- to intra- personal (Vygotsky, 1987b). As noted, Vygotsky (1987b) explains that internalisation signifies the beginning of the development of higher mental functions. In other words, when children learn to look introspectively for a solution, as opposed to interpersonally, then internalisation has occurred. Vygotsky (1978) explains internalisation as the process where the external operation is re-structured within the mind of the child so that meaning can be made in the context of the child's prior knowledge structures. Internalisation consists of three processes: (1) the external activity is transformed and becomes meaningful to children (i.e. an internal activity) (2) there is the move from interpersonal to intrapersonal; and (3) this transformation (from inter- to intra- personal) requires a long series of developmental stages. Piaget's cognitive developmental theory is used in my study to describe these internal developmental stages, as explained later on in this section.

Once speech is internalised, it becomes part of the higher function process, and influences perception, memory and problem-solving abilities and experiences. Words are believed to have the same property (Vygotsky, 1978). Words are a part of thought; and also have a verbal and textual form. In Vygotsky's theory on cognitive development he refers to writing as being a symbol of speech (Van der Veer & Valsiner, 1994; Vygotsky, 1978, 1987a). Vygotsky (1978) explains that young children are able to 'draw' internal speech in the form

of writing, and that writing has a mnemonic function. Since speech is a form of sign-usage, written words are also a form of sign-usage. We use ‘thought words’ or ‘inner speech’ as a form of a psychological tool to evolve and develop our thinking. Language is made up of words, and is the ‘tool’ that enables us to think (Vygotsky, 1987a). The development of meaning of words therefore takes thinking to higher cognitive level. Words carry meaning, and this meaning has been established by society, and our use of this meaning is what allows verbal thought or inner speech to occur (Vygotsky, 1962). It is therefore proposed that the learning environment that is prevalent within the school setting plays a fundamental role in the level of literacy and depth of meaning that students are able to achieve when they enter University. Thus, children whose mother tongue is also the medium of instruction benefit or have an advantage over second-language students.

1.3.4 Learning a language

Vygotsky (1987a) explained that learning a foreign language as an adult is not the same as learning a native language as a child. In the latter case children develop the meaning of the words that they learn, but in the former case adults already have meaning that is associated with the words, which they then translate into a foreign language. In the development of the native language children are not consciously aware of the meaning of words, although they know how to – and do – use these words. In learning a foreign language there is the assumption that word-meaning has been established in the native language. In relation to this study, the extent to which English was used within the classroom at school, and within the social environment of the child, impact on the depth of meaning he/she is able to achieve in the English-medium lectures at university. This means that he/she might not have developed the necessary vocabulary that is required within the first-year classroom.

According to Vygotsky (1987a), a native language is learnt on the basis of children having an inner drive to communicate with the world, and learn words and meaning within the context of everyday conversation and speech. However, a foreign language is learnt in a more formal sense, where learning words is done for the sake of learning (Vygotsky, 1987a). The motivation and way in which learning occurs (i.e. in an uncontextualised manner) in the foreign language is different to how this would have occurred in learning the native language. Learning a foreign language requires being conscious of learning, and having the intention to learn the language. The learning of a native language occurs at a concrete level and then extends up to the abstract level, where the meaning of words is fully understood, but in

learning a foreign language there is a move from abstract to concrete, i.e. having to establish meaning before a word is used at the concrete level (Vygotsky, 1987a).

Vygotsky's notion of learning in a foreign or native language is used as a lens to examine and compare the depth of notes and subsequent academic performance of first and second-language students in this study. In the section that follows I show how Piaget's cognitive developmental theory may also be used as a lens through which student note-taking and note-making can be considered and analysed. Piaget focused on the way in which individuals come to an understanding of concepts. In this study Piaget's (1964, 1968) definition of disequilibrium, assimilation and accommodation, compensation and equilibrium, is used to explain how students would likely negotiate the note-taking and note-making process, and the relationship between this and their learning.

1.3.5 Piaget's cognitive developmental theory

Knowledge and cognition requires thinking, which is an internal process (Piaget, 1980). As Piaget explains, children are not born with higher cognitive processes, this level of comprehension occurs over time. Thus, Piaget's cognitive developmental theory describes how new knowledge could become integrated into existing knowledge structures. Learning occurs by modification of knowledge (Davis, 2004; Piaget, 1964, 1968, 1969). Knowledge construction is thought to be an active process that is dependent on individual experience, prior knowledge and social background.

Piaget focused on the development of cognition, providing the terms 'disequilibrium', 'assimilation and accommodation', 'compensation', and 'equilibrium' to explain the process of learning (Piaget, 1964, 1968, 1969). Piaget's cognitive developmental theory describes the process of individuals who are faced with new knowledge and do not see how this fits into the existing knowledge structure: this creates disequilibrium. The individual then attempts to determine how this information can be incorporated into their existing knowledge structure, with the cognitive process then involving either assimilation and/or accommodation. Assimilation is achieved by repetitive action; children repeat behaviour as a response to a need, or to find a solution to a problem (Piaget, 1951, 1969). While assimilation refers to the gathering and consolidation of factors that individuals may come to understand (Piaget, 1955, 1980), accommodation refers to the restructuring of their knowledge according to the new knowledge gained within the environment (Piaget, 1980). Assimilation and accommodation are the basis of cognition.

During the process of accommodating new information people could go through another process known as compensation. Piaget described three stages to compensation: alpha, beta and gamma. During the alpha phase, individuals will attempt to change the new knowledge to fit into their prior knowledge, during the beta phase they start to recognise that there is some disjunct in their interpretation of the new knowledge, and in the gamma phase these individuals accommodate the new knowledge such that their prior knowledge is re-structured according to the new knowledge that they have encountered. The new knowledge could then become part of the existing knowledge structure, thus creating equilibrium. Thus, as the individual comes into equilibrium with their environment they assimilate and accommodate the new knowledge which they have gained from the environment (Piaget, 1980).

1.3.6 The significance of Piaget's cognitive developmental theory to note-taking and note-making in the process of learning

Students may only note what they see as important to the lecture, and these key points may be relative to the students' understanding of the topic. Any points that seem vague or confusing may not necessarily be noted by the students even if these points are important. In terms of the discipline of biology, the familiarity of words could also influence student note-taking, note-making and thus their learning. If students are familiar with the terminologies used within a discipline, more focus would be placed on determining and noting other relevant and more in-depth detail related to the content. However, students with less relevant prior knowledge and understanding of terminology and are likely to spend more time noting definitions and may lose out on other important knowledge regarding the topic being lectured.

1.3.7 Bringing together Vygotsky's and Piaget's theories to be used as a framework for this study

During the lecture there are many demands placed on the students' attention. In class, students have to negotiate and correctly interpret the meaning of words on the lecturers' slides, understand the structure of the lecture material, and be able to note information according to their prior understanding. They then need to build on their class notes by reading their textbooks and other resources in order to deepen their understanding. During the note-taking and note-making processes the students' understanding of concepts may change to incorporate the new meaning and knowledge that they have gained. In the process of re-writing (during note-making) students are likely to identify gaps in their understanding,

and this could lead to them creating a set of revised notes (i.e. the sign) which has a personalised meaning to them. The students' intention is driven by a particular behaviour to meet a specific aim (Piaget, 1969); if students use the notes that the lecturers provide on slides or on the chalkboard (i.e. the tool) effectively, then having these slides could help students more deeply engage with the content that they are required to learn.

The ownership and level of responsibility that the students have in taking and making their own notes at school could determine their expectation of themselves and their lecturers when they enter University. The quality of the notes that students make is dependent on the extent to which they feel they need to interact and develop meaning of the content of the work provided in class. If students feel that their class notes produce sufficient meaning for their learning they do not extend their class notes, but those students who feel that they need to develop more meaning of the notes made in class would in some fashion extend the words in their notes, and consequently their notes would become more reflective of deeper thought processes. Therefore the students' notes could reflect the development of a deeper level of understanding through making notes which they then use to study from for examinations.

While Vygotsky's cognitive developmental theory is used to investigate the influence of external and social factors (i.e. the schooling backgrounds and kind of notes offered by the lecturers) on the students' expectations and note-taking and note-making practices, Piaget's theory on knowledge construction is used to analyse the influence of the notes that students make on their depth of learning and their subsequent academic performance.

1.4 The Structure Of The Thesis²

The thesis consists of six chapters, including an overarching discussion and conclusion. The introductory chapter (Chapter 1), is followed by one published paper (Chapter 2) and three manuscripts (Chapters 3-5) which form the main body of the thesis. Chapter 6 presents a general discussion, which is followed by a conclusion. Chapter 2 presents the findings of a pilot study which looked at the influence of social and cultural capital on student expectation of their academic performance and the actual grades they achieved in their first year (i.e. sub-question 1). Following on from this I decided to use Piaget's and Vygotsky's explanations of cognitive development as my overarching frameworks for the main part of the study, which

² It was a requirement from my Institution that I write-up the thesis in the form of papers, thus I looked for emergent themes upon which to base each paper (reflected as respective chapters in this thesis). Therefore, each chapter is based on the theme that arose, as shown in section 1.4 above. I conducted the research under the guidance of my supervisors, they are second and third authors on papers sent to journals.

was to investigate any transformation that students made to their notes as they gained experience at University, in order to provide a window on the cognitive development of the students. Since Vygotsky's and Piaget's constructivist theories focus on cognitive development at the level of the individual, and the aim of my study was to investigate the factors that influence note-taking and note-making of first-year students, the use of Piaget's and Vygotsky's theories meant that I could analyse my data with a view to make recommendations to (a) students and (b) lecturers, to assist in improving student learning and academic performance. Chapter 3, which answers sub-questions 2-4, focuses on (a) how the students' practices in taking and making notes at school impacts on their University expectation and practice of these tasks, and (b) on how the students' practice changes as they experience first year. Chapter 4 focuses on sub-question 5, which considers (a) the influence of the access students have to lecturers' slides on the learning managements system (i.e. University intranet), and (b) the detail of the lecturers' slides on the students' note-taking and note-making practices. Sub-question 6, which was aimed at investigating the relationship between the factors reported in chapters 2, 3 and 4, and students' academic performance, is reported on within the respective chapters. While conducting interviews with students and lecturers it became apparent that students had issues with the language of instruction, therefore Chapter 5 focuses on first and second-language learners in relation to their note-taking and note-making practices, and their academic performance.

1.5 Graphical Representation of This Study

Figure 1.1 shows the complex interconnections between the different aspects of this study. This includes the students' role in taking and making notes at school and at University; the students' and lecturers' expectations and practices; and the influence of language on the quality of notes that students take and make in their first year.

The quality of notes students make in their first year is influenced by the prior experience they had at school. This impacts on their expectations of the ownership that they have in constructing their notes at university. In turn this influences the amount of content they capture in class, and the depth of notes they make after class. The students' expectations and practices in taking and making their notes can also be influenced by the type of access they have to the lecturers' slides, as well as the amount of detail that the lecturers have on their slides. The detail that lecturers provide on their slides could be based on the expectation of the role the student has in capturing their own notes, thus while some lecturers provide

detailed slides (e.g. containing definitions or examples) others may provide slides that have only key-words. The level of detail students have on slides could impact their engagement with their notes and therefore the depth of notes that they construct. Additionally, the type of access that students have to slides (i.e. only during the lecture or on the intranet) might impact the quality of notes that students make, this is taken into consideration in this study. Since all the lectures at the University where this study was undertaken are conducted in English, second-language students are likely to be at a disadvantage in terms of the depth of understanding they can establish in class, and this could influence the quality of notes that they construct. Figure 1.2 provides the methodology followed to access the data from students' and lecturers' for this study. Ethics clearance was granted by the Universities' Research Ethics Committee (HREC Non-Medical Protocol number: 2009ECE114).

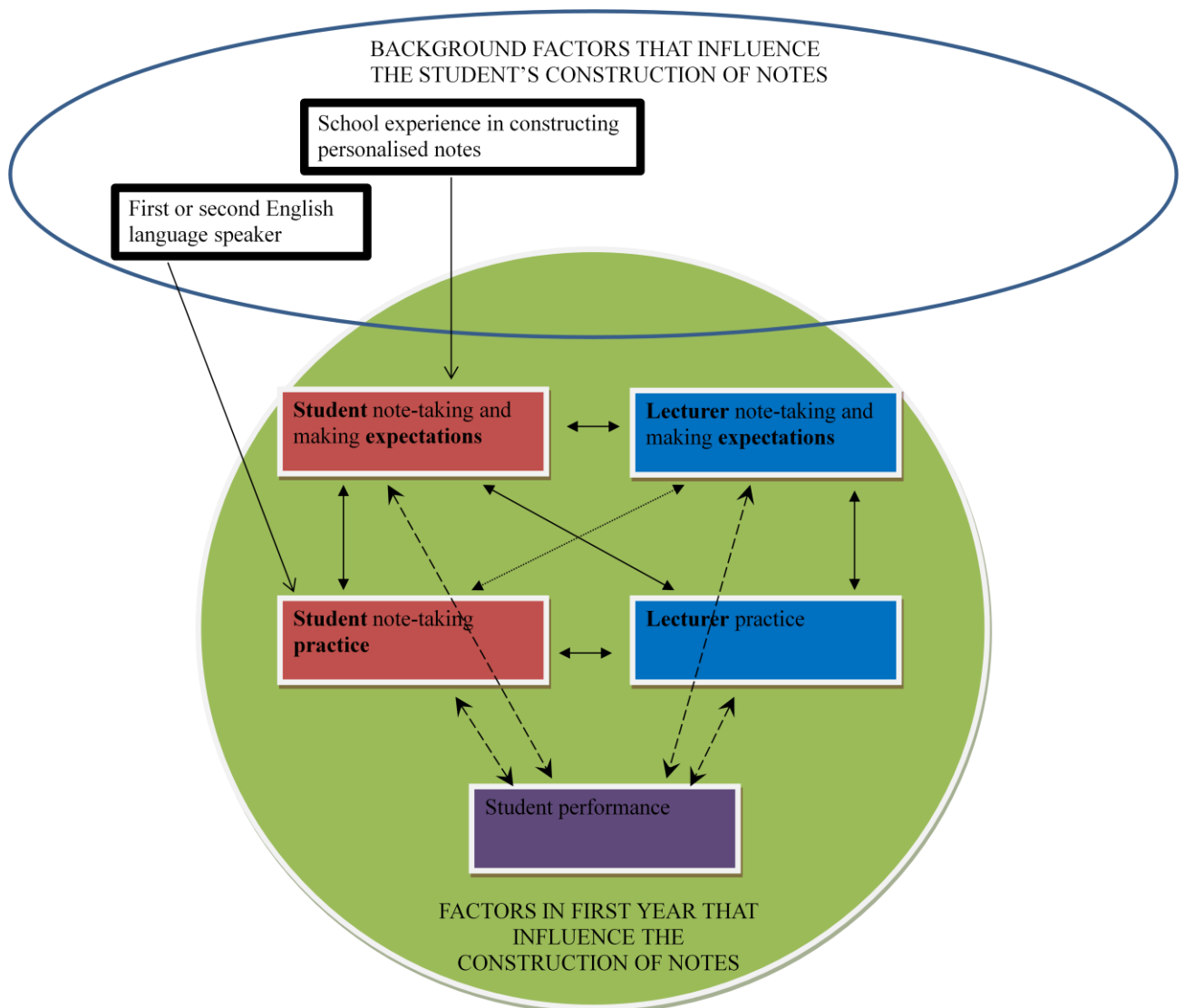
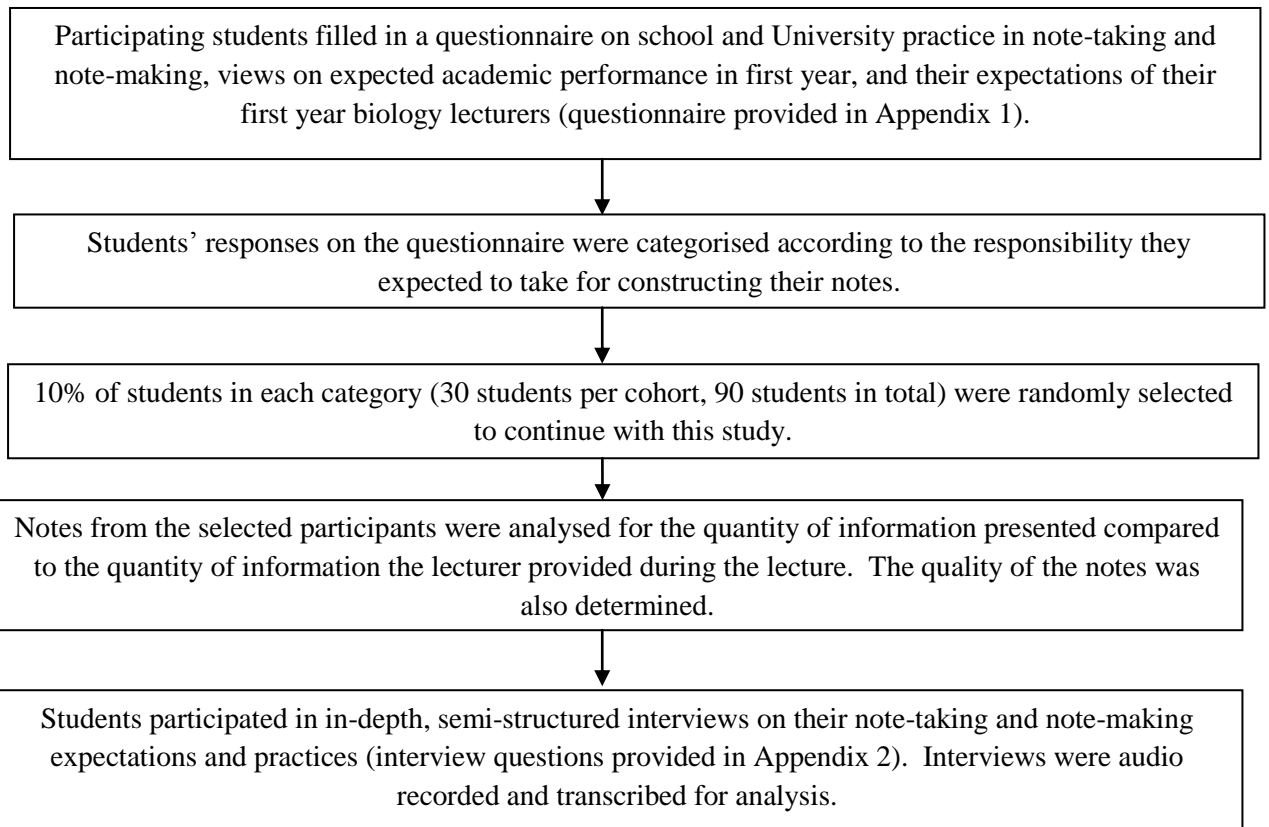
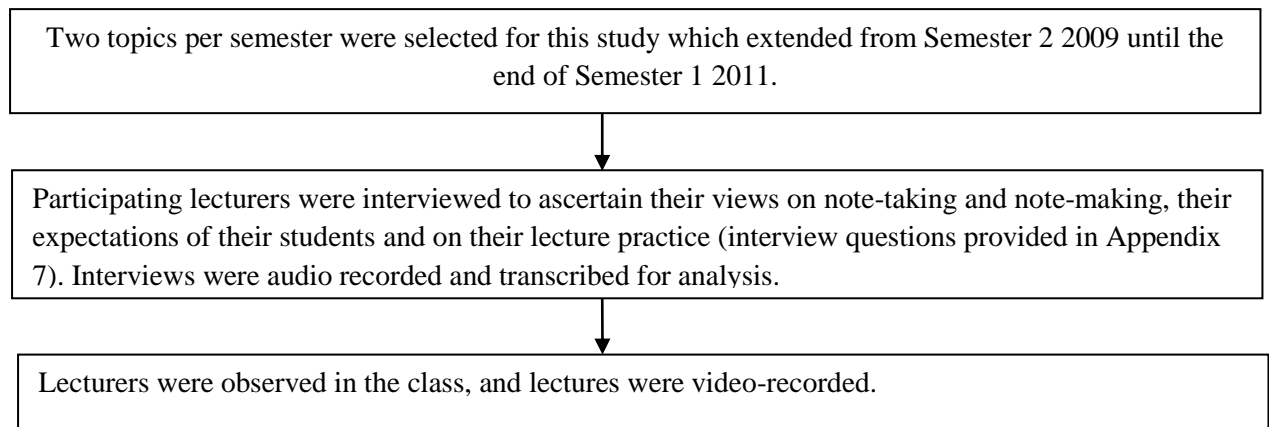


Figure 1.1: Interconnections between different factors investigated in this study

Flow chart for gathering information on students' expectations and practices



Flow chart for gathering information on lecturers' views and practices



My note-recording for analysis

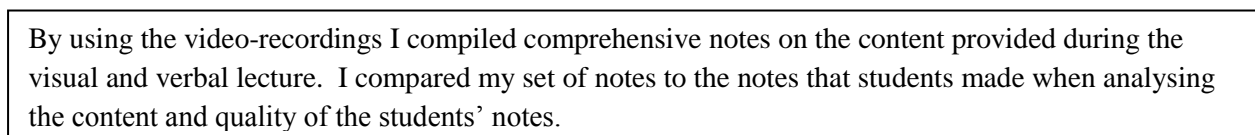


Figure 1.2: Flow chart showing methodology for data gathering on student and lecturer views and practices

CHAPTER 2:

THE INFLUENCE OF DIFFERENCES IN SOCIAL AND CULTURAL CAPITAL ON STUDENTS' EXPECTATIONS OF ACHIEVEMENT, ON THEIR PERFORMANCE, AND ON THEIR LEARNING PRACTICES IN THE FIRST YEAR AT UNIVERSITY

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Abstract

Even in post-Apartheid South Africa a legacy of inequality persists, since members of the wealthier sector, who generally have parents with a University education, are able to attend well resourced schools, while the majority of the population is forced (through economic circumstances) to attend under-resourced schools. Since access to tertiary education has increased, many individuals, who have attended under-resourced schools, are now able to attend University as “first generation” students whose parents have had no University experience. First and second generation students thus enter University having different expectations, learning practices and experiences which have been influenced, to a large extent, by their high school experiences. In addition, first generation students lack social and cultural capital which also influences their learning practices.

This study compares the learning practices and academic performance of first and second generation students in a first year Biology course at Wits University. The influence of social and cultural capital on student academic performance is investigated. Students' expectations and experiences of their academic performance become more realistic as they go through first year but they experience great difficulty in trying to adjust their study methods to meet the expectations of the academic environment. As much as first generation students who have sibling experience of University have access to social capital, and therefore more realistic views on the academic requirements at University, they still do not perform any better than first generation students who have no sibling experience of University.

In order for educational redress within South African democracy to be effective, it is important to understand the supportive measures that students may require in order to succeed at University. Furthermore, first generation students who have siblings that attended

University have access to social capital, unlike those without this experience. This study examines the importance of social capital and cultural capital in the context of a Biology course at Wits University.

2.1 Introduction

During the Apartheid regime education provided the platform for the oppression of the majority of the South African black population (Fiske & Ladd, 2004). Access to education became a priority when the democratic government came into power in 1994. Basic Education was made compulsory and Higher Education was opened to all (The Bill of Rights, 1996). While this brought in opportunities that the majority of the previously disadvantaged groups had not yet experienced, it also brought with it a range of challenges that urgently need addressing for effective redress.

In terms of education these challenges have centred on the contrasting availability of teaching and learning resources at rural, public and private schools (Fiske & Ladd, 2004). Funding dictates the availability and quality of these teaching and learning resources. These impact on students' learning experiences at school, and consequently on the development of the learning practices that they implement in tertiary studies (Asmal & James, 2001; Fiske & Ladd, 2004). Their learning practices impact on their ability to achieve in the University environment. Moreover, students whose parents have not attended University are often not aware of the rigours of University learning. Unlike in school, self-regulated learning at University is crucial for student success (Bryd & MacDonald, 2005). Furthermore, school instruction that has facilitated critical engagement with texts provides a better preparation for University than authoritative teaching models where transmission of facts is the normal mode of teaching (Craig, 2001; Slonimsky & Shalem, 2006). This is because textual engagement develops the ability to approach material in a manner that allows for deep constructive learning (Haggis, 2006; Slonimsky & Shalem, 2006). Therefore students who have been inculcated into a deeper learning approach (Marton & Säljö, 1976) adjust more easily to University academic requirements.

Another factor affecting the performance of students at University is linked to the idea of social and cultural capital. Social capital can be defined as the knowledge the individual has received from the community to which they belong. Access to this knowledge is determined by the relationship people have with members in the community, and this relationship provides the pool of resources upon which the individual can draw (Bourdieu, 1985 cited in

Portes, 1998). In terms of this study, access to social capital provides students with insight into different approaches to learning. This could assist students, who have not been exposed to critical engagement methods in their prior schooling experience, to improve their learning techniques. Our study looks at the relationship between generation and academic performance. Social capital in this context therefore refers to the relationship that may exist between the student and (a) sibling/s and/or (b) parent/s that attended University.

Cultural capital has been defined by Zweigenhaft (1993 pg 211) as the 'knowledge, dispositions and skills' that are available as a resource within the community. Members of the community would have an understanding of the tastes, styles and requirements of the community. Social class dictates cultural capital (Dumais, 2002). Understanding cultural capital is important because it demonstrates the way in which social structures are maintained (Lamont & Lareau, 1988). In this paper, cultural capital refers to the knowledge that students have access to from their community regarding the academic rigours of University. This knowledge is usually based on parental-expertise, status within the community, and/or experience of the University system. In addition, in this context, cultural capital also refers to an understanding of institutional cultural capital.

Many international studies have shown differences in the academic success of first generation students (i.e. students whose parents have not attended University) and second generation students (i.e. those students whose parents have experience of tertiary education). First generation students are more likely to drop out of University by the end of first year since they usually face a more difficult transition from school to University (Pascarella, Pierson, Wolnaik & Terenzini, 2004; Terenzini, Springer, Yaeger, Pascarella & Nora, 1996). Other factors contributing to first generation drop-out include having lower-income backgrounds, receiving less family support, exhibiting lower initial ability to read and think critically, and spending less time consulting with peers and instructors regarding their learning (Pascarella et al., 2004; Terenzini et al., 1996). In addition, it appears that they perceive faculty and staff as being less concerned with their academic performance. From this point of view first generation students may be considered to be disadvantaged, based on their limited social and cultural capital.

Educational disadvantage refers to the individual's internalised cultural context that is misaligned with that of the institution (Slonimsky & Shalem, 2006). This means that in addition to having to adjust to their academic studies, the institutional cultural context must

still be internalised. Although the advent of democracy in South Africa has enabled the admission of students with intellectual aptitude to University, the absence of social and cultural capital may play a significant role in their eventual attainment of a University qualification.

In terms of University education, the social and cultural capital of each student determines the availability and the response to educational opportunities. However, since acceptable social practices are dictated by the dominant classes, who also determine the nature of accepted cultural practices, educational systems typically favour people with the appropriate cultural capital (Dumais, 2002). Furthermore, University students are expected to demonstrate cultural capital but are not necessarily provided with this opportunity for development at school (Dumais, 2002). De Graaf, De Graaf and Kraaykamp (2000) showed that parental cultural capital (e.g. interest in reading) is perpetuated by children. These habits are usually positively related to learning and success in academia. Accordingly, first generation students may be less prepared for certain aspects, like textual engagement, that are related to success at University (Haggis, 2006; Slonimsky & Shalem, 2006).

Sociological role theory, as described by Collier and Morgan (2008), is used to explain academic integration and achievement within the confines of a student's role in a University setting. Role-playing refers to the way in which students use existing patterns to carry out the role of student, while role-making refers to the students' development of their own versions of their role (Collier & Morgan, 2008). Students generally enter University using role-playing and then move into role-making, as they gain experience within the University environment.

Collier and Morgan (2008) further provide a conceptual model (Figure 2.1 below) that defines student role and course content as being crucial to student success. This model incorporates the traditional educational model (the lower pathway) which recognises that understanding of content is required for success, while the upper pathway of the model requires implicit knowledge of lecturer expectations and student capacity to recognise and meet these expectations. For example, to be successful at University, a student would be required to adapt to the styles and types of assessment of different lecturers as well as recognise the different expectations of workload expected from them. Therefore, students would need to know explicit content knowledge taught to them, as well as be aware of implicit aspects such as those in the upper level of the conceptual model which stems from

cultural capital (Collier & Morgan, 2008) and can be influenced by social capital (e.g. influence of peer-learning and peer-support). Both the upper and lower pathways are equally important and influential in student success at University.

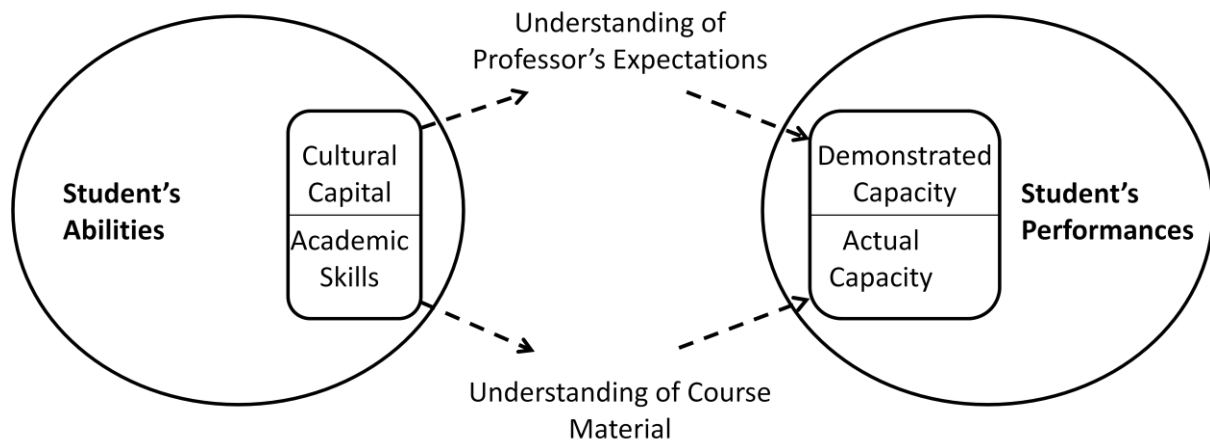


Figure 2.1: The Conceptual Model (Collier & Morgan, 2008)

According to the conceptual model (Figure 2.1), there are two abilities (or resources) and two performance criteria. Abilities include prior preparation in acquiring content knowledge (e.g. the ability to read and comprehend texts at the required level at University), while cultural capital refers to the pre-existing knowledge required to negotiate the academic setting (e.g. social skills, the ability to recognise and respond to lecturer expectations). In student performance, actual capacity refers to content knowledge, while demonstrated capacity refers to the lecturer's expectation. Nevertheless, demonstrated capacity is examined and graded by lecturers.

Many of the current population at South African universities are first generation students who lack social and cultural capital. The high attrition rates in the first year of University have lead to concerns about throughput and retention rates. Also at issue are problems regarding redress in South African society. In light of this, this study compares the academic performance and differences in learning practices of first and second generation students in a first year Biology course as a means of highlighting issues of social and cultural capital that have been cited as important factors contributing to student learning practices (Coleman, 1988; DiMaggio, 1982; Lareau, 1987; Pascarella et al., 2004; Portes, 1998). Although the differences in performance between first and second generation students at University has been well researched (e.g. Bui, 2002; Collier & Morgan, 2008; Grayson, 1997; Ishitani, 2003, 2006; Pascarella et al., 2004; Pike & Kuh, 2005; Terenzini et al., 1996), there is little

evidence of the effect of older siblings who have attended University on social and cultural capital (Shields, 2002). Therefore, more research is needed in this area because of anecdotal reports that first year students' impressions of University may be impacted or influenced by the experiences, or lack thereof, of family, friends and teachers at school. Consequently an aspect of this study has been on the notion that a younger sibling would learn from the experiences of the older sibling, and benefit or not, from this experience, depending on the guidance given. This study thus takes into consideration the importance of the potential access a younger sibling has as a result of the experiences of the older sibling who attended University. These experiences may be implicit (through observations made by the younger student of the older siblings' experience at University), or explicit (in terms of the advice that may be provided to the student by an experienced sibling).

The research questions aim to establish whether students with family experience of University have different expectations of how they would perform relative to how they actually perform in their first year at University, compared to those of students with no family experience of University. The research questions that were asked were thus:

1. How does the mark that the three categories of students expect to achieve in first year examinations differ from the marks achieved in these examinations?

Category 1 = first generation students who are the first in their family to attend University (referred to as 'first-in-the-family student')

Category 2 = first generation students with sibling experience of University (referred to as 'first with sibling University experience')

Category 3 = students whose parents have experience within the tertiary academic setting (referred to as 'second generation')

2. What differences exist between the learning practices of Category 1, 2 and 3 students?

2.2 Methods

The context of the study was the Introductory Life Sciences course (ILS), which is a prerequisite for all second year major courses in the Schools of Animal, Plant and Environmental Sciences (APES) and Molecular and Cell Biology (MCB), at Wits University. The ILS course runs over two semesters and is co-taught by four lecturers each from APES and MCB. Classroom observations confirmed that the lecturers have different teaching styles and differing expectations from their students regarding workload and assessment.

This is a longitudinal study that extended from Semester 2 2009 to Semester 1 2011. Data was gathered from a questionnaire and interview sessions. 23% of the class of 229 students completed the questionnaire. 30 students were randomly selected to participate in this study. Each of these students participated in three one-on-one semi-structured interview sessions. An interview was conducted during Semester 1 and 2 of first year, and a third interview was conducted at the beginning of second year. The questionnaire and interview sessions, developed on the basis of a study conducted by Bonner and Holliday (2006), covered the following areas: firstly, the marks students viewed as achievable at University, secondly any changes to these views as experience at University was gained, thirdly learning strategies used within the secondary schooling and University environment, and lastly the student's expectation of their lecturers at University. The final interview required the student to reflect on their first year experience. Students were then categorised according to their family's experience of University, (i.e. **Category 1** = first-in-the-family student, **Category 2** = first with sibling University experience, **Category 3** = second generation student). The demographics of the student participants who have been classified according to the three categories being compared is shown in Table 2.1 below.

Table 2.1: Student demographics

	Number of students
Total registered in ILS course (slot D)	229
Participants in study	30
Category 1	11
Category 2	5
Category 3	14

Student semester examination marks were obtained from departmental records. Qualitative analysis involved reviewing of questionnaires and transcribed interview data in order to compare prior schooling and University learning practices, the student's expectations of their academic performance at University, the student's expectation of the lecturer and self-

regulation requirements at University, and family history at University (in terms of generation and/or sibling attendance of University). Data were quantitatively analysed using the Statistica two tailed t-test. Comparisons were made between the defined categories of students and their academic performance. Ethics clearance was granted by the Universities' Research Ethics Committee (HREC Non-Medical Protocol number: 2009ECE114).

2.3 Results and Discussion

In the first instance, actual examination marks obtained in each of the semester examinations by students in each of the three categories (i.e. **Category 1** = first-in-the-family student, **Category 2** = first with sibling University experience, **Category 3** = second generation student) were compared with the marks that they had indicated that they had expected to obtain at University. This result was seen as an indicator of whether students had a realistic reflection of academic requirements within the University when compared to that of their previous schooling environment. During Semester 1 students in each of the categories had anticipated scoring, on average, between 14-23% higher than the marks they had received in the Semester 1 examinations (Table 2.2). Also, data in Semester 1 suggests that Category 2 students had a slightly lower expectation of their examination marks compared to the other two categories of students (Table 2.2). There was no significant difference between the marks that the different categories of students expected to attain in Semester 1 ($p=0.3$).

All categories of students anticipated performing better in Semester 2 examinations than they had performed in Semester 1 (Table 2.2). However, all categories of students reported a decreased mark that they expected to achieve in the second semester examinations compared to the mark they had expected to achieve in the first semester examinations (Table 2.2). In spite of this, in Semester 2 Category 1 students still perceived achieving more than 15% higher than what they had achieved in Semester 1 examinations (Table 2.2). On the other hand in Semester 2 the Category 2 and 3 students expected an examination mark that was similar to their Semester 1 examination mark (Table 2.2). Again, Category 2 had a slightly lower expectation of their Semester 2 examination mark compared to Categories 1 and 3 (Table 2.2). However, data (Table 2.2) shows that even though the Category 2 students may have had a better understanding of University demands, and more realistic views on how they would do, they did not generally perform better than Category 1 students. In Semester 2 all categories attained lower examination marks than they expected to achieve (Table 2.2).

Furthermore, even though in Semester 1 the Category 1 and 3 students had expected similar marks, and the Category 1 student did not perform as well as anticipated, the expectation of a high mark in Semester 2 persisted, unlike in Category 3 (Table 2.2).

Crisp, Palmer, Turnell, Nettlebeck, Ward, LeCouteur, Sarris, Strelan and Schnieder (2009) noted that as much as students expected that there would be some sort of transition required when they entered University, they did not usually anticipate the actual nature of the change, while Brinkworth et al. (2009) reported that students enter first year with unrealistic expectations of their workloads, feedback and access to lecturers, and may not expect a difference in their level of achievement.

The social capital that first generation students usually had available to them (especially if there was no sibling experience of University) came from advice that friends and school staff provided. During the interviews a few first generation students related that teachers had informed them of the differences between school and University, but most students only realised the difference once they experienced the University environment firsthand:

‘...when I just got here I thought it was school, the same, its just school, you study, write test, no one just told me it was something different from school... I think actually I realised after this exam, the June exam...’

Cultural capital that second generation students have access to may give them a head-start in recognising the patterns in the expectation of University assessments. From the viewpoint of this study, although second generation students had been guided by other family members who had attended University, and second generation students had performed better academically, they also did not always have a better understanding of what was actually expected in terms of University standards. The following comment from a second generation student attests to this:

‘...my sister’s friends and my brother’s friends ... they’d be like oh don’t worry you know 51 you worked too hard, 49 you just haven’t worked hard enough, so I mean you come in thinking wow! University is really difficult...’

Therefore, it is not surprising that, due to the lack of cultural capital, first-in-the-family students to attend University had the general expectation, at the beginning of the year that their marks would be similar to the marks attained at school. However, when considering that most students with family experience of University generally expected University assessments to be at a higher standard and a heavier workload, it is surprising that they also

related similar mark expectations to those students with no family experience of University. By the middle of first semester most students found they had underestimated the actual effort that was required at University. This study therefore supports Brinkworth et al. (2009) and Smith and Wertlieb (2005) conclusions that student expectation of the academic environment does not always provide a good predictor for performance.

Table 2.2: 2010 average examination marks obtained by students who were first generation (category 1), first generation with a sibling who had attended University (category 2) or second generation students (category 3)

	Averages		
	Category 1	Category 2	Category 3
Semester 1 expected mark	71.2	64.8	71.2
Semester 1 achieved mark	48.5	49.6	57.4
Difference between expected and achieved marks for Semester 1	22.7	15.2	13.8
Semester 2 expected mark	65	55	63
Semester 2 achieved mark	51.4	46.9	57.3
Difference between expected and achieved marks for Semester 2	13.7	8.1	5.7
Difference between expected marks between Semester 1 and 2	6.2	9.8	8.2

The marks achieved in Semester 2 were generally consistent with marks achieved in Semester 1 (Table 2.2). In both semesters the Category 3 students generally performed better than Categories 1 and 2 (Table 2.2).

When the examination marks for Category 2 and 3 were combined (i.e. all students who had a family member/s that attended University were pooled) there was a significant difference between this pooled category and Category 1 ($p=0.0014$). It is possible that only this set of

analysis provided significant results due to the small sample size that resulted from division of students into three categories.

Shields (2002) reported that the only difference between first generation students with and without sibling University experience is that the ones with sibling University experience studied for longer hours. In the current paper it is suggested that the social capital that students with sibling University experience have is likely to have assisted in the alignment of these students' personal expectations to University standards. As much as first generation students with sibling experience of University have a more realistic expectation of University requirements and standards (compared to those without access to this experience) they still do not perform any better. The reason for this could be that those with sibling experience still need to integrate the implicit and explicit experiences from their sibling into their own understanding of the University situation. Therefore while access to only social capital may account for these students more realistic expectations of University standards, the difference in academic performance between these two groups shows that more than social capital may be required for adequate academic alignment of student expectation and experience at University.

Second generation students have markedly different experiences of University due to access to social, cultural and institutional cultural capital (Slonimsky & Shalem, 2006). Therefore, these students generally have fewer hurdles that they need to negotiate in their first year. Second generation students usually had the benefit of school study methods which were better aligned with University study requirements. From the interviews it was clear that students who were encouraged by teachers and/ or parents to do additional work outside contact time had the inclination and experience to continue self-regulated strategies at University as well. Collier and Morgan (2008) also explain that second generation students would generally be coached in their time management and approach to University by parents who have had tertiary education experience and are aware of the demands of University. These students may also be more familiar with University expectations from listening to other family members who have academic histories. A comment from a second generation student shows the benefits of having access to cultural capital:

‘...because my mum is a teacher so she’s often taught me to like think what they’ll be asking us, so my mum’s always like tested me like, when I was a kid, always tested me in the way that she thought the teacher would test me, so that’s often what I do.’

Similar to Shields (2002) findings, unlike first generation students, second generation ones usually have a network of emotional support from parents who have experienced the University system. This support is evident in the comment from a second generation student:

‘... I did blank out for a lot of my tests last week so I think its going to show in my marks, so I felt – I spoke to my mum about it and she was like you need to just find that balance and stop stressing yourself cos its not like you don’t know the work its just you stress to much, and she’s right.’

In the final stage of the study differences in the learning practices between students in each of the three categories was examined. First generation students (particularly the second language learners) reported memorising information by either verbal rehearsal, or re-writing notes taken in class, or attempting to learn by reading the textbook - without necessarily being able to identify key concepts. More Category 3 students were noted to utilise resources effectively, e.g. the use of the internet and the prescribed textbook, in order to revise study notes. Second generation students usually did this with the aim of gaining a better understanding of lecture material.

The conceptual model (Figure 2.1) proposed by Collier and Morgan (2008) indicates that success at University is not determined by academic ability alone. Shields (2002) noted that students felt high school was most influential in their preparation for University; however first generation students also felt that this preparation was inadequate. In this study first generation students usually attended public or rural schools, while second generation students usually attended historically better-resourced schools. The resources available at the different schools influenced the learning practices that students developed at school and therefore had access to when they entered University. Figure 2.1 suggests that first-generation students, especially ones from lower-resourced schools, may not necessarily be as prepared with their expectations, written work, and grammar of the discourse as second generation students who have access to appropriate resources.

Furthermore, first generation students, who are usually second language learners, generally experience more difficulty understanding lecturers, compiling notes and interpreting test questions. The following statement by one of the first generation students evidences the general problem second language learners experience with regard to summative assessments:

‘...so here [University] you have to read the question, underline, like try to figure out what they are trying to say but then last year [at school] it was easy cos you read a question once and then you know what to do, ya so this year it is different...’

While first generation students reported usually transcribing work written on the chalkboard, second generation students related that they usually used textbooks, with additional handouts provided by teachers, and were accustomed to technology being part of the learning resources at school. Students from the less-resourced schools generally had less of an expectation to prepare for lessons or engage with the school syllabus outside contact time. Students attending poorly resourced schools are less likely to come into University with appropriate experiences and attitudes towards their learning, these findings are aligned with the conceptual model provided above (Figure 2.1).

Additionally, while the better-resourced schools generally provide opportunities for students to write essays, engage with feedback, and gain practical advice on preparation towards University, the historically black schools provide less opportunity for preparing students for the rigours of scholarly learning expected within the University setting. The University setting, being similar to that of the better-resourced schools, is more familiar to second generation students.

Diseth, Pallesen, Brunborg and Larsen (2010) suggest that deeper learning approaches, which require students to understand material and show interest in relating ideas, is positively correlated to academic performance. First and second generation students had used past papers for revision prior to tests and examinations. Reports from the interviews indicated that this was the predominant approach used in school for preparation for matric examinations. First in the family students to attend University usually practised surface study methods (such as rote-memorisation) while more of those students with sibling University experience and second generation students had the benefit of study methods which were better aligned with University study requirements. It is possible that since students with family experience of University had more social capital they understood, through implicit and explicit interactions, the demands and challenges presented by University studies.

The data appears to indicate that differences between first and second generation students could, at least in some measure, be ascribed to differences in their schooling background, as described above. However, issues of social and cultural capital are critical to the nature of the experiences of first and second generation students.

During Semester 1, Category 1 students, particularly, held the perception that the majority of their learning was completed during contact hours at University. There were fewer Category 2 and 3 students that held similar beliefs. For most of the first semester many students across

all categories seemed to be unaware that they were required to work independently and in a self-regulated manner. Pascarella et al. (2004) reported that learning for self-understanding is not initially prevalent amongst first generation students. In the current study, the two test marks that students received prior to their mid-year examinations did mildly concern them. It was only when students realised that they had performed badly in the semester examinations that they became concerned about their study method. When first and second generation students entered the second semester, most of the surface-learners recognised that their learning methods were not as effective at University as they anticipated. However, mostly the poorer performing first-in-the-family students believed that all that was required to achieve a better mark was to put more hours into studying, take more notes and read more, i.e. to 'work harder'. Even so, students did not usually do what they felt was necessary to succeed at University (i.e. work consistently, revise lecture material regularly, etc). The role of social capital in providing access to the students' awareness of the University academic setting is evidenced by first-in-the-family students being less informed about the deeper-learning approaches and self-regulation abilities required for success at University. In contrast, students with family experience of University attempted to be more strategic about the way in which they approached their learning.

Collier and Morgan (2008) have shown that first generation students in particular had problems with time management. Students across all categories were found to not follow a guide to the number of hours recommended for self study. It is possible that students perceived that the time spent preparing for tutorials, pre-labs and practical sessions was sufficient to understand concepts they perceived as important. During the second semester of their first year, and at the beginning of their second year, when students reflected on their learning practices they reported that they had not managed their time well. This finding supports the results reported by Collier and Morgan (2008) who show that first generation students may not be mindful of their role as a college student. The students' mastery of this role includes understanding explicit knowledge (e.g. self-study requirements for a course) and implicit knowledge (e.g. knowledge of University type assessments). While it is possible that due to the limited social capital the first-in-the-family students have, they do not initially realise the rigours of University learning, it is surprising that second generation students struggle here as well.

While students lacking in the appropriate social and cultural capital are generally those who are likely to have experienced poorer quality schooling, which as noted, impacts on their learning practices, second generation students have a somewhat easier transition due to the social and cultural capital that is at their disposal (Collier & Morgan, 2008). One takes into consideration that second generation students usually come from a higher income family, either live at residence, with family or in adequate accommodation, have the family support, and usually have a schooling background of textual engagement as opposed to rote-learning. It is likely that all of these factors enable second generation students to be more successful than first generation ones at adapting to the challenges they experience within the University system.

Even though most first year students do not involve themselves with peer-learning, Pascarella et al. (2004) has shown that peer-learning is beneficial: 'extracurricular involvement had significant positive effects on critical thinking ... and preference for higher-order cognitive tasks' (pg 273). The social capital that is generated through peer-learning is especially important to first generation students and may increase their chances of performing better in assessments.

2.4 Conclusion

Understanding student role at University is crucial to student success. The implicit expectations and tacit understandings of faculty need to be internalised by students. Students appear to expect that the learning practices they used at school will bring similar success within the University environment. As a result, these practices are usually applied by students when they begin their studies at University. Even though students are usually aware that University assessments are generally more difficult than that experienced at school, they anticipate doing better than they actually do. This was true for both the first and second semester, indicating that although the students' expectation of the marks they would get changed as they gained experience, they continued to believe that they would perform better than they did. As much as all students become aware that their performance does not meet their expectation, first-in-the-family students to attend University take longer to find effective methods of studying.

Students enter University with different levels of social and cultural capital, this affects their performance. The first generation students with sibling experience of University have slightly more realistic expectations of their marks. The social capital that these students have access

to offers implicit and explicit opportunities that first-in-the-family students to attend University have no access to. On the other hand, second generation students have access to social and cultural capital that enables them to adapt to and meet challenges quicker than first generation students. It is important to understand and demonstrate understanding of course content according to the expectation of the lecturer, but the student who is more aware of the lecturers expectation will perform better.

The data collected for this study indicates that within this context, first generation students may require additional support to help them adjust to the University environment. While second generation students are better equipped in their understanding and expectations of University due to their social and cultural capital – which gives them a better platform in terms of institutional cultural capital- the first generation student with sibling University experience had some advantage over first-in-the-family students to attend University due to their social capital. In terms of this study, access to social capital (e.g. peer networks) provides students with insight into different approaches to learning. This could assist students, who have not been exposed to critical engagement methods in their prior schooling experience, to improve their learning techniques.

This paper points to the need to investigate the nature of social and cultural capital that enable students to better adjust to the transition into University.

2.5 Acknowledgement

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CHAPTER 3:

THE INFLUENCE OF STUDENTS' SCHOOL EXPERIENCE ON THEIR ABILITY TO CONSTRUCT NOTES, AND THEIR PERFORMANCE AT UNIVERSITY.

Abstract

Students at South African Universities enter first year having come from a variety of school backgrounds. They consequently come with different experiences and skills in terms of learning practices, such as the ability to take good notes in class. International studies in tertiary education have established a strong link between the notes that students construct and their subsequent academic performance, so a diversity of practices associated with these differences in background was seen to offer potential insight into the differences experienced by students in succeeding in first year. First-year students are expected to take notes during class (note-taking) and to revise these notes after class (note-making). However, it was found that generally students had not received specific instruction on how to do this either at school or University. This paper reports on a study to determine a) the extent to which the students' note-taking and note-making expectations, and note-making practice in their first year, was based on prior experiences at school, and b) the extent of the relationship between their notes and their academic performance. The context of the study was a first-year introductory biology course. The investigation included gathering data via a student questionnaire, individual interviews, and video-recordings. Analysis of students' expectations of the extent of help they would receive from their lecturers in the construction of notes suggested 3 categories of students: these were *self-regulated students* who used the process of note-making as a vehicle for their learning and *developing* and *underprepared students* who used their class notes as the product that they needed to learn. Two sets of students' notes per semester were analysed and compared to the grades they received on first-year tests and examinations. The study established that students' experiences at school determined (a) their sense of ownership in terms of creating a personalised set of notes in their first year; (b) it established their expectations of the level of assistance they should receive from their lecturer in constructing these notes; (c) it impacted on their note-taking and note-making practice when they enter University, and (d) it influenced how long it took for them to adapt to making personalised notes. It was clear that the students' schooling background was critical in terms of their awareness and ability in taking ownership of their learning. By establishing

the link between the transformation of the students' class notes during the revision stage and their depth of learning, this study shows that note-making affected academic performance.

3.1 Introduction

Notes play a pivotal role within the academic environment. There is a wealth of research which shows that because students generally use their notes as a record (Bonner & Holliday, 2006; DiVesta & Gray, 1972, 1973; Stefanou et al., 2008) from which to study for tests and examinations (Baker & Lombardi, 1985; Kobayashi, 2006; Neef et al., 2006; Van Meter et al., 1994), the level of expertise in constructing a good set of notes is fundamental to the quality of learning (Makany et al., 2009). This quality of learning is then reflected in academic performance (Bonner & Holliday, 2006; Crawford, 1925; Di Vesta & Gray, 1972, 1973; Kiewra, 1991; Kiewra, 2002; Titsworth & Kiewra, 2004).

3.1.1 Note-taking and note-making

Within the academic environment a good set of notes can be defined as one that is understandable to the reader, and that provides sufficient detail of the concepts that are covered in class (Williams & Eggert, 2002). This means that the final copy of notes that students produce should be a reflection of their understanding, and should be based on key aspects that the lecturer discussed in class. In other words, there are two stages in the construction of a good set of notes, viz. note-taking followed by note-making.

While taking notes during a lecture (*note-taking*), students either simultaneously listen and note content or shift between listening and noting content (Boyle, 2007; Carrier, 1983; Kiewra, 2002; Williams & Eggert, 2002). An ideal scenario calls for students to revise their notes afterwards according to their understanding of the lecture and by using prescribed textbooks, other library books and/or sources such as the internet. This stage is referred to as *note-making*. Thus, during the University lecture students are usually involved in the recording of information or in the taking of notes which they can later review and revise (*note-making*) when learning for tests and examinations (Kiewra, 2002; Van Meter et al., 1994; Williams & Eggert, 2002). Consequently, while note-taking can be thought of as a 'gathering' phase, note-making is the stage at which students make meaning of content. Therefore, in note-making students are expected to paraphrase notes while constructing meaning. Thus, note-taking and note-making require different skills.

3.1.2 The relationship between the construction of notes and learning

Note-taking and note-making are stages that include the use of working memory and generative learning, but to different extents. ‘Working memory’ is used when listening to the lecturer and then writing notes accordingly within a short space of time during that period, while ‘generative learning’ refers to the meaning that students are able to construct, and refers to links or connections between new knowledge and prior knowledge (Peper & Mayer, 1978, 1986). However, when students have to listen, use their working memory to select relevant ideas and details, determine what should be noted and to record this, as well as engage in the mechanics of writing, i.e. spelling, grammatical errors and personal transcription style, they do not have the capacity to engage generatively (Kiewra, 1991; Makany et al., 2009). Therefore, it is unlikely that a student would be able to engage in much generative learning during a lecture. But, during the process of note-making students do not have to engage in as many tasks simultaneously, and would then have the capacity to form links and connections between prior knowledge and new knowledge. Generative learning may be reflected in notes that contain more than the lecturer has said or illustrated visually (Stefanou et al., 2008). Since meaning is deepened during the process of note-making, the quality of notes that students produce at this stage is likely to be dependent on their level of generative engagement.

3.1.3 The influence of self-regulation on the construction of notes and meaning-making

Self-regulated students are metacognitively, motivationally and behaviourally active in their learning processes (Boekaerts, 1997; Zimmerman, 1989; Zimmerman & Schunk, 2001). Therefore they would set academic goals, strategise how to achieve them, and monitor their progress towards their attainment (Butler & Winne, 1995). This means that self-regulated students regard learning as a self-directed process, so that they are proactive in constructing meaning when learning. In contrast, the less self-regulated students require external regulation (Boekaerts, 1997).

During the process of learning, it is not uncommon for students to come across content that they have difficulty interpreting at the first attempt. Self-regulated students are usually those who would be able to adapt or change their learning strategy to overcome the problem (Zimmerman, 2002), and in this process would manage their motivation so that they continue to cognitively process the relevant content (Butler & Winne, 1995). Therefore self-regulated students are aware of the need for quality and relevance of content knowledge, and their

values and motivation to attain a particular level of comprehension, **and** have planned strategies to complete academic tasks (Boekaerts, 1997; Butler & Winne, 1995; Zimmerman, 1989, 2002; Zimmerman & Schunk, 2001). Thus students' academic performance is influenced by their ability to self-regulate (Butler & Winne, 1995) and by their metacognitive ability (Zohar & Barzilai, 2013).

An ideal situation in a school environment, in terms of preparing learners for University, would be to cultivate their level of self-regulatory skills (Boekaerts, 1997). This is because the more students engage in self-regulated activities the more capable they become in refining their learning strategies. This means that by regularly engaging in self-regulated tasks students practice internal feedback regarding their approach to learning and their level of comprehension of content (Butler & Winne, 1995). Studies, such as that by Boekaerts (1997), have stated that learners can increase their level of self-regulation if they are provided with opportunities to actively and independently participate in their learning environment. Boekaert places the responsibility for creating learning environments that facilitate the learners taking responsibility for their learning on the teachers.

3.1.4 The influence of schooling background on academic performance at University

It has been well documented that the schooling backgrounds of some learners better prepare them academically than others (Ardington, Branson, Lam and Leibbrandt, 2011; Badger et al, 2001; Case & Deaton, 1999; Case & Lam, 2001; Case & Yogo, 1999; Van der Berg, 2008). In support of this view, South Africa's Council for Higher Education (CHE) reported in 2013 that the students' metacognitive level and academic performance at University is related to the type of schooling that they received.

In South Africa there are different types of schools: privately funded and generally well-resourced schools; government funded schools in upmarket areas, which are well-resourced, partially as a result of parental input; and government funded poorly resourced schools which are mostly located in poor rural communities. Funding is closely connected to the type of resources that students have access to at school; resources include access to libraries, laboratories, computers, and the level of qualification of teachers (Baloro, 2000; Christie & Collins, 1982; Fiske & Ladd, 2004; Kaburise, 2000; Setati, 2002). While the urban schools are multi-racial, the township and rural schools are attended almost exclusively by 'black' students. Nevertheless learners from all the different types of schools do gain access to University (Bharuthram, 2012; CHE, 2013; Parkinson, 2000).

Students who attended well-resourced schools usually had a learning experience that encouraged self-regulated learning, while those who attended the under-resourced ‘black’ schools usually learnt by rote (CHE report, 2013). In the context of my study, when students who are self-regulated enter University they are more likely to extend the notes that they receive during class, demonstrating their understanding of the need to apply self-regulatory strategies, through understanding the value of personalised notes.

My study came about as a result of the concerns of throughput at University. Many studies have shown the type of notes that students construct is related to the grades that they achieve on tests and examinations (Bonner & Holliday, 2006; Crawford, 1925; Di Vesta & Gray, 1972, 1973; Kiewra, 1991; Kiewra, 2002). It is therefore important that students view their notes as a means to engage with their learning, and not as a product which needs to be ‘known’. Due to the large class sizes and limited contact between lecturers and students, the notes that first years produce during lecture periods can be viewed as the primary interface between themselves and their lecturers (Ganske, 1981). In my study, based on the links between notes and performance, I wanted to determine the factors that influenced the quality of notes that students made, and to establish the extent to which the ability of students to self-regulate and make personalised notes was initially dependant on their schooling background. I also wanted to establish how first-years changed their approach to note-making as they gained experience of the university academic environment. It was hypothesised that my study would show that self-regulated students are more likely to personalise their notes, and therefore have a deep approach to learning compared to underprepared students.

3.2 Theoretical framework for this study

Following the idea of Zimmerman and Schunk (2001) that constructivists assume that there is an intrinsic motivation to deepen meaning during learning, my study is theoretically framed within the constructivist framework. Constructivism is a theory that has four primary fundamentals: (1) defining how knowledge is constructed, (2) the influence of the learning environment on the learner, (3) the responsibility of learning being held by the learner, and (4) contextualising learning within real-life situations (Loyens, Rikers & Schmidt, 2008).

Piaget’s (1964, 1968) description of the processes of ‘disequilibrium’, assimilation and accommodation’, ‘compensation and equilibrium’ explains learning from the perspective of constructivism. He believed that learning is an independent and individual process (Davis, 2004; Piaget, 1968). During the learning process, when students encounter new knowledge

which does not fit into their existing knowledge structure, they experience a state of disequilibrium. They would then ideally attempt to make meaning of the new knowledge by reasoning out how this fits into their current understanding, or they may eventually achieve integration between new and prior knowledge. Piaget explains that in attempting to create new meaning students may move through compensation or they might have to revise their original understanding. If the new knowledge is incorporated into the existing knowledge structure, this new state is known as 'equilibrium'. This process of constructivism, as described by Piaget (1964) and known as his theory of cognitive development, can also be used to view the process of note-taking and note-making, and thus can be used to categorise the level of understanding that students have presented within their notes. Students who have paraphrased their study notes, and whose notes contain more than what appears on the lecturers' visuals, are likely to have used their notes to engage with their understanding of content, whereas students whose study notes are a close reflection of the lecturers' slides will simply have transcribed them, and are likely to indicate a surface approach to their learning. Piaget's cognitive developmental theory therefore provides a 'scale' to investigate the quality of the students' notes, as elaborated in the methods section of this chapter.

In an ideal scenario the students' construction of their notes should begin with pre-reading the relevant section in the textbook. This would enable them to be aware of gaps in their knowledge. Ideally, during class students should only capture what they regard as key to the lecture. These key points should be relative to their understanding of the topic. However, researchers, such as Baker and Lombardi (1985), show that students generally do not have the necessary expertise to identify and capture key content and relevant details without some guidance from their lecturers, and thus in their report they stated that students captured less than 50% of content that was relevant to tests and examinations.

Even though students enter University having experienced 12 years of schooling they still are unable to effectively apply deep learning approaches to the construction of their notes (Fraser & Killen, 2003; Kiewra, 2002), and due to the lack of training in note-taking and note-making many first-year students find application of these skills overwhelming at University (Van Meter et al., 1994). Within the context of this study this means that students would not be adequately prepared for learning in the independent and self-directed approach that is required by their lecturers. This may be due to the extensive assistance provided at school, and which is no longer available when they enter University (Macdonald, 2000).

At school, teachers generally monitor and provide feedback on the academic progress of each individual learner (MacDonald, 2000). Furthermore, learners are usually only required to reproduce and apply information that the teacher has made available to the class (Boekaerts, 1997). In other words, at school, learners are expected to imitate and practice the skills that teachers have modelled for them. Since students do not receive as much direction in their learning at University as they do at school, they need to become more self-directed in order to achieve academic success (Torenbeek, Jansen & Suhre, 2013). However, most students are not self-regulated, and most teachers are ill-equipped at converting students into self-regulated learners (Boekaerts, 1997). This means that, for most students, first year would be the first time that they would have to take charge of compiling their own notes in an act of self regulation of their learning.

The notes that students make are an aid that reminds them of the concepts that were covered in class, and if they personalise their notes then this revised set acts as a 'sign' of their understanding in relation to the content that was in their class notes. Notes can thus be viewed in terms of Vygotsky's conceptions of 'tools and signs'. According to Vygotsky, a 'psychological tool' is analogous to a physical tool, i.e. the tool assists people to achieve a particular aim or to fulfil a particular task at a cognitive level, and this process is meant to change the external world in some way (Vygotsky, 1978, 1987a and b). Thus, Vygotsky distinguishes between the 'internal' state of individuals and the 'external' environment or society which influences individuals. Vygotsky's definition of a 'sign' stems from his definition of a 'psychological tool'. A 'sign' differs from a 'psychological tool' on the basis that the change is at an individual level and does not change the external world in any manner (Vygotsky, 1987b). In this study Vygotsky's (1978) definition of 'signs' is used to describe the transformed and personalised notes that students make in relation to their level of learning, while the lecturers' slides represent a 'psychological tool'.

In the context of my study, the way in which students compile their notes would carry meaning that is specific to themselves and would thus act as a sign. Students may change the way in which they structure their notes as they gain experience within first year. Thus, the process of making personalised notes, which carries a particular meaning and is based on the students' prior understanding, could assist them to find gaps in their knowledge. Therefore the student could use the process of note-making as a diagnostic device to enhance their learning.

3.3 Context of the present study

In the last five years there has been increased concern regarding student performance and throughput in a first-year biology course at the South African University in which this study was conducted. Student throughput has been under scrutiny because it has become a factor which affects government funding to universities, and wastage of resources and manpower.

Within the University, lecturers in an introductory biology course had noticed that the majority of first-year students seemed passive during lectures, and appeared to only capture information presented on slides shown to the class. The lecturers were therefore concerned that students had not captured sufficient detail of content that had been covered verbally during the lecture period, and wondered whether this was a contributing factor to the poor grades that students obtained in tests and examinations. Since the first year intake comes from disparate school backgrounds, the question arose concerning whether school experience would influence note-taking and subsequent note-making practices and whether these would influence learning and academic performance in this specific context. There is little research of this kind within the context of the University, so the students' approach to their construction of notes in biology provided the research field, and the notes that students used when studying for tests and examinations were analysed and compared to grades they achieved on these assessments. Most students used their class notes or the lecturers' slides when studying, and a few had personalised and transformed their class notes when learning. Data was thus collected within a natural setting.

The study involved an in-depth analysis over a long period, in order to also determine whether any shifts occurred in:

- the students' views on their note-taking and note-making practices
- the notes that they had made
- their academic performance
- and the reasons for any shifts in their views and/or practices of their construction of notes.

This initiative was aimed at searching for opportunities which would assist in enhancing student performance at first-year level. The findings lead to recommendation on how students could undertake constructive note-taking and making practices, thereby making the learning process more meaningful.

3.4 Methods

This study was conducted in a first-year course, Introductory Life Sciences (ILS), taught in a science faculty at a South African University. The study commenced in Semester 2 in 2009 and ended after Semester 1 in 2011 with the calendar year running from January to December. ILS is a prerequisite for all second-year major courses in biology. The course runs over two semesters, with each semester comprising two terms. During the first semester students were taught by two Schools, for the purpose of this study these schools are distinguished as 'School A' and 'School B'. School A taught topics in the first semester centred at the molecular and cellular level, while in the second semester students were taught by School B which focused on the macro-environment. During the years in which the study was conducted approximately 500 students enrolled for the course. These students were divided into two groups due to the large number of registrants with the consequence that lecturers repeated each of their lectures. Lecture sessions were 45 minutes each.

Four lectures per year were selected for this study. This resulted in eight data sets for the overall study. Lecturers participated in this study on a voluntary basis. Lecturer 1 lectured in term 1, lecturer 2 lectured in term 2, and lecturers 3 and 4 lectured in term 3. Lectures were video-taped and transcribed for analysis. Lecturers 1 and 2 made their slides available to students on the learning management system while this was not the case for lecturers 3 and 4. The lecturers who lectured first semester remained the same over the duration of this study, but different lecturers lectured the topics selected for semester 2 in 2009 and 2010.

Ethics clearance for this study was granted by the Universities' Research Ethics Committee (HREC Non-Medical Protocol number: 2009ECE114).

This study was conducted using only one of the two groups in the ILS course. Since students had been randomly assigned to the groups on registration, the first years from one group could be regarded as typical of the whole ILS cohort. Thus, all students in one of the ILS classes were provided with a questionnaire which probed their school and University expectations and experience in the practice of note-taking and note-making (Appendix 1). Participation was voluntary and there was an average of 25% responses per year from a class of approximately 250 students. Thirty students per year were then selected from the larger group for this study; therefore there were a total of 90 students who participated in this entire study. The students' responses to the questionnaire, which provided the criteria for the final

selection of students to continue with this study, were analysed according to each of the following eight aspects:

- the factors that they thought would make up a good set of notes,
- prior schooling practice in note-taking and note-making,
- how notes were used for test and examination preparation at school,
- their expectations of the University lecturer in terms of providing them with notes,
- how they used the slides provided at University,
- how they added to the information provided on the lecturers' slides,
- how they had recorded notes during the lecture,
- what their reasons were for note-taking and note-making.

When analysing the questionnaires on the basis of the students' expectation of their role and their lecturers' role in their construction of notes, three categories of students were defined i.e. *self-regulated*, *developing*, *underprepared*. The '*self-regulated*' category of students was defined as those who generally expected to be independent and self-reliant in terms of their note-taking and note-making in first year, while the '*underprepared*' category of students referred to those students who usually expected that notes would be provided by the lecturer. The '*developing*' category of students was defined as those who expected to take on some responsibility but also depended on extensive lecturer assistance and support. From their responses to the questionnaires, students were placed into one of these three categories. Ten students per category per year were then selected to be interviewed in order to probe their learning habits more deeply and to gain further insight to their expectations and practices on note-taking and note-making during their first year. This resulted in gathering interview data from all 90 students in the overall study. Each student participated in one-on-one semi-structured interview sessions (Appendix 2). The first of these sessions was conducted in Semester 1, the second in Semester 2, and the third at the beginning of the following year. Therefore the 2009 cohort participated in two interviews, the 2010 cohort in three interviews and the 2011 cohort partook in one interview. Thus, there were 180 student interviews that were transcribed and analysed.

The topics selected for the study were based on the familiarity of content to students, thus two topics that were an extension of the school syllabus were chosen ('Meiosis and Mitosis' and 'The Animal Reproductive System') and another two topics which were new to students

(‘Cell Communication’ and ‘Metabolism’) were selected for this study. ‘Meiosis and Mitosis’ and ‘Cell Communication’ were lectured in semester 1, the other two topics were lectured in semester 2. Students’ notes for the four lectures selected for this study in 2010 and two sets in each of 2009 and 2011 were photocopied at the start of the interview session, i.e. after a period where students could edit class notes. This resulted in the analysis of a total of 240 sets of notes for this study.

A rubric (Appendix 3 page 150) was developed as a research tool and was used as a starting point for the analysis of the students’ notes. There are two dimensions to the rubric. One dimension represents the levels of students’ cognitive ability that were considered necessary at the University level. The other dimension represents the knowledge and skills that students built up as experience at University were gained. The rubric enabled me to evaluate the quality of the students’ notes in terms of structure, coherency, accuracy of content, and the development of ideas. The construction of the rubric was based on SOLO taxonomy. SOLO taxonomy is used to evaluate a student’s cognitive ability on certain tasks. Here focus is on the student’s mental ability. SOLO taxonomy defines different cognitive levels and knowledge dimensions (Biggs & Collins, 1982). Cognitive abilities are defined at the structural, conceptual and procedural level, and show an increase in mental abilities as one move up each of these cognitive levels. In my study, the application of the different cognitive levels can be gauged by analysing students’ notes. The more links to prior knowledge and greater incorporation of the students’ opinion the higher the cognitive level of the student in that piece of work. This was taken into consideration when the rubric was developed for the purposes of this study. The qualitative results from the analysis using the rubric are referred to as the ‘notes score’. A set of notes from each of the categories has been provided in Appendix 4 (*self-regulated*), Appendix 5 (*developing*) and Appendix 6 (*underprepared*).

The notes that students used for study purposes, and which were copied for this study, were also quantitatively analysed according to a comprehensive set of lecture notes that I had made. With permission from the lecturers I attended and video-taped each of the four lectures per year selected for this study. I transcribed the video-tape to produce my own comprehensive set of notes. Student notes were analysed by looking for ‘information units’ which are defined as blocks of information or whole ideas (Hughes & Suritsky, 1994), and which may include a sentence or a clause or stand-alone phrase. This method for analysis of

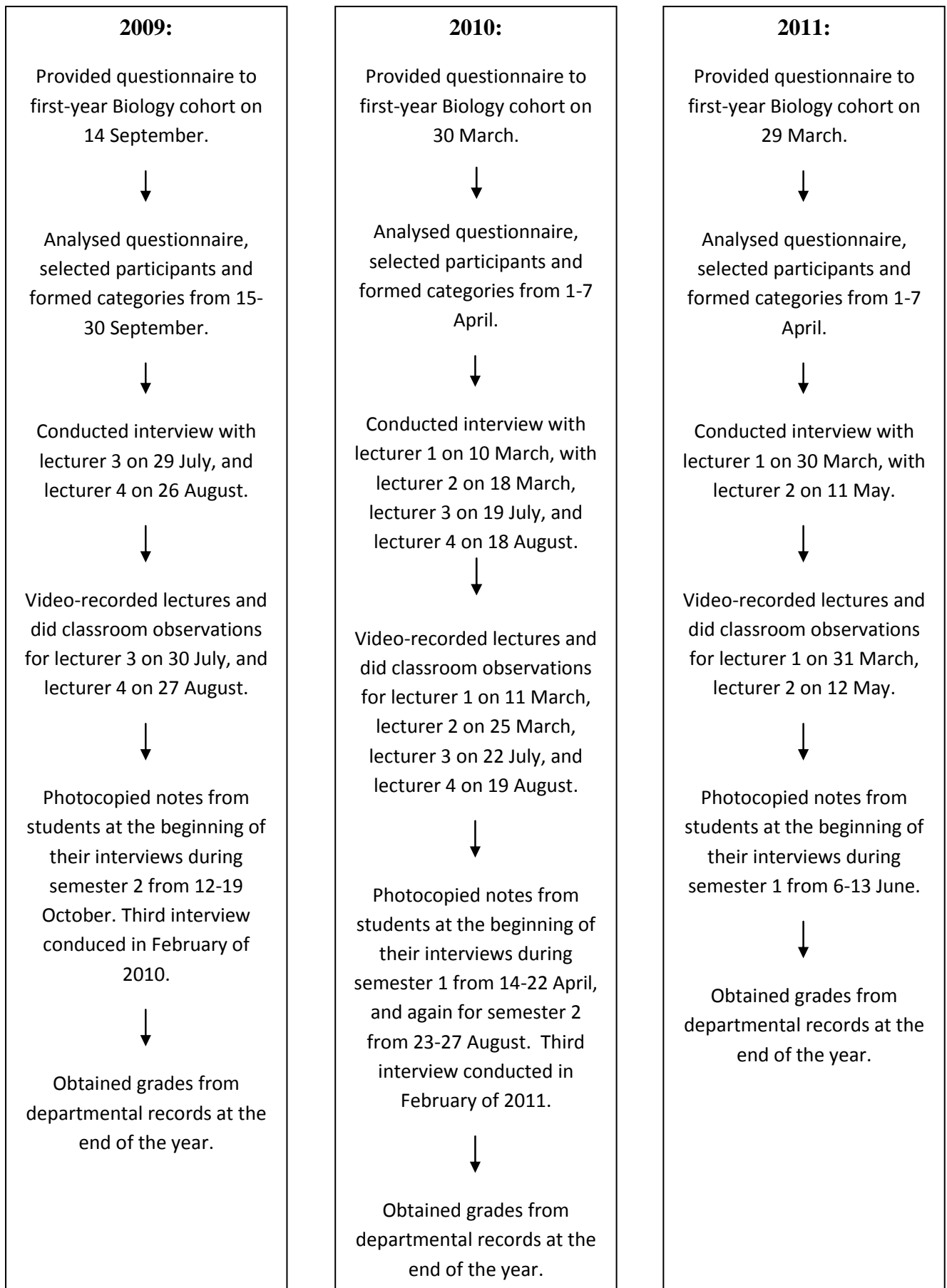
notes has been used as a measure in numerous studies (such as DiVesta & Gray, 1972; Dunkel, 1988; Hughes & Suritsky, 1994; Kiewra, Benton, Kim, Risch & Christensen, 1995) and allowed me to analyse (1) completeness, (2) amount of content noted from the verbal and visual lecture, and (3) additional information from other resources (such as the textbook).

During interviews data was gathered on what students' expected of the University lecturers' in terms of the provision of notes, and their actual University experience. The types of notes that the three categories of students made were analysed and compared. Two peers in the education field independently evaluated 10% of the students' notes in my study and there was over 95% agreement with each of the reviewers.

Investigations were conducted to determine whether there was any relationship between these categories of students, the notes that they made, their approaches to learning, and their academic performance. Grades for four test and four examinations in first year were obtained from departmental records. Two tests and two exams were written at the end of each term per semester. Data were quantitatively analysed using ANOVA Single factor analysis to determine whether there was any significant difference amongst the three categories of students. When a significant difference was present, KyPlot (Tukey-Kramer test: Pairwise Comparisons for One-Way Layout Design) was used to determine exactly which two categories were significantly different to each other.

The visual below provides a diagrammatic representation of the method for this study:

Flow chart for gathering information for study



3.5 Results and Discussion

The aims of this study were to determine (1) the extent to which students' school experience influenced their expectations and practice in constructing notes in their first year at University, and (2) whether there was a relationship between the notes that students made and their academic performance. This study is based on Zimmerman's definition of self-regulation, and on the wealth of studies related to the students' construction of notes. Kiewra contributed extensively to literature on the function of notes in student learning. The focus of his studies moved from defining effective note-taking skills (Kiewra, 1984b), to how students could use notes to engage generatively in their learning (e.g. Benton & Kiewra, 1986; DuBois & Kiewra, 1996; Kiewra, 1985a and b; 1988, 1989, 1991; Kiewra & Frank, 1988; Kiewra et al., 1995; Kiewra et al., 1989; Risch & Kiewra, 1990; Titsworth & Kiewra, 2004), and to the ways in which teachers could assist students' to learn generatively by means of different layouts of notes (Kiewra, 2002, 2005, 2009). The findings in the current study support literature by Zimmerman and Kiewra. However, the contribution that my study offers in extending our understanding of the role and importance of student notes to their learning is that it reflects on the impact of the students' school experience on their expectation of note-taking and note-making in first year, and on their approach and practice to note-making and learning when they enter university.

One of my findings was that students' school experience was critical in influencing their **expectation** of their role and their lecturers' role in their construction of notes in first year. This finding is linked to the second, which is that their school experience influences their note-making **practice** in their first-year. This led to another finding which supports and confirms existing literature, i.e. the students' construction of their notes is related to their depth of learning, and thus to their academic performance.

With regard to my first two findings, which focus on the relationship between school background and University experience and practice, it was important to establish what kind of schools students had attended prior to their first year at University (Table 3.1); and more importantly, what kind of note-taking and note-making practice they had experienced at school (Table 3.2).

Table 3.1: Number of students who attended the differently resourced schools

	2009	2010	2011	Combined
Rural school	7	4	8	19
Public school	14	18	18	50
Private school	9	8	4	21

More students in the study sample had attended public schools, than had attended rural and private schools (Table 3.1). In my study, it was evident from the students' responses to the questionnaires that they had experienced different learning environments at the different schools, and had different expectations of their role in making their own notes. Three categories of students emerged, and based on their responses, participants were categorised as being either a (1) *self-regulated*, (2) *developing*, or (3) *underprepared* student.

The sections that follow focus on the school practices and University expectations and experiences of each of these categories. Tables 3.2-3.6 and 3.12 show the analysis of information gathered from the questionnaires.

3.5.1 School experience influences first-year expectations and practices in note-taking and note-making

Data collected in this study showed that teachers at school provided support in the compilation of the learners' notes, but that the extent of support differed at different schools. While 63% of the *self-regulated students* reported constructing their own notes at school, 87% of the *underprepared* and 80% of the *developing students* had said that they transcribed the notes that the teacher provided (Table 3.2). However, when students move from school into University, their learning and thus academic success is mostly their responsibility; but the students' schooling background does not always provide them with the necessary foundation to take on this self-directed approach (MacDonald, 2000). As discussed below, the results in Table 3.2 explain why some students considered that note-taking and note-making was their responsibility in first year, while other students believed that the lecturer would provide their learning material.

Table 3.2: Students' practice of taking and making notes at school (%)

	Constructed own notes (%)	Used the textbook to compile notes (%)	Transcribed notes from teacher explanations during class (%)	Copied notes from the chalkboard or used handout provided by teacher (%)
<i>Self-regulated students</i>	63	40	33	63
<i>Developing students</i>	53	43	30	80
<i>Underprepared students</i>	37	40	30	87

*This table and the ones that follow show that the percentages in each category add up to more than 100%. This is because the students sometimes reported that they had a mix of experiences at school, and this range of experience reflects in the tables.

Self-regulated students

As is evident in Table 3.3, larger numbers of the *self-regulated students* (27%) did not expect the lecturer to provide them with any form of notes. In fact only 7% of this category expected to receive a comprehensive set of the lecturers' notes, and only 6% of them expected that the lecturers' slides provided **all** the material that was required for their tests and examinations (Table 3.3). Since the *self-regulated students* were accustomed to having a bigger role in constructing their notes at school (Table 3.2) they entered University with the expectation that they would have to continue with this practice (Table 3.3).

Table 3.3: Students' expectation of the type of handouts they would receive from their first-year lecturers

	No expectation of any handouts (%)	Get handouts /slides (%)	Get handout with all detail (%)	Handouts will show examinable content only (%)
<i>Self-regulated students</i>	27	43	7	6
<i>Developing students</i>	13	40	30	20
<i>Underprepared students</i>	0	40	33	16

* Students sometimes reported that they had a mix of expectations of their lecturers at University; therefore this table shows that the percentages in each category add up to more than 100%.

Since at school learners from all categories did not often note additional material from the teachers' explanations during the class lesson (Table 3.2) it is not surprising that only a few students (between 3-10%) said that they added the information from the verbal lecture onto their notes in first year (Table 3.4).

Table 3.4: Students' view on their initial use of the slides provided by their lecturers

	Made own notes using slides as a guide (%)	Studied slides with own notes (%)	With textbook (%)	Put in content from verbal lecture (%)	Studied slides (%)	Made summaries of slides (%)
<i>Self-regulated students</i>	33	10	33	10	3	3
<i>Developing students</i>	23	13	23	3	3	10
<i>Underprepared students</i>	20	7	17	3	37	20

During interviews generally the *self-regulated students* reported that their academic success at University was dependent on listening to the lecturer in class. They also commented that note-making helped them to develop their understanding of content. Thus, when these students were questioned about their aim when revising their notes after class many of them said that they placed emphasis on selectively writing down content from the lecture that was relevant to their understanding (53%) and noting relevant material from the textbook (44%) (Table 3.5). Students who did this understood that if they personalised and transformed their notes these revised notes would benefit them in deepening their understanding. To them notes represented a means to engage with their learning. However, in terms of my analysis, such personalised notes represented a 'sign' in the Vygotskian sense, of their understanding.

Table 3.5: Students' thought process when note-making in first year biology

	Links to other content (%)	Important to my understanding (%)	Difficult concepts (%)	Write logically (%)	Text-book guide (%)	Examinable material (%)	New content (%)	To keep focused and attentive (%)	All visual lecture content (%)	All verbal lecture content (%)	All content from lecture (%)
<i>Self-regulated students</i>	10	53	10	17	44	25	10	10	10	37	23
<i>Developing students</i>	15	49	15	24	27	54	5	3	3	20	30
<i>Underprepared students</i>	0	51	5	3	37	48	10	0	13	20	10

As the year progressed, they related that they added cues into their class notes so that they could easily identify concepts that they had not grasped fully in class, and needed to review and engage with after class in order to gain a fuller understanding of content. More of the *self-regulated students* (33%), compared to the other two categories of students, reported that they had used the lecturers' slides only as a guide for making their own notes (Table 3.4). Thus, this category of students were aware that the lecturers' slides should not be used as the only material that needed to be learnt, they saw the lecturers' slides as a means which they could use to shape their understanding. Thus, the *self-regulated students* understood the lecturers' slides as part of the external environment, and thus a 'tool' in the Vygotskian sense.

In this study approximately 40% of all categories of students stated that they used the textbook in constructing their own notes at school (Table 3.2). When they entered University they generally did not place emphasis on using the textbook. About a third of the *self-regulated students* and less than that of the *underprepared* and *developing students* said that they had **anticipated** use of this resource to revise their notes at University (Table 3.4). The present study also shows that generally when students entered first year they viewed the University textbook as a **possible supplement** to content covered during the lecture, and not as **mandatory** to expand their understanding and notes. Considering that there are schools in South Africa that lack access to textbooks (Legotlo, Maaga & Sebego, 2002; Mji & Makgato, 2006), the students' experience at these schools would not include reference to textbooks since the teachers' notes would have been all that was available for their learning. These students would not have been exposed to habitual use of texts to supplement their notes. The

results from this study support Doreen’s (1999) findings that due to the limited independent reading students were required to do at school, they do not read with much effort or focus when they come to University. This leads to students’ generally experiencing difficulty in critically reading, evaluating and discussing the material (Doreen, 1999).

But, the current study also shows that by the second term of Semester 1 more than 80% of the *self-regulated* students, 60% of the *underprepared students* and 67% of the *developing students* reported that they made use of the textbook to extend their notes and deepen their understanding (Table 3.6). This provides evidence that students adapt to the ‘new’ academic environment as they gain experience in their first year.

Table 3.6: Student view of their use of resources to revise notes after one month of experience in first year

	Textbook (%)	Library (%)	Internet (%)	e-learning resource (%)	Compared notes with friend (%)
<i>Self-regulated students</i>	83	7	13	3	7
<i>Developing students</i>	67	10	40	3	3
<i>Underprepared students</i>	60	3	23	3	0

At University students are expected to independently read a variety of complex texts (Bharuthram, 2012). This was confirmed in the current study because it was established from interviews that lecturers expected students to extend their class notes by adding material from the textbook. Therefore, based on the students’ experience of note-taking and note-making at school it seemed that the *self-regulated students* were more likely to meet the expectations of the lecturers. Bharuthram (2012) claims that prior practice in reading with comprehension at school, i.e. the extent to which the textbook was used at school for this purpose, enables students to more easily adapt to the level of reading required within the University system. The results from the present study support this claim. Furthermore, similar to findings of other studies, students who have experienced a diverse learning environment at school, such as having access and the opportunity of using different learning recourses (the library books,

the internet, textbooks) have more opportunity, skill and confidence to engage with material and therefore are able to form stronger cognitive connections (CHE report 2007, 2013). Data from my study shows that the highest percentage (40%) (Table 3.6) of students from the *developing* category, compared to the other two categories of students, said that they used the internet when revising their notes after class. However as shown later on Table 3.9, the analysis of the notes obtained from the *developing students* in 2010 indicated that, similar to the other categories of students, there was a decrease in the amount of information students noted from resources other than that presented in the lecture from the beginning of semester 1 to the end of semester 2. In fact, the students' notes were often a close reflection of the content provided on the lecturers' slides. The majority of the *developing students* attended public or rural schools, and although at university they had access to the internet, they still did not have the necessary experience to understand how they could effectively use this resource to develop their notes (and their knowledge).

In order to determine the extent to which students personalised their notes it was important to establish the amount of detail that first-year lecturers' provided during their lectures. Lecturers' slides varied in the quantity of detail that was presented; slides provided by some lecturers comprised of detailed, wordy content and examples for the topic whilst slides presented by other lecturers contained mostly key-points or key-words and/or few examples (Table 3.7). Lecturers verbally elaborated on these key points when they explained the concepts to the class during the lecture. While some lecturers provided only 8% additional information in the verbal aspect of their lecture compared to the amount of detail they had on their slides, others provided as much as 76% new information in their verbal elaborations during the lecture (Table 3.7).

Table 3.7: The lecturers' use of slides in the classroom

	Semester 1				Semester 2			
	*L1 2010	*L1 2011	*L2 2010	*L2 2011	*L3 2009	*L3 2010	*L4 2009	*L4 2010
Number of facts provided in lecture	144	79	141	291	169	207	123	102
Number of facts on slide presentation	81	17	51	198	169	96	29	39
Number of facts only in verbal lecture	63 44%	62 8%	90 64%	93 32%	‡ -36 -21%	111 54%	94 76%	63 62%
Average time spent per slide (minutes)	1.8	2.4	1.26	0.75	1.74	2.12	4.39	8.38

* 'L' denotes 'lecturer', the number that follows distinguishes one lecturer from another.

‡ represents the amount of content on the slides that was not mentioned during the lecture

The kind of notes that students made was distinguished on the basis of two factors. The first factor, i.e. the quantity of notes was reflected by the number of facts that were present in the copies of the students' notes (Tables 3.8 and 3.9). The second factor was the quality of their notes (Table 3.10). The quality of notes is termed the 'notes score' and provides a reflection of the structure, overall coherency and development of ideas in the students' notes, as explained in the 'methods' section. Thus, students who had paraphrased notes and/or had added in more information than that presented on the lecturers' slides, and in the lecturers' explanations during the lecture, set out their notes with clear sub-ordinate and super-ordinate contents which showed flow and logic scored higher points on the rubric used for this qualitative analysis of notes than students who did not fulfil these criteria.

Table 3.8: Average number of facts in students' notes

		Lecturer 1	Lecturer 2	Lecturer 3	Lecturer 4
2009	<i>Self-regulated</i>	-	-	93	34
	<i>Developing</i>	-	-	85	23
	<i>Underprepared</i>	-	-	87	30
2010	<i>Self-regulated</i>	79	68	164	66
	<i>Developing</i>	44	81	132	43
	<i>Underprepared</i>	37	65	130	50
2011	<i>Self-regulated</i>	35	46	-	-
	<i>Developing</i>	40	52	-	-
	<i>Underprepared</i>	71	76	-	-
Combined ³ average	<i>Self-regulated</i>	57	57	129	51
	<i>Developing</i>	42	63	106	31
	<i>Underprepared</i>	56	69	109	41

The *self-regulated students* generally noted more facts (Tables 3.8), and produced notes of a higher quality (Table 3.10) in 2009 and 2010 than in 2011. In 2010 and 2011 all students attended a compulsory workshop which used writing as a means to promote critical thinking; this is elaborated later on (Brenner & Nichols, 2013), this could explain the change in trend from 2009 and 2010 to the trend in 2011. Students in this category may have become more selective of the information that they needed to note in 2011.

In 2010, the *self-regulated students*, compared to the other two categories of students, started each semester with supplementation of the content noted during a lecture with information from other resources, although the quantity of content that was captured in their notes generally declined by mid-semester in all student categories (Table 3.9). The 'additional content' that students had added into their notes was identified as material that the lecturer had not covered in the visual and verbal aspects of the lecture. The decline in the amount of additional material present in the students' notes is related to the detail that lecturers provided on their slides (refer to Dukhan et al., chapter 4).

³ 'Combined' data, in this chapter, reflects an average of the individuals in the entire cohort, and is not an average of the averages attained in each year of the study.

Table 3.9: Average additional content present in students' notes from resources other than the lecture

		Lecturer 1	Lecturer 2	Lecturer 3	Lecturer 4
2009	<i>Self-regulated</i>	-	-	0.3	2.1
	<i>Developing</i>	-	-	0.9	1.2
	<i>Underprepared</i>	-	-	0.3	1.1
2010	<i>Self-regulated</i>	25	4.4	10	2
	<i>Developing</i>	10	3.3	5	0
	<i>Underprepared</i>	0	3.4	3	1
2011	<i>Self-regulated</i>	2	3	-	-
	<i>Developing</i>	3	5	-	-
	<i>Underprepared</i>	21	5	-	-
Combined average	<i>Self-regulated</i>	13	2	5	2
	<i>Developing</i>	7	3	3	1
	<i>Underprepared</i>	12	5	2	1

Moreover, the *self-regulated students* pointed out the necessity in reviewing and revising notes shortly after the lecture so that they could remember more details from the verbal lecture and more importantly so that they could better recall their understanding and interpretation of the material provided in the lecture. Most of these students had transformed their class notes through the use of a matrix, mind map or flow chart. They generally had more coherent notes (Table 3.10), and were more aware of their level of understanding, and thus of any gaps in their understanding. Therefore, these students are more metacognitively active in their learning process, and expressed an internal motivation to monitor their progress and level of understanding than the other two categories of students.

Table 3.10: Average 'notes score' ⁴ representing quality of notes

		Lecturer 1	Lecturer 2	Lecturer 3	Lecturer 4
2009	<i>Self-regulated</i>	-	-	12	11
	<i>Developing</i>	-	-	9	9
	<i>Underprepared</i>	-	-	9	9
2010	<i>Self-regulated</i>	21	22.9	19	19
	<i>Developing</i>	17	19	13	9
	<i>Underprepared</i>	12	14	13	13
2011	<i>Self-regulated</i>	18	19	-	-
	<i>Developing</i>	18	20	-	-
	<i>Underprepared</i>	18	20	-	-
Combined average	<i>Self-regulated</i>	20	21	15	15
	<i>Developing</i>	18	19	11	9
	<i>Underprepared</i>	15	16	11	11

Also, due to the preparation of detailed and personalised notes the *self-regulated students* generally required less time to study for tests and examinations. Therefore, more of these students also viewed their note revision as directly influential to their academic performance. Thus it is likely that transformed and revised notes offer an indication of a transformation in the students' understanding. Therefore, in reference to Piaget's cognitive developmental theory, student's could use the process of transforming and personalising their notes to identify the gaps in their understanding, and thus could reach a state of equilibrium in their comprehension as they make links between new and prior knowledge during the note-making stage.

The notes score for the *self-regulated students* generally remained constant as the year progressed, however the notes scores were lower in 2009 compared to subsequent years (Table 3.10). The difference between the notes score of the 2009 cohort and the 2010/2011 cohorts is again attributed to the workshop. As noted earlier on, students in this category became more selective in the content that they noted in 2010 and 2011 compared to 2009. There was only a slight difference between the note scores of the 2010 and 2011 cohorts.

⁴ The maximum notes score that can be attained is 24 points. If students did not add any additional information onto their slides or notes made in class then they received zero for that specific part of the mark allocation.

Developing students

Since the *developing students* were accustomed to receiving a set of notes from the teachers at school (Table 3.2), it was not surprising that only 13% of them had no expectation of receiving notes from the lecturers in their first year (Table 3.3). A further 30% of this category felt that they would receive a comprehensive set of the lecturers' notes (Table 3.3). It therefore seemed that the school experience of these students led them to the view that the lecturers would provide a copy of all their learning material, and they therefore relied less on a self-directed approach to making notes.

20% of students in this category expected that the lecturers' slides provided **all** the material that would be assessed on tests and examinations (Table 3.3). It is therefore not surprising that at the beginning of the year only 3% of the *developing students* indicated that they added information from the verbal lecture into their notes (Table 3.4). Moreover, 54% of them related that during the lecture they only noted content that they thought was directly relevant to tests and examinations (Table 3.5). A comment from a first-year student in the *developing* category depicts that unlike at University where their understanding was tested, at school they had to 'know' their work.

'...Like you'll study and you'll be confident and you'll say I know this work and even when you in the paper and you finish the paper you say I did know the answers, and when you look at your grade its like completely different to what you had expected...' '...test 3 for ILS I went for all lectures, I studied, I did everything that I was supposed to do, that I thought I should do-, I didn't make it, I failed with forty [%]...' (O422010)

As experience within the University environment was gained, the *developing students* generally started to place more emphasis on reading and understanding the information on the lecturers' slides. They mentioned that this strategy made the content more recognisable when they studied for tests and examinations. They also generally reported that it was important for them to transform and reconstruct their notes according to their understanding because this task made studying easier. However, when the notes from the *developing students* were analysed there was no evidence of any transformation of the content provided on the lecturers' slides. Therefore, although Van Meter et al. (1994) indicated that students may be aware of strategies that they could use to improve their note-making, the current study shows that students still did not necessarily implement these strategies. This may also provide a reason that in 2009 and 2010 this category of students usually noted less content than the *self-regulated* category.

Underprepared students

The *underprepared students* usually received notes from their teachers at school (Table 3.2); and **all** of these students anticipated that they would receive assistance from the lecturer in the construction of their notes (Table 3.3). 33% of this category of students felt that the lecturer would provide them with comprehensive slides (Table 3.3), therefore it is understandable that only 3% of the *underprepared students* reported adding the lecturers' verbal explanations into their notes (Table 3.4). Compared to the *self-regulated students*, a larger proportion of the *underprepared students* (23%) used the internet as a resource to extend their notes (Table 3.6). In contrast to the other two categories of students a smaller proportion of *underprepared students* (20%) reported that they had used the lecturers' slides as a guide to making a personalised set of notes (Table 3.4). Additionally, this category had the smallest percentage of students (60%) who referred to using the textbook to supplement their University notes (Table 3.6). While in 2009 and 2010 *underprepared students* generally made the least notes, in 2011 they made the most notes (Table 3.8). In 2011 they had additionally noted the highest amount of information from material other than that provided in the lecture (Table 3.9). Again, this could be due to the workshop which the 2010 and 2011 cohorts had attended. The workshops facilitated in the students' move from viewing slides as the content which they 'needed' to learn, to transforming their notes to suit themselves, and thus they began to see their revised notes as a 'sign' of their comprehension.

Even though 48% of the *underprepared students* related that during the lecture they noted content that they thought was directly relevant to tests and examinations (Table 3.5), during interviews it emerged that in their first semester they did not realise that the information the lecturer had spoken about in class was examinable, if they had not received it in some other tangible form. This probably stems from this category of students rote-learning material that teachers provided at school, and not having to extend their notes or deepen their knowledge further after class (Table 3.2). A comment from a first-year *underprepared student* reflects this view:

‘...whatever the teacher said you took it just as is, and you studied it, and like at high school they'd ask you what is photosynthesis and then - and in your notes it will have photosynthesis is this and this.... And then you write that exactly down in the test, so high school is like a regurgitation of all your notes. now it ask us like, - like confusing sentence, but it has something related to photosynthesis but it will

tie up to some other section in the textbook and then you realise that okay, how I wrote notes is not going to help me now so that's-, and you have to link everything up together...' (R272010).

Also, during interviews it was found that generally all categories of students felt that they had not developed the skill of listening, understanding and constructing their notes to the extent that was required and expected within the University setting. A comment from a first-year showed that at school they were only required to learn content provided on the teachers' notes, however at University, they were expected to pay attention and note material during the lecture:

'...in school, it was just a lot of droning, you tuned out, you had the work so why bother listen, but here [at University] you have to listen to what you have to write down and it might not be in the work [lecturer slides] or in the textbook...' (O472010).

During interviews it was evident that by Semester 2 all categories of students generally recognised the value of actively listening and understanding in class. They saw these activities as being critical to their academic performance. Therefore, through reflective practice, as they gained experience many from the *underprepared* category felt that if they only listened to the lecturer, and did not note content in class, then they would better comprehend the verbal lecture. These students reported that they believed the majority of the answers to tests and examinations lay within the verbal and not the visual lecture.

Thus much as students in the *underprepared* category identified a strategy to achieve their goal, listening and not noting content was only a short-term solution. Due to the workload covered in each semester, students were unlikely to be able to remember the details of the lecture or later be able to identify those sections in the textbook; this would have lead to issues with them identifying, remembering and understanding examinable content. The self-regulation process involves the setting of achievable goals (i.e. the forethought phase), employing strategies to attain the goals, monitoring and evaluating progress, effective time-management (i.e. the performance stage), and adapting future learning methods (i.e. the self-reflective phase) (Zimmerman, 2002). If the *underprepared* category also noted content from the lecturers' explanations then they could have built a more comprehensive set of notes that would have better served their learning for tests and examinations.

A large portion of the *underprepared students* indicated that when studying they either used only the lecturer's slides (37%), or made summaries of the slides (20%) (Table 3.4), and 16%

of them expected that the slides would provide all the material that they needed to know for tests and examinations (Table 3.3). Thus, this category of students (similar to the *developing* category) generally viewed the lecturers' slides as the product that they needed to learn. As a result, the students who perceived that they had received detailed slides also viewed the lecturer as being responsible for providing them with a copy of notes. However, this approach results in the students not learning in sufficient detail or with sufficient understanding.

Statistical analysis using ANOVA (Table 3.11a) showed that there were significant differences between the different categories of students for the following factors: additional information that students added into their notes for Lecturer 1 and 2's section in 2011, the total number of facts for the combined data set for Lecturer 4's section, the number of visual aspects for Lecturer 4's section and for the notes score for Lecturer 1, 2 and 4 in 2011, and for Lecturer 4 in the combined data set. The levels of significance for type of notes that the students made is provided in Table 3.11a.

Table 3.11a: p-values on ANOVA for comparison of notes

Lecturer	2009		2010				2011		Combined average			
	3	4	1	2	3	4	1	2	1	2	3	4
Total number of facts	0.82	0.21	0.25	0.84	0.26	0.13	0.20	0.54	0.60	0.79	0.30	* 0.05
Number of verbal aspects	n/a	n/a	0.18	0.97	0.73	0.52	0.59	0.70	0.40	0.69	0.83	0.41
Number of visual aspects	0.80	0.36	0.37	0.98	0.31	0.12	0.59	0.68	0.58	0.79	0.32	* 0.05
Additional information	0.61	0.40	0.14	0.85	0.43	0.19	** 0.01	** 0.01	0.60	0.26	0.62	0.09
Notes score	0.52	0.76	* 0.03	** 0.01	0.18	** 0.01	0.96	0.94	0.21	0.08	0.10	* 0.03

* $p \leq 0.05$

** $p \leq 0.01$

In-depth analysis using KyPlot (Table 3.11b) showed which categories were significantly different for each of the statistically significant factors identified using ANOVA. Hence,

KyPlot showed that there was a significant difference between the *self-regulated* and *underprepared students* notes score for Lecturer 1 ($p=0.025$) and 2 ($p=0.009$) in 2010. Kyplot showed a significant difference between the *self-regulated* and *developing students* for the notes score for Lecturer 4's section ($p=0.010$) in 2010. When data from 2009-2011 was combined significant differences were found for the total number of facts taken amongst the three categories for lecturer 4, KyPlot showed a significant difference ($p=0.044$) between the notes that the *self-regulated* and *developing students* made. The number of visual aspects that was noted between the categories was also significantly different, KyPlot showed that significant differences lay between the *self-regulated* and *developing* categories ($p=0.044$). The notes score also reflected a significant difference between the groups, there was a significant difference between the *self-regulated* and *developing* categories as shown by KyPlot ($p=0.032$).

Table 3.11b: Means, standard deviations and p-values (≤ 0.05) from KyPlot associated with the type of notes that students construct

		Mean			Standard deviation			p-value ≤ 0.05
		Self-regulated (1)	Developing (2)	Under-prepared (3)	Self-regulated	Developing	Under-prepared	
Notes score	L1 2010	21.78	17.25	12.38	4.52	9.32	6.05	(1-3) 0.025
	L2 2010	22.9	18.6	14	3.33	7.3	6.68	(1-3) 0.009
	L4 2010	19.63	8.7	12.6	6.06	4.13	6.14	(1-2) 0.01
	L4 combined	15.13	8.8	10.7	8.14	5.33	6.19	(1-2) 0.032
Total number of facts	L4 combined	50.93	31.8	40.5	25.07	15.76	21.41	(1-2) 0.04
Visual aspects	L4 combined	48.8	30.33	39.5	24.2	14.88	21.08	(1-2) 0.04

The small sample size taken in each year is, in terms of generalisability, a limitation in this study, but it was a necessary one. The smaller sample size provided the opportunity to closely follow student practice and academic growth at University during their first year. Tracking a smaller sample enabled the in-depth probing of the students' prior note-taking, note-making and learning practices at school, the timing and reasons for any changes in note-making practices at University, and in-depth comparisons of these factors to student academic performance over time. Therefore the selected sample sizes enabled deeper analysis of students' notes as well as in-depth interviews.

For students to be academically successful at University their note-making and learning expectations and practices need to be aligned to the University's expectation of the student's role. This alignment was usually achieved as students gained experience within the University environment:

‘...our lecturers made us aware [of keeping up with our work] and many people failed anyway, so I think it builds up from experience, ya you have to experience it yourself to say okay I really have to start picking up my socks or whatever, or else-. I mean everybody – I mean we get advice from so many places and so many things and it’s either you choose to follow it or not so I guess its up to the person, they have to experience it, ya to see it for themselves...’ (R552010)

As students progressed through first year they felt that their notes became more reflective of the independent note-making required within this environment, but this study found that the rate at which they were able to make the change to developing a more personalised set of notes was also dependant on their levels of self-regulation. Zimmerman and Schunk (2001) state that self-regulated students usually show more personal initiative, perseverance and adaptive skill. The findings of this study lead me to agree with Zimmerman to the extent that the *self-regulated students* are able to show these characteristics because of the encouragement of independent learning during their school years. Also, with increased practice that students gain from their university experience this process of self-regulation becomes easier and quicker, and the rewards are higher. The students are less likely to become despondent and give up on the ‘insurmountable’ tasks associated with independent learning at University.

Due to the *self-regulated students* being accountable for their construction of notes at school they also viewed the start of their learning process as either the listening stage within the lecture or the note-making stage, unlike the *underprepared students* who believed that their learning started when studying content after class. The *self-regulated students* also reported that because noting material kept them focused in class they had developed an understanding of the content before they revised their notes. As a result of the lack of practice and experience the *developing* and *underprepared students* had at school in taking charge of their notes and in their self-directed learning, they took a longer time to realise and adapt to the expectations of the University academic environment. This switch in mind-set usually came about when these students had received their semester examination grades. If students are not actively engaged during the lecture and during note revision, then they are not usually fully aware of their level of understanding (Kiewra, 2002). During note-making students have more opportunity to form connections and to develop a depth of understanding than the level that is achieved during note-taking (Kiewra, 1991).

3.5.2 A workshop intervention

In ILS, the 2010 and 2011 cohorts were provided with two workshops that aimed to promote critical thinking by training students to read and write with a deep approach to their learning (Brenner & Nichols, 2013). These workshops focused on teaching students to define a thesis statement, how to argue effectively, and how to take good, meaningful notes relevant to their understanding during lectures. The type of tasks that first years engaged in included having to answer one essay question per block where they had to provide an argument for their opinion on a topic in science; there were weekly tasks that included the students having to read and answer questions based on journal articles. Additionally, students were regularly given assignments and had to provide observations to experiments they conducted in the laboratory sessions which involved answering in the form of short paragraphs; thus there was constant focus on their development of critical thinking by means of writing. Teaching assistants were trained to provide feedback which also aimed to promote student critical thinking and to enrich the first years experience in writing effectively. The training received during these workshops influenced students to reconstruct and transform their class notes into a more personalised set of notes than previous cohorts of students, thus generally students in 2011 likely made a better quality of notes than that made by previous cohorts. The *self-regulated* students therefore became more selective in the content noted. Thus they noted fewer facts but more relevant information according to their understanding (Tables 3.8, 3.9 and 3.10). In contrast the *underprepared students* in 2010 and 2011 may have realised (through the interventions provided in the workshop) that both visual and verbal information are important in a lecture, and that they needed to make use of additional resources (Tables 3.8, 3.9 and 3.10). The results from the current study are in agreement with other studies that concluded that students who were trained to be effective note-makers performed better in tests than those who either did not take notes or took notes in the conventional unguided manner (Austin, Lee & Carr, 2004; Boyle, 2007). Thus findings from my study show that even though students do not come into first year with the same extent of skills and expectations, and that even though they start to realise the mismatch between their expectations and practice in relation to the expectations of their lecturers, they still do not know HOW to change their approach to study so that it better suits the University academic environment.

3.5.3 Transformed and revised notes indicate better academic performance

The type of notes that students made is related to their academic performance. Bonner and Holliday (2006) indicate that note-making helped students organise the content of their class notes according to their knowledge structure. This was confirmed in my study, it was evident that the *self-regulated students* who also were the students that personalised and transformed their notes generally viewed their class notes as only a guide to what needed to be learnt, whereas the underprepared students viewed the class notes as the only material that needed to be learnt. This is further evidenced below.

Self-regulated students

43% of the *self-regulated students* reported that they had used their notes together with the textbook when learning for tests and examinations at school (Table 3.12). 33% of them reported reading through their class notes when studying for these assessments at school (Table 3.12). The *self-regulated students*, in comparison to the other two categories, had also produced higher grades in all the tests and examinations in 2009 and 2010 (Table 3.13).

Table 3.12: Students' use of notes to prepare for school tests and examinations

	Own notes plus textbook (%)	Simplified class notes (%)	Read through class notes (%)
<i>Self-regulated students</i>	43	13	33
<i>Developing students</i>	3	23	60
<i>Underprepared students</i>	3	43	60

Although in 2011 the *self-regulated students* took fewer notes than the *developing* and *underprepared students* (Table 3.8), they still usually had higher grades in tests and examinations compared to the students in the other categories (Table 3.13). Statistical analysis using ANOVA (Table 3.14a) showed there were significant differences between some categories, and then KyPlot was used to probe these differences (Table 3.14b) and showed that there was a significant difference ($p=0.031$) between the *self-regulated* and *underprepared students* for test 4 2009 for combined data. There was also a significant difference on KyPlot for the combined data sets when comparing exam 1 ($p=0.05$), test 3 ($p=0.041$), test 4 ($p=0.05$) and exam 3 ($p=0.02$) between the *self-regulated* and

underprepared students. There was a significant difference on KyPlot ($p=0.033$) for the exam 3 combined data between the *self-regulated* and *developing students*. Due to the small size of the data set a significant difference was apparent only when data was combined across the three years (Table 3.14a, b). Thus, findings in my study evidence that self-regulated students are more aware of their approach to deep learning. Kiewra (2002) reported from his study that students appeared confident in all the answers that they provided on tests and examinations, regardless of whether they were correct or not. This suggested to him that students are unable to monitor their own comprehension abilities. The present study extends on this knowledge; analysis of the results show that first years who constructively engaged with their notes and as a result used their revised notes as a 'sign' of their understanding, performed better on tests and examinations. This was because their focus was on understanding content as opposed to knowing content (i.e. applying knowledge and not memorising information). Therefore this study is in support of Katayama (2000) who stated that the more actively students are involved in their learning, the deeper the processing of information and the better able students are to apply new knowledge to new situations. Therefore, students who did not monitor their learning are unable to identify content that would be assessed in tests and examinations (Kiewra, 2002).

Table 3.13: Assessment grade averages per category

		Test 1	Test 2	Exam 1	Exam 2	Test 3	Test 4	Exam 3	Exam 4
2009	<i>Self-regulated students</i>	55	75.8	50.2	42.3	56.6	64.8	58.3	61.2
	<i>Developing students</i>	39.7	66	43.2	40.6	43.7	55.9	46.9	49.8
	<i>Underprepared students</i>	43.5	64.4	37.9	36.4	43	47.9	44.3	54.4
2010	<i>Self-regulated students</i>	72.7	52.1	60.9	50.3	50.7	58.3	54.7	62.2
	<i>Developing students</i>	67.1	46.2	56.7	37.5	47.4	61.9	45.7	57.1
	<i>Underprepared students</i>	63	44.6	55.8	47	43.8	53.2	46.5	56.6
2011	<i>Self-regulated students</i>	60.4	49.6	60.7	47.5	49.8	41.8	51.4	51.4
	<i>Developing students</i>	56.8	55.3	52.2	48	41.7	34.6	47.9	47.9
	<i>Underprepared students</i>	57.6	49.5	50.1	46.2	45.7	38.1	48.5	45.8
Combined average	<i>Self-regulated students</i>	62.7	59.1	58	46.7	52.4	54.8	53.5	58.1
	<i>Developing students</i>	54.5	55.9	50.7	42	44.2	50.4	44.5	51.2
	<i>Underprepared students</i>	54.7	52.8	47.9	43.2	44.2	46.4	45.6	52.2

Table 3.14a: p-values on ANOVA for academic tests and examinations of categories

	2009	2010	2011	Combined average
Test 1	0.11	0.24	0.83	0.11
Test 2	0.19	0.67	0.71	0.85
Exam 1	0.21	0.61	0.14	*0.05
Exam 2	0.64	0.20	0.96	0.49
Test 3	0.07	0.46	0.68	*0.03
Test 4	*0.04	0.45	0.55	*0.05
Exam 3	0.06	0.23	0.65	*0.01
Exam 4	0.15	0.61	0.65	0.12

*p≤0.05

Table 3.14b: Means, standard deviations and p-values (≤0.05) on KyPlot associated with test and examination performance

		Mean			Standard deviation			p-value ≤0.05
		Self-regulated (1)	Developing (2)	Under-prepared (3)	Self-regulated	Developing	Under-prepared	
Test	4 2009	64.77	55.91	47.94	9	17.6	12.68	(1-3) 0.03
	3 combined	53.81	45.49	43.45	14.22	13	11.1	(1-3) 0.04
	4 combined	61.7	58.72	50.72	13.54	15.41	13.4	(1-3) 0.05
Exam	1 combined	61.9	54.43	52.93	15.41	11.19	9.08	(1-3) 0.05
	3 combined	56.58	46.29	45.5	14.38	10.01	12.09	(1-2) 0.03
								(1-3) 0.02

Developing students

In 2010 the notes score for the *developing students* generally decreased as the year progressed (Table 3.10). 60% of them reported reading only class notes when learning for tests and examinations at school (Table 3.12). The *developing students* generally produced slightly higher grades than the *underprepared students* (Table 3.13).

Underprepared students

At school, in preparation for their tests and examinations the *underprepared students* generally relied heavily on only reading (60%) or, reading and simplifying their class notes (43%) (Table 3.12). Only a small percentage (3%) of these students reported deepening their understanding by compiling a revised set of notes using other resources such as the textbook (Table 3.12). During interviews it became evident that in first-year generally the *underprepared students* depended on memorising notes provided by their lecturer.

The ‘parrot-fashion’ learning methods that mostly the *underprepared students* used were ineffective at University due to the heavier workload. Also, the memorisation of copious content provided at University was difficult and oftentimes impossible. From interview data it became clear that students in the *developing* and *underprepared* categories realised their depth of understanding only upon being tested, whereas students from the *self-regulated* category attempted to find gaps in their understanding prior to being tested. However, students from both the *underprepared* and the *self-regulated* categories suggested that it was only when they understood their notes, that they were able to explain concepts in their own words.

‘...whatever you write with your hand, you can’t really forget that easily, so it’s very hard for you to take someone’s work and know it, you can’t know someone’s work, you take someone’s work, you break it down to your own understanding, you always know it, ... , you will never forget it...’ . (O482010)

The *developing students*, compared to the *underprepared students*, had a better idea of their independent role in making notes, but their practice did not always align with their views. When they entered University they generally perceived note-making to involve highlighting points in the textbook, and the process of learning to equate to memorising definitions:

‘notes [lecturer handouts/slides] just made me like lazy, I always thought that maybe for a test I’m covered with the lecture notes so I’m just going to go through that and ya, so I’ve discovered so it doesn’t work cos you have to like not only read about it, you have to understand and the notes you just cant understand them without getting a background, where they come from, so the textbook helps me

to like understand some of the things... in first semester I just wanted to like, I was just studying, just to pass, just to study and pass and move on, but now I figured out you can't just study and pass cos some of the questions they require you to think so you can't rely on the notes of what you have read so you have to read them, interpret them and understand them' (O432010)

Whereas most of the *self-regulated students* considered note-making as an internal and independent process, most of the *underprepared students* felt that if the lecturers provided comprehensive notes then they would not have 'wasted their time' looking for relevant information, and would therefore have had more time to study. Mostly the *underprepared students* reported that they did not get any direction from their first-year lecturers regarding the accuracy of their notes. These are important points for first-year student academic development programmes and in relation to staff development. If staff are aware of the students' perspective of the role of the first-year in constructing their own notes, staff could guide students to better aligning their perspectives with staff expectations. Kiewra and Frank (1988) reported that students in their study benefited from the lecturers' provision of detailed notes for study purposes. They showed that this was because those students who took their own notes and those who received and had to add onto skeletal notes noted fewer ideas than was provided in class. They also mentioned that the lecturers' detailed notes explained concepts more fully than did the notes that students took. Other studies, e.g. by Van Meter et al. (1994) and Kobayashi (2006) additionally show that although transcription of the verbal lecture provided a more accurate set of notes for student learning, these verbatim notes also interfered with the deeper processing of learning. Results from my study concur with Carrier (1983); Morgan et al. (1988) and Stefanou et al. (2008) who stated that learning was best achieved when students actively participated in their construction of knowledge.

Personalising notes had the advantage of notes being directly relevant to the students' understanding (Van Meter et al., 1994). In the current study, the *self-regulated students* used their notes as a tool for in-depth learning and knowledge construction. Consequently this category relied less on lecturers' slides being the primary source for their learning than did the other two categories. The ownership that the *self-regulated students* took of their note-making facilitated a deeper comprehension of concepts. The *self-regulated students* generally made proactive decisions at the different stages of note-taking and note-making, i.e. preparation for the lecture, during the lecture and subsequent to the lecture:

‘...you need to prepare before going to class so that you know what you don’t know, then you’ll take notes in relation to that, instead of you going to class and just taking down notes without having studied on your own...’ (G102009)

Thus, whereas the *self-regulated students* saw their construction of notes as an active and facilitative process in their learning, the students in the *underprepared* and *developing* categories saw capturing notes as a mechanical process which was used to state points that needed to be learnt for assessment purposes. The current study supports the notion that note-making is a facilitative tool that can be used to enhance the students’ understanding and therefore academic performance (Bonner & Holliday, 2006; Di Vesta & Gray, 1972, 1973; Kiewra, 1991; Kiewra, 2002).

Findings from my study evidence that the students’ school experiences influence their expectations of their role and their lecturers’ role in their construction of notes, and crucially that the University lecturers have a pivotal role to play in identifying the skills that are lacking in first-year students. When lecturers then provide supportive measures, in a contextualised frame, the students have a more enriched learning experience.

3.6 Additional explanations for the findings

School background has been the focus of this chapter. However, other studies have shown that social and cultural capital (chapter 2) as well as the lecture slides (chapter 4) also influence the way in which students take and make notes. English as a first or second language as well influences the type of notes students construct and their academic performance (chapter 5).

3.7 Conclusion

This study set out to establish the impact of the students’ schooling background on their construction of notes in a first year biology course. The process of constructing a personalised set of notes deepened student understanding of concepts and had a positive influence on academic performance.

As experience at University was gained a greater number of students in each category reported that their expectations and practices in note-making and learning had evolved to be more aligned with University expectations in terms of the responsibility for learning. The practice and ownership that the *self-regulated students* had of note-making and learning at

school, in contrast to the other two categories of students, meant that the *self-regulated students* adapted to University pressures earlier.

Notes enable students to capture the content and organisational structure that is provided in class. But, within the lecture there is 'competition' between generative learning and working memory. This study has confirmed that if after the lecture notes are revised and reviewed according to the students' understanding then note-making is considered a tool for knowledge construction and transformation. The process of reviewing and revising notes enabled students to identify gaps in their knowledge earlier than feedback from their test results. Therefore when note-making is used effectively this enabled students to reconstruct and transform their knowledge to an increased cognitive level and higher order of thinking, thereby facilitating increased student academic performance. Students need to practice making personalised notes in order to recognise the value of this in relation to their learning. Students who are able to restructure their class notes according to gaps in their knowledge are likely to develop an in-depth understanding of topics. This is important because the construction of knowledge is a structured process, where the understanding of new knowledge is based on prior knowledge. If the required prior knowledge for a particular section is lacking, the student may not be able move into the more complicated concepts dealt with at University.

Students needed to be made aware of the importance of note-making as an internal process which is independent and individual, and therefore needed to be aligned to their understanding. They generally recognised that note-making could enhance their learning, but it was only after training in note-taking and note-making that there was an observable improvement in the quality of students' notes. Training in the construction of notes explicitly set out the importance of determining gaps in knowledge prior to the lecture session, in turn this allowed the student to focus on specific problematic components of the content lectured, and then later to build on this understanding by using the textbook. As students gained experience at University they realised that the ownership of note-taking, note-making and learning was their responsibility, and less emphasis needed to be placed on the lecturer assistance. Note-making provided a tool that enabled students to take more responsibility for their knowledge construction. This study provides evidence to show that the students' school experience influences their adaptation to their first year, but that lecturers can assist to facilitate students move to a deep approach to learning, and thus have a more enriched university experience. In South Africa there is the need to explicitly train students in note-

taking and note-making, with academic staff needing to be equally made aware of their responsibility to assist students in this regard.

CHAPTER 4:

FACTORS AFFECTING THE CONSTRUCTION OF TEACHING SLIDES AND THEIR IMPACT ON TEACHING AND LEARNING

Abstract

The link between the lecturers' expectation of students in taking notes and the amount of detail provided on the lecturers' PowerPoint slides is viewed in relation to student academic performance in a biology class. The quantity and quality of students' notes was also investigated in relation to their grades in their first year. Data from students and lecturers were collected in the study. After classroom observations and interviewing of the eight lecturers involved in the study, the analysis of data resulted in 3 groups of lecturers: those who were '*student-centred*', or '*student-directed*' and those who were '*teacher-centred*'. These categories reflected their perceptions of their role in the classroom. The *student-centred* lecturers provided key points on their slides, anticipated that students would build on their class notes, and focused on the development of the students' critical thinking ability. In contrast, the *student-directed* and *teacher-centred* lecturers aimed to complete the syllabus and emphasised the provision of detailed slides containing 'all' the information which first years needed to learn. Unlike the *teacher-centred* lecturers, lecturers who were *student-directed* stated that they identified topics that students found challenging and tried to make these topics easier for students to access during lectures. Students' expectations of their role in constructing notes at University were then also probed by questionnaire and interviews. Students reported that when they perceived that the lecturers' slides did not provide sufficient content for tests and examinations, and when they had access to slides only during class they were more attentive and captured more notes during and after the lecture. They reported difficulty in extending their notes when limited content (i.e. only key words, as opposed to key points) was provided on lecture slides. Analysis of the data showed that the first-years' notes were usually a close reflection of lecture slides, and that the grades attained were similar, regardless of whether slides were available on the intranet for after-class access or not.

4.1 Introduction

Lecturers construct their lessons based on their perceptions of their role within the learning environment (Biggs, 1989; Kane, Sandretto & Heath, 2002; Verloop, Van Driel & Meijer, 2001; Virtanen & Lindblom-Ylänne, 2010). This understanding impacts on the level of visual support and verbal explanations offered during face-to-face contact periods (Clark, 2008; Wecker, 2012). Those who see themselves as facilitators in the students' construction of knowledge would be cognisant of how their practice might stimulate critical thinking, as opposed to others who focus on the transmission of content and completing the syllabus (Bruce & Gerber, 1995; Fox, 1983; Kember & Kwan, 2000; Trigwell & Prosser, 2004; Verloop, et al., 2001). Thus lecturers who consider it their responsibility to provide all the material from which students need to learn (Kane et al., 2002; Verloop et al., 2001) may provide slides that are very detailed. To teach well, lecturers need to be consciously aware of students' practices, and to determine how well these conceptions match up to their teaching practice (Biggs, 1989; Kane et al., 2002). The purpose of this study was to determine in the context of a first-year biology class, whether the lecturers' views and practice impacted on the quality of notes that students made. From this, it was hoped that some insight would be gained as to how lecturers' practice impacted on their students' approaches to learning.

Marton and Säljö (1976) have described two contrasting approaches to learning, i.e. a deep approach in contrast to a surface approach. A deep approach is one where students focused on finding the meaning of the material they are learning, while in a surface approach they aim to reproduce information (Marton & Säljö, 1976). Biggs (1989) has suggested that students who have a surface approach are extrinsically motivated by the fear of failure, and thus only work hard enough to pass. Biggs also notes that deep learners are motivated intrinsically. He goes on to say that students with a deep approach would read widely to understand and reflect on new knowledge to see how it fits into their current understanding; and thus cultivate their own opinion on material, this is important to their construction of understanding.

Students only use a deep approach if they perceive that this type of practice is a requirement within the academic environment (Kember & Kwan, 2000; Marton & Säljö, 1976). A deep approach generally results in higher grades because it enables students to form links and connections between content within a topic and with related topics, which does not happen when a surface approach to learning is applied (Biggs, 1989; Kember & Kwan, 2000). While surface learners do not usually review the notes they capture in class, deep learners plan,

compose, and review their notes (Biggs, 1989). Lecturers can facilitate the approach that students take in response to the learning environment. Stefanou et al. (2008) have reported that the quantity of material in the lecturers' presentation influences the amount that students capture during class. From anecdotal evidence it appears that if first years view the lecturers' slides as 'comprehensive notes' then it is unlikely that they would put much effort into personalising this content during and after class. In this study it was therefore considered important to determine the impact that the lecturers' expectations of the student role would have on the amount of detail they provided on their teaching slides. From this, the impact of the slides on the quality of notes student make and on their approach to learning could be made.

Note-taking represents the main evidence of the interaction between the lecturer and students during lectures at University (Castelló & Monereo, 2005). Undergraduates capture notes in class (note-taking) to provide themselves with study material for tests and examinations, to assist with homework assignments and to help concentration (Van Meter, et al., 1994). They should ideally be attentive during lectures and actively decide what is important to record (Castelló & Monereo, 2005; Dukhan et al., chapter 3; Stefanou et al., 2008). Therefore, during class they should listen, select relevant ideas and details, and determine material they want to record (Boyle, 2007; Carrier, 1983; Kiewra, 2002; Williams & Eggert, 2002). They may choose to later review and personalise their notes (i.e. note-making). Compared to the note-taking stage, during note-making students may make stronger connections between new concepts covered and prior knowledge. If notes are 'personalised' then note-making is a symbolic mediator between what is taught by the lecturer and how this is constructed within the minds of the students (Yilmaz, 2008). Importantly, the students' construction of their notes during and after class can form a central part of the cognitive process (Castelló & Monereo, 2005; Dukhan et al., chapter 3; Pauk, 1979; Stefanou et al., 2008). Stefanou et al. (2008) claimed that students' notes are a reflection of their mental processes, and that learning is best achieved when they are given the opportunity to actively participate in their construction of knowledge. From this perspective the idea that constructing notes is simply 'data collection' is discarded. Generally, when making their notes students can get an indication of the key concepts from the material that is provided on the lecturers' slides (Clark, 2008; Debevec, Shih & Kashyap, 2006; Kinchin, 2000). In my study lecture slides make the key aspects explicit as well as provide an indicator of the level of understanding

students are expected to achieve; thus students can use the slides to construct their own personalised set of notes.

There are different processes and skills required in the capturing of notes in class compared to the transformation and personalisation of notes after class. According to Peper and Mayer (1978, 1986) the tasks involved in note-taking use 'working memory'. Students use some of their working memory to take notes in their own personal style and to ensure correct spelling and grammar (Kiewra, 1991). Peper and Mayer (1978, 1986) defined a term which they called 'generative learning'. This is the formation of connections between new knowledge and prior knowledge, and the facilitation of the creation of links between concepts taught within a topic, and between different topics. This definition of generative learning has parallels with Biggs' definition of a deep approach to learning described above. Nevertheless, Kiewra et al. (1991) and Stefanou et al. (2008) argue that it is unlikely that students would be able to engage in generative learning during the information processing stages expected during lectures. However, if students subsequently review material, they do not have to engage in as many tasks simultaneously, and would have an increased capacity and be more likely to form links and connections between prior knowledge and new knowledge. Generative learning would therefore be more likely to occur during a subsequent note-making process. Notes that have been paraphrased, making connections with prior knowledge, and having more information than lecturers' slides may be indicative of generative learning (Stefanou et al., 2008). Thus, by analysing and comparing the notes that students make to the content provided on the lecturers' slides, it is possible to get an indication of whether generative learning has occurred.

Deep learning has been shown to improve academic performance (Scouller, 1998). One could therefore justifiably assume that generative learning would result in better grades. Moreover, it has been established that the construction of students' notes and the subsequent level of comprehension and grades that they achieve can be connected to the type of visuals that they receive from lecturers (Cornelius & Owen-DeSchryver, 2008; Kiewra, 1985b; Klemm, 1976; Wecker, 2012). Thus, it can be inferred that academic performance may be influenced by the lecturers' slides.

Another factor that influences students' construction of knowledge and thus their academic performance is their social environment. Vygotsky (1978) believed that learning occurred within the social interactions between the learner and their environment. In my study the

slides which the lecturers used in class were the main interface students could have used, as a guide, to their personalisation of their notes and to deepen their understanding of content after class. Thus, lecturers' construction of the lecture slides could influence the students' response in taking and making notes. Vygotsky used the concepts of 'psychological tools' and 'signs' to explain how the external environment shaped the individual's cognition (Vygotsky, 1987a and b). A 'psychological tool' is an instrument which is used to change the environment in some way, for instance an inspirational book can be considered a 'psychological tool' because it is written so that when it is read it is meant to change the mind-set of the reader. In my study, the slides lecturers provided can be viewed as a 'psychological tool'. Here the slides indicated to the students the content that the lecturer required them to be familiar with and to guide student learning. Usually these points would also indicate the depth of comprehension that the students are required to attain. Thus, the slides provided a means for lecturers to explicitly point out the level of learning they expected students to achieve.

In contrast to the lecturers' slides, the students' notes have no impact or influence on their external environment, and are only important to the individual in their learning; therefore the students' notes are considered a 'sign'. Vygotsky explained that a 'sign' is also a tool, but it differs from a tool in that a sign is something that is established by the individual for their own internal change (Vygotsky, 1987a and b). Thus in my study the class notes act as a reminder to the student of the content that is covered during the lectures. When students transform their class notes into a personalised set of notes then these revised notes act as a 'sign' of their understanding.

This study was initiated with the aim of finding strategies which could deepen student learning experiences and increase their performance in their first year. In this chapter the focus is on the link between the lecturers' conception of the students' role within the first year academic environment and the amount of detail lecturers' provide on their slides, and how their construction of these visuals impacts the notes that students make. The findings could provide guidance on how lecturers could facilitate student engagement and deepen learning through the visual material provided during and after lecture periods.

Research has provided valuable insights into the lecturers' conceptions about their teaching practice, and how this relates to their actual classroom practice (Biggs, 1989; Bruce & Gerber, 1995; Fox, 1983; Kane et al., 2002; Kember & Kwan, 2000; Trigwell & Prosser,

2004; Verloop et al., 2001). The results from my investigation demonstrate the influence of the lecturers' conceptions of students' note-taking and note-making practices in relation to the type of slides that they produce. In the analysis, I compare these slides to the quality and quantity of notes that students construct, which illustrates the influence that the level of detail on the slides had on the students' perception of what their level of engagement had to be during class, and of the effort that they needed to put into note-making. The analysis shows that the access students had to slides on the intranet was another factor that influenced their construction of notes and their generative engagement during class. The cognitive level of test and examination questions also plays a major role in determining the grades that students achieve (Cornelius & Owen-DeSchryver, 2008), so the test and examination questions were analysed as part of this study to offer insight into how the level of these questions might affect student performance.

4.1.1 Lecturers' views of student practice influences the type of teaching slides that they make

When lecturers are asked about their teaching practice they usually speak about their approach to teaching and not necessarily their actual practice (Kane et al., 2002; Verloop et al., 2001). Thus, as Kane et al. (2002) explain, there may be mismatches between what lecturers think they do and their actual practice. In my study it was important to establish whether the lecturers constructed slides as a means of providing information for the class, or as a way to facilitate a deeper level of engagement amongst students. The question I was seeking to answer was could their practice influence the students' approach to their construction of notes and learning. When analysing my data from lecturer interviews, classroom observations and the content they provided during the lecture it became evident that there were three types of lecturers: lecturers who focused on the completion of the syllabus; lecturers who aimed to engage the understanding of the class and build on this; and lecturers who wanted to cover a set amount of content but were aware of and placed emphasis on topics that students normally found challenging. Many studies (e.g. Biggs, 1989; Fox, 1983; Kember & Kwan, 2000; Verloop et al., 2001) have reported on different categories of teachers, with the basic distinction lying on the extent to which the teacher expects they would be involved in the students' learning, and the extent to which their practice aligns with their views on this. Three categories of lecturers were established in my study. These were based on the categorisation of lecturers from three studies that are outlined below.

Kember and Kwan (2000) described ‘*content-centred*’ and ‘*learning-centred*’ teachers. The ‘*content-centred*’ teachers focus on the syllabus, envisage teaching as an activity that they need to perform, and perceive students as passive participants to whom knowledge is disseminated. According to Kember and Kwan, the *learning-centred* teachers actively attempt to get students to think about information provided in class, try to ascertain the level of understanding that the class has achieved, and aim to develop the students’ level of self-regulation.

The Verloop et al. (2001) study describes *student-directed* and *teacher-centred* categories of teachers. They explained that teachers belonging to the *student-directed* and *teacher-centred* categories do not see themselves as part of the students’ development of cognition; rather they expect that the student would have to independently come to an understanding of the material that is provided. The characteristics described here are analogous to the *content-centred* lecturers described by Kember and Kwan. But, unlike the *teacher-centred* lecturers, the *student-directed* lecturers are mindful of the content students find challenging and attempt to make these concepts easier for students to access during lectures. The Verloop et al. (2001) study also distinguishes a third category, namely *student-centred* teachers: this category resembles the *learning-centred* lecturers described by Kember and Kwan. These teachers actively provide activities that aim to support independent learning amongst students. Verloop et al.’s description of these three categories of lecturers closely matches the categorisation by Biggs (1989): one category that views lecturing as being the transmission of knowledge to students; a second category is based on lecturers who prepare their teaching so that they could integrate concepts they believe students find challenging; and a third that focuses on the development of self-regulated students.

4.2 Methods

This study was conducted in the Introductory Life Sciences course (ILS) at a South African University, and extended over four semesters, from the beginning of semester two 2009 to the end of semester one 2011. ILS is a first-year course which extends over both semesters of the academic year. This course has 500 registrants. Because of the large number of registered students the class was split into two groups of approximately 250 students each, and each lecturer teaches the same content twice in the year. The teaching is shared by two Schools (here designated A and B). The first semester dealt with topics at the molecular and cellular level, taught by School A, and in semester 2 the macro-environment topics are taught by

School B. Four lecturers were involved in teaching in each semester, so students were exposed to 8 teaching styles over the course of this study. Topics in semester 1 were taught by the same lecturers in concurrent years of this study; topics in semester 2 were taught by a different set of lecturers.

Two lectures per semester were requested to participate in this study and they agreed. The topics selected for this study were based on sections that were an extension of high school work ('Meiosis and Mitosis' and 'The Animal Reproductive System') and two topics were not part of the high school syllabus ('Cell Communication' and 'Metabolism'). Thus while the first topic in each semester was likely to have been familiar to students, the second topic was considered the 'new' topic. Each lecture was 45 minutes long, and was video-taped, with the video-tape transcribed for analysis. Thus data were collected for 8 lectures over the duration of this study. The two Schools to which the lecturers who lectured ILS belonged had a different ethos about providing students with copies of the lecturers' presentation. Since School A posted lecture slides on the intranet, in the first semester students had access to slides outside lecture periods. However when lecturers from School B lectured in the second semester students had access to slides during the lecture period only.

All participants contributed to this study voluntarily. Ethics clearance was granted by the Universities' Research Ethics Committee (HREC Non-Medical Protocol number: 2009ECE114). Interviews were conducted with lecturers and students to gather information on their views on note-taking, note-making and student learning.

Lecturers were interviewed at the beginning of their lecture series to ascertain:

- the number of years involved in first-year teaching
- a description of their current classroom practice, and views on changes in their practice over the years
- any observations of changes in student engagement during the lectures, in answering assessments and in performance over the years
- any note-taking and note-making advice or guidance that the lecturers provided to students
- their expectations of a student's role in note-taking and note-review practices
- what would be considered a "good set of notes"
- how they anticipated students would identify key points during the lecture.

The lecturer interview questions are provided in Appendix 7.

Since students were randomly assigned to one or other class at registration it was considered that either class would be representative of the whole intake. Thus, all students in one of the ILS classes were provided with questionnaires which they were asked to fill in if they wanted to participate in this study (Appendix 1). Approximately 25% of students from one class per year chose to participate.

The student questionnaire probed the following: previous note-taking and note-making experience at school, and expectations of what was required at University. The students' answers to the questionnaire were analysed according to the following eight variables:

- the factors that would contribute to a good set of notes
- the experience of constructing notes at school
- how notes had been used for test and examination preparation at school
- their expectations of the University lecturer regarding the provision of notes
- how handouts provided by lecturers were used
- how they added to the information provided on the lecturers' slides
- how notes had been recorded during lectures
- reasons for note-taking and/or note-making in their first year.

As I read through their responses to the questions it became evident that there were three categories of students: those who had the expectation that they were largely responsible for constructing their own set of notes for their learning; those who had anticipated that the lecturer would provide a 'complete' set of notes which first-years would have to learn; and a category of students who anticipated that they would have to independently revise their class notes but also expected assistance and individual feedback from the lecturer. 30 students per year i.e. just over 10% per cohort (90 students in total) were randomly selected from these categories to participate in one-on-one interviews. The first interview was conducted at the beginning of the academic year, the second in semester 2, and the third at the beginning of the following year. Thus, since this study started in semester two 2009 the first cohort of students participated in two interviews, the 2010 cohort participated in three interviews, and the 2011 cohort participated in one interview, as indicated on the visual below.

Interview 1: Beginning of semester 1 of first year	Interview 2: Beginning of semester 2 of first year	Interview 3: Beginning of second year at University
—————First cohort of students (i.e. 2009)—————		
—————Second cohort of students (i.e. 2010)—————		
Third cohort —————of students (i.e. 2011)—————		

These interviews were used to probe student expectations and experiences on note-taking, note-making and learning as experience at University was gained.

Students who were interviewed were asked to bring the notes which they had constructed for study purposes for each of the selected lectures. As two lectures per semester per year were video-taped for the purpose of analysis, the sets of students' notes associated with these lectures were photocopied for analysis. Since this study commenced in semester two 2009 and ended after semester one 2011 two sets of notes were analysed in 2009 and 2011 respectively, and four sets were analysed in 2010. Consequently 240 sets of notes were analysed. While in the majority of cases the study notes were their class notes, some students had revised their class notes during the note-making stage.

These notes were analysed in terms of the quality and quantity of content presented. The notes were compared, for purposes of analysis, to a comprehensive set of notes that the researcher made from the selected lectures. A rubric (Appendix 3 page 150) was developed for analysis of the notes, based on SOLO taxonomy (as described in the previous chapter). The rubric had two dimensions: one which represented the levels of the students' cognitive ability that were considered necessary in first-year (row), and another (column) which represented the knowledge and skills that students built up as experience at University was gained. The rubric thus enabled an evaluation of the quality of the students' notes, and is later referred to as the 'notes score'.

Many studies (e.g. DiVesta & Gray, 1972; Dunkel, 1988; Hughes & Suritsky, 1994; Kiewra et al., 1995) have used the "measure of information units" as a method for analysis of content. Information units are blocks of information or whole ideas, and comprise of a sentence, clause or stand-alone phrase (Hughes & Suritsky, 1994). In this study the number of information units that the lecturer provided on the slides, and verbally during the lecture, was quantified. The time that

the lecturer spent per slide, and the amount of information that the lecturer read off the slide was calculated. Thus students' notes were analysed by looking for the number of information units in comparison to that provided by the lecturer. This allowed the researcher to 1) analyse the completeness of the content first years noted i.e. the amount of content noted from the lecturers' explanations, and on lecture slides and any material lecturers had provided on the chalkboard; and 2) to identify additional information students noted from other resources (such as the textbook). Two peers in the education field independently repeated this analysis, and evaluated 10% of the notes. They randomly selected the sets of notes for their analysis. There was over 95% agreement with each of the reviewers when evaluation results for this analysis were compared.

The first years' grades were obtained from departmental records to determine whether they had been affected by the access to slides outside lecture periods, and by the amount of detail provided on the slides. Data were quantitatively analysed using ANOVA Single factor analysis. When significant differences were identified using ANOVA, then KyPlot was used to determine where the differences were between groups.

When trying to link student performance with the quantity of content on lecture slides, it is also important to be cognisant of the influence of the cognitive level of the test and examination questions they are given. The type of assessment questions that lecturers set in tests and examinations influences the grades students achieve (Cornelius & Owen-DeSchryver, 2008). In this chapter, part of the analysis was to grade test and examination questions according to whether they required the student to recall, understand or apply information, or to analyse data. This rubric is based on one developed by Brenner et al. (2010). The students' academic performance was then compared in the light of the kinds of questions asked to the cognitive level of the tests and examinations that they had written.

There were two dimensions to the analysis of the tests and examinations questions (Table 4.1).

Table 4.1: Template for analysis of test and examination questions

		COGNITIVE LEVELS			
		1	2	3	Total
		(Recall)	(Understanding)	(Analysis)	
KNOWLEDGE DIMENSIONS	F (Factual)				
	C (Conceptual)				
	P (Procedural)				
	Total				

The first dimension (which represents the required cognitive level) has a scale of 1-3, where:

1 = Recall; 2 = Understanding; 3 = Analysis

The second dimension represents the different knowledge dimensions, where:

F = Factual (facts were required to answer the question); C= Conceptual (concepts/processes/theories were being tested); P = Procedural (this type of question required the student to do a calculation/interpret a graph or diagram in some manner)

Examples:

1. Where does the Calvin cycle take place?
 - a. stroma of the chloroplast
 - b. thylakoid membrane
 - c. cytoplasm surrounding the chloroplast
 - d. chlorophyll molecule
 - e. outer membrane of the chloroplast

This was categorised as F1 i.e. factual recall of knowledge

2. Select the list which shows the muscle components arranged in increasing size.
- a) Actin filament; myofibril; fibre; fascicle; muscle
 - b) Fibre; myofibril; fascicle; actin filament; muscle
 - c) Fascicle; actin filament; myofibril; fibre; muscle
 - d) Muscle; myofibril; fascicle; fibre; actin filament
 - e) Actin filament; fascicle; fibre; myofibril; muscle

This was categorised as F3 i.e. factual, but requiring analysis.

3. Explain the significance of autophagy in the eukaryotic cell.

Here the student had to show an understanding of concepts, thus this was categorised as C2.

4. Show with the aid of a labelled diagram how the ATPase synthase uses the proton gradient to drive ATP synthesis.

This question required that the student show their understanding of a process with the aid of a diagram, this question was categorised as P2.

4.3 Results and Discussion

The framework applied in my study incorporates the frameworks established by Biggs (1989), Kember and Kwan (2000) and Verloop et al. (2001) which have been described above. My approach is that since lecturers who focus on the quality of the learning environment within the class intend to mould the **student** into an independent thinker - following Verloop et al. - I used the term '*student-centred*' lecturers to describe this first category in my study. The second and third categories in my study resemble that of the '*student-directed*' and '*teacher-centred*' categories described by Verloop et al. The data in my study demonstrates that the level of detail which the three categories of lecturers provide on slides differs, and that their slides influence the students' approach to personalising their notes.

'Student-centred' lecturers

In the current study the '*student-centred*' lecturers viewed themselves as playing a role in the development of the undergraduates' cognition, but also expected that the first years would independently come to an understanding of the material that was provided during the lectures.

They required the class to interact with material on the slides by adding to content explained during class and/or from their textbooks or library books after class; and these lecturers made this expectation explicit to first years, as shown from the following comments:

‘...to not be passive I need them to make notes, so I don’t give out [slides] ...I always tell them that the information flows through their pen, up their arm and into their brain that way, and that is just a philosophy that I have...I think a lot of a student becoming [pause] capable, is that they engage with the work.’ L410

‘I make it explicit in the beginning of the course that much of the material that they would get taught to them is not available in their textbooks and so it’s really important that, one, they understand what’s being said and, two, that they get down what’s being said, and that’s why I make sure that I give them what I think is sufficient time to listen to what I am saying and then I’ll say okay make sure you get these points down, and [I] revise that with them and say okay, this is it just to sum up, points x, y and z are really important, and I try to put feedback- in terms of the time, I try to put feedback in and try and gauge how much the class has completed.’ L409

While the students’ transcription of notes could be a reflex action, the point that the lecturer emphasised was a level of activity that was in contrast to the students only using slides downloaded from the intranet. Therefore by lecturers guiding students to making their own notes as opposed to relying on only PowerPoint slides when studying, first years could get a better handle on what it means to be an independent, self-regulated learner.

This category of lecturers had also given thought to the challenges that first-years could experience in constructing their notes. Lecturer 1 in 2011 and Lecturer 4 in 2009 and 2010 were analysed as being the ‘*student-centred*’ lecturers (Table 4.2) on the basis of their expectations of student note-taking and note-making activities and on classroom observations. Although the amount of detail that the *student-centred* lecturers presented verbally varied, they lectured at the slowest pace, and thus spent more time per slide compared to the other categories of lecturers in this study (Table 4.2).

‘*Student-directed*’ lecturers

In contrast to the *student-centred* lecturers the ‘*student-directed*’ lecturers provided many examples on their slides to make challenging concepts more accessible to students.

‘what I say to them is that my powerpoints are on the internet... they need to attend the classes, for all my stuff it’s what I do on the board that’s unpacking the concepts... Now I have to unpack that on the board, now I’ll draw that and I’ll explain now if its on two chromosomes... - initially I just teach them, now I do a lot of tutorial work’ L210

These lecturers also expected that the students' notes were a 'gathering of facts' from the content on the slides and of the explanations during the lectures:

'I've tried to do more examples, they've been given more examples, they were given more tutorials, they were given more examples to practice, they had that extra book that they could work with which had all the answers' L211

They had few concrete expectations of the students' note-making practices. For instance one of these lecturers stated during the interview that she expected students to engage with the content in the textbook after class, yet in class she was observed announcing that all that students were required to know for assessments was on her slides. Lecturer 2 in 2010 and 2011, and Lecturer 3 in 2010 emerged as being *student-directed*' (Table 4.2) because although they were conscious of the content that students experienced difficulty in understanding and these lecturers pointed out these challenging topics to students, and provided additional material during the lectures on these concepts, the focus of these lecturers was still to complete the syllabus.

'I'm finding that especially last year and this year they find it very difficult to grasp certain concepts, ehm, from from what I'm seeing it appears that its based on the fact that they don't necessarily have the grounding in particular areas to understand bigger concepts... but having looked through the textbook, the stuff that was covered in the lectures is sufficient for the actual test itself' L310

'I let them write those little prac tests, so I teach them for the prac test, then they write it. I teach them for the next one, then they write it' L211

'Teacher-centred' lecturers

From the analysis of data in my study it emerged that there were also lecturers who were concerned only about getting through the syllabus, and showed no inclination to determine the level of understanding that students had attained in class. For example, one of these lecturers felt pressured to finish a section 'on time' and did not address 21% of the points on her slides, and read 17% of the content directly from her slides without any other verbal explanation of the content (Table 4.2). This third category was termed *'teacher-centred'* lecturers. Lecturer 3 in 2009 and Lecturer 1 in 2010 emerged as the *'teacher-centred'* lecturers (Table 4.2). They had not considered the different aspects that were part of the note-taking and note-making process, as shown in a comment from one of these lecturers:

'there was someone who interacted with the students and taught them something about mind mapping, and I, I'm completely still ignorant..., I'm sorry about that, - not having understood a lot about the deeper understanding about mind mapping, but I thought this was a kind of note-taking...I haven't

given enough thought to note-taking myself, I was really too occupied about getting my lecture going, that I haven't given too much thought to it, so my expectations would be [long pause] yes I would expect them to take notes from *hem* both the lectures [slides] and from what I speak.' L110

'I let them take down the powerpoint slides and I expect them to do things,- to annotate that as well and write...I don't [provide guidance to their construction of notes] because they should have covered it in the beginning of the year. And I don't really want to repeat it.' L309

Table 4.2 distinguishes between the '*student-centred*', '*student-directed*', and '*teacher-centred*' lecturers, and provides a comparison of the quantity of content that lecturers had delivered verbally during the lecture; on their slides; and on the lecturers' pace. The section that follows provides a comparison of the level of detail that the three categories of lecturers provided on their slides and the students' approach to making their notes and to student learning.

Table 4.2: The lecturers' use of slides during the lecture

	Semester 1				Semester 2			
	Slides provided on intranet				Slides not provided on intranet			
	*TC	*SC	*SD	*SD	*TC	*SD	*SC	*SC
	#L1 2010	# L1 2011	#L2 2010	# L2 2011	# L3 2009	# L3 2010	# L4 2009	# L4 2010
Total number of facts provided during the lecture	144	79	141	291	169	207	123	102
Total number of facts on slide presentation	81	17	51	198	169	96	29	39
Total number of facts only in verbal explanations	63 44%	62 8%	90 64%	93 32%	‡ -36 -21%	111 54%	94 76%	63 62%
Average time spent per slide (minutes)	1.8	2.4	1.26	0.75	1.74	2.12	4.39	8.38
Facts read off slide (%)	0.3	0	0.67	0	17	0.1	0	0

*SC denotes '*student-centred*' lecturers, SD denotes '*student-directed*' lecturers, and TC denotes '*teacher-centred*' lecturers.

'L' denotes 'lecturer', the number that follows distinguishes one lecturer from another.

‡ represents the amount of content on the slides that was not mentioned during the lecture

The *student-centred* lecturers provided the least information on their slides; only key points were provided, with few, if any examples compared to the slides that '*student-directed*' and

'teacher-centred' lecturers presented (Table 4.2). Within the context of this study, students were encouraged to take responsibility for extending their notes (and knowledge) when they perceived that the information provided on the lecturers' visuals was not sufficient for their learning. When first years were presented with 'skeleton slides', they reported that they actively listened during class and reviewed their notes after class. Thus the students' notes acted as a 'sign' to remind them of the links that they had established in relation to their understanding of the material. If they went through their class notes during the note-making stage first years could identify what the gaps in their understanding of content was, thus their notes aided them to read other resources (such as the textbook or internet) to deepen their understanding. However, even though students claimed that they captured more material when they were presented with skeleton slides, from the analysis of their notes it emerged that most of the content that they captured was a close reflection of the lecturers' slides; little was added to their notes from other resources such as the textbook or from the lecturers' verbal explanations (Table 4.3).

Table 4.3: Comparison of averages of the quantity and quality of notes students made in response to the access they had to slides

	Semester 1				Semester 2			
	Slides provided on the intranet				Slides not provided on the intranet			
	*TC	*SC	*SD	*SD	*TC	*SD	*SC	*SC
	L1 2010	L1 2011	L2 2010	L2 2011	L3 2009	L3 2010	L4 2009	L4 2010
Facts in students' notes	55	48	71	55	88	142	29	54
Verbal aspects in notes that are not present on lecturer slides	1	0	1	0	0	4	0	2
Visual aspects (content from the slide/board/overheads) in notes	49	40	64	52	87	137	27	52
Additional information from other resources (e.g. textbook)	13	9	3.8	3	1	6	1	1
Notes score	17	18	18	19	10	15	10	14

*SC denotes '*student-centred*' lecturers, SD denotes '*student-directed*' lecturers, and TC denotes '*teacher-centred*' lecturers.

'L' denotes 'lecturer', the number that follows distinguishes one lecturer from another.

Compared to the *student-centred* lecturers, the *student-directed* lecturers provided more content on their slides. For example as shown on Table 4.2, lecturer 2 in 2010 and 2011 provided wordy slides, and the key points were usually “buried” in associated information and a range of examples. The students reported that due to the density of the slides they experienced difficulty in sifting out the main points when they studied for tests and examinations, they were also observed to disengage in class when these types of slides were provided. But it was also observed that when students had a more detailed, structured set of slides from their lecturers (Table 4.2), they made a better quality of notes, as reflected by the ‘notes score’ (Table 4.3). This however, is unsurprising, since these lecturers’ slides provided explicit cues to the hierarchy of information (i.e. super-ordinate and sub-ordinate ideas) and the detailed slides would have also guided the overall coherency of the students’ notes. However, since the students’ notes were a close reflection of the detailed slides lecturers provided, this was an indication that not much generative learning would have occurred when students compiled their notes. This means that when ‘wordy’ slides are provided, students are encouraged to rote-learn the content. It is recognised that although Lecturer 1 in 2011 provided skeletal notes students still achieved a high notes score. It is likely that the workshops which were provided by this stage taught students how to take and make personalised notes, therefore the notes that students produced in 2011 were generally of a higher quality than 2009 and 2010.

The *student-directed* lecturers generally spent less time per slide than the *student-centred* lecturers (Table 4.2). Clark (2008) reported that lecturers’ management of their presentations influences the students’ level of engagement in the lecture: if the pace is too fast and the lecturers move quickly through slides, then students become disinterested in making meaning of the information that is provided on the slide; results from my data confirms that when students have to read lengthy slides and listen to a fast-paced lecture they disengage.

The *teaching-centred* lecturers provided mostly keywords on their slides. The analysis of the students’ notes critically points out that students took down more notes for lecturer 3 (Table 4.3) than for most other lecturers sections, lecturer 3 was categorised as a *teaching-centred* lecturer in 2009. As much as he provided only keywords on his slides, the important point is that he lectured in semester 2: by this stage students had realised that noting only keywords would not provide them with sufficient material to study from for assessments. Therefore

students supplemented some of the examples that were on the slides with content that he provided in his verbal explanations during class.

However, importantly other students reported that since lecturer 3 in 2010 provided limited content on his slides (i.e. mostly keywords and not key points or full sentences) they were unable to determine what content they needed to add to their class notes from the textbook.

‘like when I was going through Mr L’s work, there was just a word there and I was like okay what about this word, I didn’t remember from two weeks ago lecture what that word was about and then you go through the textbook and that word has a whole page of stuff and you don’t know what he was trying to talk about that was that point, so if it [the slide] was more detailed, maybe just have two lines extra it will give you just an idea of what to study’ O4210

The analysis of data from this study indicates that key points need to be explicitly shown on slides, and that this level of detail (i.e. providing key points only as opposed to ‘wordy’ slides) is what indicates to students that they need to be attentive during class, and note content from the lecturers’ verbal explanations and from the slides. Also, this study shows that the provision of key points (as opposed to key words only) provides first years with sufficient detail to facilitate their after-class engagement with other resources such as the textbook. Findings also show that students should be revising notes every day when they can still remember what the points referred to – rather than a week later when they might find difficulty in connecting the content on the slides to what the lecturer had said in class. When students make their own notes it assists in them developing into autonomous learners (Kiewra, 1989). Therefore, the disadvantage with students receiving a complete set of the lecture notes is that they do not actively engage as they would with skeleton notes (Neef et al., 2006; Sweeney, Ehrhardt, Gardner, Jones, Greenfield & Fribley, 1999). Findings from my study show that to stimulate generative engagement it is important for students to perceive that **they need to personalise** the content on the slides and which they receive on the intranet or need to transcribe in class. This study highlights that skeleton slides (which do not just include keywords but instead contain key points) from the lecturer encourage learning opportunities for students.

4.3.1 The impact of the access to slides on the quality of learning

Another factor that influences the quantity and quality of notes that students construct is the access they have to the lecturers’ slides on the University intranet. Access to slides on the

intranet influences the students' perception of the effort needed to put into capturing notes during and after class, and the quality of generative learning students achieve when reviewing and revising their class notes.

Many studies, such as Austin, Lee, Thibeault, Carr and Bailey (2002), Babb and Ross (2009) and Murphy and Cross (2002) have shown that students believe 1) access to the lecturers' slides prior to the lecture assists them being able to prepare for class; 2) slide presentations allows them to remain attentive and develop a better understanding of content; and students think that they perform better as a result of their access to slides. Chen and Lin (2008) and Grabe (2005) have looked at whether there was any effect of slides being provided either before or after the lecture on students' grades. Chen and Lin claim that students perform better when they have access to slides prior to the lecture, while Babb and Ross, and Grabe, report that there is no difference to students' academic performance based on whether slides are made available to students before or after the lecture. In my study when slides were made available on the intranet there was no regular practice in providing access to slides before or after the lecture, thus it was not possible to determine whether this affected academic performance. But, considering the prominent use of PowerPoint during lectures there is still a clear need for further investigations to determine whether the quality of notes that students make, and their perception of the level of engagement they need to put into learning, and their performance on tests and examinations are related to whether they have, or do not have, access to slides on the intranet.

4.3.1.1 The effect of access to slides on the intranet

Kiewra (1991) explains that the more content students note down during class the less opportunity there would be during the lecture period for generative learning; this is because of the high demand on working memory. Accordingly, in the present study, having access to slides on the intranet should have meant that students had less to note, and therefore should have had more generative learning opportunities. However, generally students reported that when they had access to slides on the intranet they did not pay as much attention during the lecture:

'When I'm not doing something [i.e. capturing notes] I'm just like watching, just not interested in what's going on, you not like paying attention' G3110

Another critical point was raised by one of the students who commented that:

‘...I think those [lecturers] who didn’t [provide slides on the intranet] **they wanted us to work hard** cos if you given all the information you are not learning, you are just going to memorise everything, and go with it to the test ...’ O1710

This comment provides an indication that when access to teaching slides was provided on the intranet the students perceived they did not have to be attentive during class or engage with their notes because they already had the lecture material.

Furthermore, several students related that having access to a copy of the lecturers’ slides on the intranet prompted them to learn directly from the slides, as shown by this comment from a first-year student:

‘I prefer getting webct notes [lecturer slides] but I know that it makes me lazy so –, but I do like the webct notes, I think I prefer getting webct notes, it makes you feel a bit more confident, also when the paper comes cos you know you have work, ...for ILS you know I do have the material [slides], I just have to sit down and learn it now.’ O4210

The analysis of interview data shows that students disengage when slides are made available on the intranet because they perceive that they have the necessary content which they anticipate would be examined; analysis of the first years’ notes shows that students take down less material in their notes when they have access to detailed slides. Thus, as will be shown below, the most critical finding was that students were more motivated to personalise their notes when they did not have access to the lecturers’ slides on the intranet.

4.3.1.2 No access to slides on the intranet

In semester 2 students only had access to slides during the lecture. Classroom observations from my study have shown that as long as lecturers create an active learning environment for students, although students had to divide their attention to listening, comprehending and capturing material, the number of activities that they are involved in may not necessarily negatively impact learning. Students seemed attentive if lecturers actively offered opportunities for knowledge construction. For instance, a lecturer asked the class questions that related to practical everyday experience and then by using the students’ comments the lecturer made the links between their experiences and theory. While Kember and Kwan (2000) claim that there is a relationship between teaching practice and the students’

approaches to learning, no part of their study explicitly investigates this link. The findings from my study provide evidence for this claim by Kember and Kwan.

According to the data gathered, the major advantage to the students in my study having to capture their own notes, as opposed to being provided with a copy of the lecturer's slides, was that they were more aware of the content that was presented, and consequently became aware of the gaps in their knowledge.

'it's harder to take down notes than to get handouts [the lecturer's slides], but in a way you kind of learn more [from writing down the notes] because you have to read it [the slide] and you have to write it down rather than just having to read it 'cos [because] you know its already there [on the intranet]'
R2709

The realisation that there were gaps in their understanding was also a motivation for students to read the textbook to broaden their understanding:

'[lecturer slides] notes just made me like lazy, I always thought that maybe for a test I'm covered with the lecture notes [slides] so I'm just going to go through that and so I've discovered so it doesn't work cos [because] you have to like not only read about it, you have to understand the notes-you just can't understand them without getting a background, where they come from, so the textbook helps me to like understand some of the things.....but now [in semester 2] they are too, way too much summarised, and you just can't like open your notes and start studying for it, you have to like consult the textbook'
O4310

Therefore, as much as it seems that when students do not receive access to slides on the intranet there is a trade-off in generative learning opportunities, first years reported that they were more aware of their level of understanding and better able to identify gaps in their knowledge of the topic because they felt compelled to be attentive during class. This means that since students become conscious of the gaps in their knowledge they also are more likely to engage with their notes and learning after class in order to better their understanding. Thus, the role of lecturers is to teach students to think independently and critically, and to ask questions that make students realise the gaps in their knowledge. Therefore, as Marbach-Ad and Sokolove (2000) have pointed out, the development of the students' critical thinking ability is more important than delivering maximum learning content. Within the context of my study, the lecturers' focus on the development of the students' skills in the self-regulated construction of notes is more important than providing 'all' the content that first-years need to 'know'.

4.3.2 The link between access to slides, the level of detail on the slides, student learning and their academic performance

A strong link has been shown between the notes that students construct and their academic performance (Baker & Lombardi, 1985; Bonner & Holliday, 2006; Crawford, 1925; Di Vesta & Gray, 1972, 1973; Kiewra, 1991, 2002; Kobayashi, 2006; Neef et al., 2006; Van Meter et al., 1994;). However, in my study it appeared that even though students had access to slides on the intranet, and the level of detail on lecture slides influenced the students' perception of the effort they need to put into transforming and personalising their notes after class, there was no tangible link between the availability of slides on the intranet and academic performance (i.e. the grade difference was very slight (Table 4.4)). Therefore, although there was a statistically significant difference between the grades that students achieved in tests and examinations (Appendix 8), and in the quality of their notes (Appendix 9a, b) when they had access to slides compared to when they did not have access to slides on the intranet, this part of the analysis has to be interpreted cautiously.

Table 4.4: Comparison of assessment grades between semester 1 and semester 2

	2010		Combined ⁵ average	
	Semester 1*	Semester 2**	Semester 1*	Semester 2**
Test average	58	52.5	56.5	52.3
Exam average	52	54	51.3	53.3

* Access to slides on intranet and in class

** Access to slides provided only in class

This indicates that although access to slides on the intranet does impact on the students' perception of the effort that they need to put into reviewing and revising their notes, on the quality of notes that students make and on their opportunity for generative learning, it does not necessarily impact on their grades in tests and examinations.

However, an important finding from data in this study (reported in Dukhan et al. (chapter 3)) which supports a number of other studies (Cornelius & Owen-DeSchryver, 2008; Di Vesta & Gray, 1972; Kiewra, 1985b; Kiewra et al., 1988) was that students who personalise their

⁵ 'Combined' data, in this chapter, reflects an average of the individuals in the entire cohort, and is not an average of the averages attained in each year of the study.

notes improve their understanding and achieve higher grades than students who study using only the lecturers' slides. Since students who use this approach achieve a deeper level of understanding of content, and make more links and connections within and between lecture topics, these students perform better on higher order questions (Cornelius & Owen-DeSchryver, 2008). The analysis of data from my study confirmed that the level of test and examination questions in relation to the level of cognitive processing that students need to achieve to answer the test or examination questions is another contributing factor to academic performance. It is thus important to take the cognitive level of assessments into consideration when looking at the relationship between students' notes and academic performance. Only one other study i.e. by Cornelius and Owen-DeSchryver (2008) has investigated this link. Cornelius and Owen-DeSchryver found that the cognitive level of questions in tests and examinations was related to the grades that students achieved. Following work done by Cornelius and Owen-DeSchryver, my study compared the level of the test (Table 4.5) and examination (Table 4.6) questions to the grades that students achieved. Only those assessment questions that were directly relevant to the selected lectures were analysed. However, the manner in which the tests and examinations questions were analysed in my study was exploratory, and the links are therefore tenuous rather than strong and clear. There were too many variables to conclusively indicate any causative links. Nevertheless, this analysis still provides an indication of the connection between the students' notes, cognitive level of the test and examination questions and the students' grades, as explained below.

In 2010 the semester 1 tests contained more conceptual questions and questions at 'cognitive' level 3, while in semester 2 there was a wider spread of questions at different levels of complexity (Table 4.5). In other words, according to the questions that were analysed, the semester 1 tests were more challenging than the semester 2 tests. Students performed better on the semester 1 tests than on the semester 2 tests (Table 4.4). The examinations results for each semester in 2010 however, demonstrated that the semester 2 examination was more cognitively challenging than the semester 1 examination in terms of questions that required application rather than recall (Table 4.6), students performed only slightly better in the semester 2 examinations (Table 4.4). It should be noted however, that although the results for tests and examinations were statistically significant, the grade difference was too small to enable any clear conclusions to be drawn.

Table 4.5: Mark allocation for test questions

	Semester 1				Semester 2			
	1	2	3	Total	1	2	3	Total
Factual	17(L1Y11)			17 (Y11)	1 (L3Y09) 5 (L3Y10)	1 (L309) 1 (L4Y09)		3 (Y09) 5 (Y10)
Conceptual			11 (L2Y10)	11 (Y10)		1 (L3Y10)		1 (Y10)
Procedural			2 (L2Y10)	2 (Y10)			1 (L3Y10)	1 (Y10)
Total	17 (Y11)		13 (Y10)		1 (Y09) 5 (Y10)	2 (Y09) 1 (Y10)	1 (Y10)	

Key:

The number preceding the bracket refers to the number of marks allocated to a particular question. Within the bracket “L” refers to the lecturer while the number after “Y” refers to the year (e.g. 17 (L1Y11) refers to 17 marks allocated to a factual level 1 type question, this question was provided for Lecturer 1’s section in 2011).

Table 4.6: Mark allocation for examination questions

	Semester 1				Semester 2			
	1	2	3	Total	1	2	3	Total
Factual	19 (L1Y10)							
	11 (L1Y11)			22 (Y10)	8(L409)			9 (Y09)
	2 (L2Y10)			29	5	2	1 (L3Y10)	8 (Y10)
	18 (L1Y11)	1 (L1Y10)		(Y11)	(L3Y10)	(L3Y09)	1 (L4Y10)	
Conceptual		1 (L1Y10)						1 (Y09)
		2 (L2Y10)		3 (Y10)		1 (L4Y09)	1 (L3Y10) 14 (L4Y10)	15 (Y10)
Procedural							4 (L4Y09)	
		1 (L2Y10)	6 (L2Y10)	8 (Y10)			3 (L4Y10)	4 (Y09) 3 (Y10)
Total	21 (Y10)	5 (Y10)	6 (Y10)		8 (Y09)	3 (Y09)	4 (Y09)	
	29 (Y11)				5 (Y10)		20 (Y10)	

From the statistical analysis of the students' notes (Appendix 9a, b) it was apparent that students took down more notes at the beginning of semester 2 compared to the beginning of semester 1 (Table 4.3). Students made this change after seeing their June examination results, which probably provoked them to capture more material in an attempt to improve their grades. Some students however, reported that because they only had access to slides during the lecture in semester 2, they felt pressured into taking more notes. Nevertheless, within the complexity of factors it is important to mention that the experience that students had in semester 1, and particularly the grades that they received helped to make them aware of the standard expected at University in relation to note-taking and note-making, and the changes effected in this practice in semester 2 were based on this experience. Additionally, the comprehensiveness of the slides influenced the amount of detail students noted.

According to Van Meter et al. (1994), as students gained more experience over the course of their undergraduate years their notes develop to include pertinent and more information

compared to lecturer visuals. Students learn how to take notes that are relevant to the course itself and to tests, assignments and examinations. In my study, although some students did begin to transform and personalise their notes as they gained experience during first year, the notes most first years produced still did not reflect much information additional to that provided on the lecture slides. However, by semester 2 many students seem to have realised the importance of listening and understanding the verbal lecture, and as a critical point that the details relevant to assessments were generally in the verbal and not necessarily the visual aspect of the lecture. Also, by semester 2 students had started to realise that University assessments required them to understand and not simply recall the material that was provided in class.

4.4 Conclusion

This study investigated whether the type of slides that lecturers provided to students were reflective of their expectation of the role of the student. Central to this investigation was the impact that lecturer practice had on student note-taking, note-making, and academic performance.

The central findings were that lecturers' expectations that students were responsible for constructing their own notes impacted on the amount of detail that the lecturers provided on their slides. While the *student-centred* lecturers provided skeleton notes, expected students to personalise their notes, and aimed to develop students' critical thinking ability, the *student-directed* and *teacher-centred* lecturers were more focused on completing the syllabus. Their primary sense was that it was their responsibility to provide students with all the information which first-years needed to learn.

However, students took more initiative in engaging with their notes during and after the lecture when they were provided with less content support (such as provision of detailed slides), and instead were provided with more facilitative support (such as provision of key points). Furthermore, when lecturers provided access to slides on the intranet, students took few notes and did not usually revise or add to these notes. Additionally, when students did not have to make notes during the lecture then there seemed to be a decrease in generative learning opportunities during the lecture. However, when slides were skeletal, and were not made available outside the lecture - as much as there was a greater competition between generative learning and working memory - students were more actively engaged in the

lecture. Students need to be actively noting information in order to be alert and attentive during the lecture by their own admission. Access to skeleton slides meant that students felt obligated to extend this information so that they had sufficient material to learn from for assessments. Consequently, the detail provided on the lecturer slides, and the access to these slides, influenced the effort that the students made in personalising their notes.

Lecturers can be misguided in their beliefs about how to best serve students through their teaching. They may be so concerned about their responsibility in making sure students have all the information that first years need to be able to pass that the lecturers may provide them with copious notes as a measure of 'insurance'. They can 'rest assured' then, of holding up their side of the teaching and learning 'bargain', and then transfer responsibility by saying 'it is now up to the students'. My study confirms the disservice this does in terms of student learning and the development of students as responsible learners.

When students used notes as a vehicle to knowledge-construction, as opposed to simply being a product that needed to be memorised, the content that they wrote down enabled them to identify gaps in their understanding of the lecture topics. The students' notes can therefore be understood as a sign, in the Vygotskian sense, that symbolises their transformation of knowledge. These notes then enable students to establish a more integrated and in-depth understanding of content. In contrast, and again in reference to Vygotsky's framework on cognitive development, the lecturers' slides are a tool which shapes the depth to which students engage with their notes. From a pedagogical perspective the findings of this study will be of interest to academic staff in helping them to understand the impact of the style and availability of notes on student learning.

CHAPTER 5:

THE IMPACT OF ENGLISH AS A SECOND LANGUAGE ON CONSTRUCTION OF NOTES AND ACADEMIC PERFORMANCE IN FIRST YEAR

Abstract

It is generally considered that compared to their first-language peers, second-language students have more challenges to overcome in their transition from school to their first year at University. The purpose of this study, which emerged from a larger body of research on first year students' note-taking and note-making practices, was to identify whether there are any differences in the notes constructed by first and second-language students, and whether this would affect their academic performance. It was established that first-language students made notes which were better structured and more detailed, and they performed better academically than their second-language peers. However, when students were provided with training that focused on using writing as a means to promote critical thinking, this led to students personalising their notes. The skills gap between first and second-language students became less apparent, and the second-language students' grades improved. The conclusion was that the University has a pivotal role to play in preparing students for academic success by providing them with supportive measures (e.g. workshops) geared to bridge the 'skills-gap' faced by many students in their first-year.

5.1 Introduction

During the Apartheid regime in South Africa, language was used as a primary means of segregating racial groups (Fiske & Ladd, 2004). In 1994, educational opportunities were opened to previously-disadvantaged ('black') populations, which resulted in increasing numbers of these students gaining entry into tertiary institutions. Teachers at black schools often teach by means of code-switching, or in the students' mother tongue (Adendorff, 1993, 1996; Martin, 1999; Rollnick, 1998, 2000; Rollnick & Rutherford, 1996; Setati, 1998; Setati & Adler, 2000). When students from these schools enter a University, where the medium of instruction is English, they may be disadvantaged as they may not have developed the English competency which is required at University and that is fundamental to their academic success.

According to Northedge (2003), being ‘knowledgeable’ means that students are able to participate in the specialist discourse of a knowledge community. Within the academic environment this means that undergraduates need to understand the lecturers’ accent, comprehend a lecture taught in the English language which includes making sense of the terminology of the discourse, and be able to capture sufficient content in their notes (Storch, 2009). The students’ understanding of the vocabulary within Science is particularly important because this influences their comprehension of the material presented during fast-paced lectures. Students who have not had sufficient experience using English to converse may require additional guidance to be able to understand scientific terms (Parkinson, 2000). As a discipline, biology is particularly rich in specialist terminology so the issue of language support is important in this context.

Where students have difficulty with the vocabulary of the discipline, the quality of the notes they capture in the lecture (i.e. note-taking) will be affected. Most students take notes to aid lecture recall, to improve their understanding, and to get down information that is required for tests and examinations (Badger et al., 2001). But the cognitive overload that second-language students face in lectures compromises their opportunities for learning. Concerns about the limited support that second-language students received in developing ‘academic language’ skills in the context of the study provided the motivation for investigating the impact of language on note-taking and hence on performance. Since research reported in the literature has shown that the quality of students’ notes is linked to academic performance (Dukhan et al, chapter 3; Titsworth & Kiewra, 2004), the question that guided this study was whether writing practice could be used to improve the second-language students’ grades. From a survey of the literature it became apparent that the connection between academic performance and students notes, where notes are impacted by issues of second-language usage, has been under-researched.

The quality of notes that students capture in class (note-taking) affects the way in which they engage with and revise their notes after class (note-making). The note-making phase is more closely associated with generative learning than the note-taking phase (Dukhan et al., chapters 3 and 4; Kiewra et al., 1991; Stefanou et al., 2008). Generative learning refers to the students’ creation of links between prior knowledge and new knowledge (Peper & Mayer, 1978, 1986). This means that during note revision, if second-language students spend more effort in understanding the language in which the concepts are taught than on enhancing their

depth of understanding, the quality of their notes will be compromised and they will lose out on generative learning opportunities. The lack of generative learning will then impact on the grades that students achieve.

This study, used Vygotsky's conception of 'tools' and 'signs' (as defined in Chapter 3 and 4) to determine the effect that lecturers can have on making concepts more accessible to second-language students, and how students can use the lecturers' slides and their own notes to engage in a deeper approach to their learning. In this study the slides that the lecturers provided was considered a psychological 'tool' because the slides usually explicitly provided key aspects that the lecturers wanted to convey to students. When students later revised their notes, and/or when studying for their assessments, they would use the slides and their class notes to guide their learning. The notes that the students constructed were considered 'signs' because they acted as a reminder of concepts that were covered in class, and/or as a reflection of student understanding.

Thus it was surmised that by analysing and comparing the notes prepared by first and second-language students, in comparison to the content on the lecturers' slides, insight should be gained regarding the differences in the ways in which these students approached their note-making and learning. The quality and quantity of notes that students made were analysed and the results were then viewed in relation to the grades that students received in tests and examinations in their first year. The shifts in the students' construction of their notes as experience was gained were investigated, again in relation to their academic performance. This enabled me to identify and compare the different strategies that first and second-language students had applied in constructing their notes in first year, and also allowed insight into the lecturing practices that students thought assisted them in capturing and understanding content.

5.2 Methods

The study was conducted in the Introductory Life Sciences course (ILS) at a South African University, and extended from the beginning of Semester two 2009 to the end of Semester one 2011. ILS is offered in first year and spans two semesters (each being taught by a different school: School 'A' taught in semester 1, and School 'B' in semester 2). During their first semester students were lectured on topics centred at the molecular and cellular level, while in the second semester students were taught about the macro-environment. During the

years in which the study was conducted the annual intake of 500 students was divided between two groups so that lecturers repeated each lecture. On registration students were randomly assigned to one of the groups, so, for the purpose of this study because one group was considered reflective of the other, only one group formed the study sample.

Two lectures per semester were identified for this study. The topics were selected on the basis of its familiarity to students; the first topics in each semester (i.e. 'Meiosis and Mitosis' and 'The Animal Reproductive System') were ones that featured in the school syllabus and students should have covered at school, while the second topics in each semester (i.e. 'Cell Communication' and 'Metabolism') were ones that were likely to be new to students. In total, eight lecturers participated in this study. A single 45-minute lecture was observed and video-recorded for each of these lecturers. The video-recorded lectures were transcribed for analysis and compared to data collected from the first-year students.

All students in one group of the ILS class were provided with questionnaires (Appendix 1). Students who chose to participate in this study completed the questionnaires. The return rate for each year of this study was about 25% completed questionnaires. The questionnaire included the following variables: expected performance at University, previous note-taking and note-making experience at school, and note-taking and note-making expectations at University. The students' responses to the questionnaire were thus analysed according to each of the following aspects:

- prior schooling experience in note-taking and note-making.
- use of notes for test and examination preparation at school.
- their expectations of the University lecturer.
- use of the handouts provided at University.
- addition to information provided on the lecturers' slides.
- how students had recorded notes during the lecture.
- what the reasons were for note-taking and note-making.

When analysing the responses it became apparent that there were three categories of students: there was one group that took charge of constructing their own notes based on the content provided on the lecturers' slides, and had no expectations of any assistance from the lecturer in providing them with a set of notes; a second group believed that the lecturers' slides were a comprehensive set of notes and expected that they would have to learn only this information

for tests and examinations; and the third group expected to receive notes from the lecturer but also thought that they would have to add to these notes, from the lecturers' verbal explanations and from the prescribed textbook. 10 students in each of these categories were selected to continue with the study. Thus each of the 30 students per year (i.e. 90 students in total) participated in one-on-one, face-to-face interviews. The first interview was conducted in semester 1, the second in semester 2, and the third at the beginning of the following year. Since the study commenced at the beginning of semester two in 2009 and ended after semester one in 2011, two interviews were conducted with the 2009 cohort, three with the 2010 cohort and one interview was held with the 2011 cohort. Interviews were used to gather insight on how students' views, expectations and experiences of their note-taking and note-making practices changed as they gained experience at University. Interview questions are provided in Appendix 2.

During the interviews it became clear that the students' understanding of scientific terminology and their comprehension of English influenced their construction of notes and their grades. This encouraged me to investigate whether English as a first or second-language could provide any explanations in relation to differences in performance.

The notes which participating students used for study purposes were photocopied for each of the selected lectures. Four sets of student notes - which were associated with the four selected topics stated above - were analysed each year in terms of the structure and quantity of content. Thus 240 sets of notes were analysed in total. Note-taking and note-making practices were compared for first and second-language students. A rubric developed by the researcher (Appendix 3 page 150) was the starting point for the qualitative analysis of students' notes - this rubric was based on the SOLO taxonomy, as explained in chapter 3. Students' notes were also analysed quantitatively according to a comprehensive set of notes the researcher made from the selected lectures. The number of information units provided in students' notes was calculated. Information units are blocks of information or whole ideas (Hughes & Suritsky, 1994), and comprise of a sentence, clause or stand-alone phrase. Numerous studies (such as DiVesta & Gray, 1972; Dunkel, 1988; Hughes & Suritsky, 1994; Kiewra et al., 1995) have used the measure of information units as a method for analysis of notes. By looking for the number of information units in the students' notes I was able to analyse for completeness, i.e. a comparison was made of the amount of content students noted from the lecturers' verbal explanations and from the visuals provided in class. Additional information that students wrote down from other resources (such as

the textbook) was also considered. Two peers in the education field independently repeated this analysis, and evaluated 10% of the notes, with more than 95% agreement in terms of analysis. Student marks were then obtained from departmental records. Data were quantitatively analysed using ANOVA Single factor analysis. KyPlot was then used, if significant differences were present, to determine exactly where these significant differences were.

Ethics clearance was granted by the Universities' Research Ethics Committee (HREC Non-Medical Protocol number: 2009ECE114).

5.3 Results and Discussion

The majority of the South African population is black and there are eleven official languages. As much as the government stipulates that students at South African schools can be taught in their home language until Grade 3, and thereafter should be instructed in English, studies such as that by Adendorff (1993, 1996), Rollnick (1998, 2000) and Setati and Adler (2000) show that code-switching (i.e. alternating between the learners' home language and a second language) still occurs into high school. Code-switching is important when teachers have the view that teaching second-language learners by interchanging between English and a second-language would assist learners achieve a better comprehension of content (Adendorff, 1993, 1996; Martin, 1999; Setati, 1998). In a study by Rollnick and Rutherford (1996), teachers were reported to have used code-switching to explicitly point out material that they felt students needed to note during the classroom lesson. However when they enter University it is rare that first-years are cued to note content in this manner.

According to the Progress in International Reading Literacy Study (PIRLS) in 2011 (Howie, Van Staden, Tshele, Dowse & Zimmerman 2012), English is the first-language of only 9.6% of South Africa's population. Students who had completed grade 12 (i.e. high school), and who were selected to enter the University at which this study was conducted had experienced some level of communication in English. Considering that the medium of instruction at the University is English, the exposure that second-language students had to English prior to entering University is likely to have posed a problem with their comprehension of lectures. In this study, 'first language' refers to students whose home language or mother-tongue is English, while 'second language' refers to students for whom English is not a first language.

The number of first and second-language students who participated in my study varied across the years (Table 5.1).

Table 5.1: Composition of first and second language students from 2009-2011

	2009	2010	2011	Combined
Number of first language students	12	17	14	43
Number of second language students	18	13	16	47

Analysis of the data obtained supports findings from work by Rollnick (2000) and Setati and Adler (2000), that code-switching or teaching in the mother-tongue continues into secondary school (i.e. Grades 8-12). A comment from a second-language first-year student in my study highlighted that since code-switching was not practiced at University, language posed a barrier to her understanding of the content presented during lectures:

‘...it depends again which kind of school did you attend, because there, if like at some point I didn’t understand - where I come from - I used to go and ask like my teacher, she used to explain in **my language** to understand, **but here everything is done in English**, and **like I’m far from home, like there’s no one to ask.**’ R2809

In my study, 10% of the students (9 students) commented that their level of competence in English affected the depth of meaning that they were able to construct within and outside class, and thus affected the quality of notes which they captured for study. Some lecturers were aware of the problems students experienced with English: four out of the eight lecturers who participated in my study related that not only did students generally grapple with understanding content to a larger extent than they had anticipated, but that first-years also struggled with writing coherently. This is shown by a comment from a lecturer:

‘I am exceptionally frustrated by the quality of the writing that I get, beyond content, the actual grammar, the language, I think there are some fundamental errors, and I have commented on it before to colleagues that quite frankly if you had to take some of the writing and engage [read] it, it’s borderline illiteracy’. L409

The lecturers' concern regarding the students' limited level of literacy corroborates findings from two international studies which have reported that South African learners are ranked amongst the lowest in international standards in reading (Howie, Venter, Van Staden, Zimmerman, Long, Du Toit, Scherman & Archer, 2008; Howie et al. 2012) and in Math and Science (Human Sciences Research Council, 2011). Moreover, these international studies have also reported that black students' performance is weaker than that of their peers, and that one of the most likely factors to contribute to the students' academic performance is the language that they were taught in at school. Furthermore, Morrow (1994) coined the term 'epistemological access' to describe the difficulties that students experience in their transition into what for them is a foreign environment. While he acknowledges students as being primarily responsible for their learning, he points out that the lecturers play a crucial and facilitative part in this process.

5.3.1 School experience influences the students' academic transition into first-year

Compared to first-language students, more of the second-language students in my study reported that, unlike the situation at University, they had been provided with a comprehensive set of notes from their teachers at school (Table 5.2). Teachers who provide a comprehensive set of notes are taking on the responsibility for student learning because they are, in essence, providing material which the learners rote-learn. Students are not then encouraged to engage with their work at a deeper cognitive level. Morrow (1994) explains that when teachers attempt to 'relieve' students of challenge within the learning environment this does not reflect good teaching practice, because it precludes them from taking ownership of their learning, i.e. first year students need to go through this process of 'challenge' in order to understand what being a self-regulated learner means. In my study, first years reported that when they received 'complete' notes from the school teacher they usually did not engage further with the material other than to memorise the content. This results in a surface learning approach because students are not compelled to form a deeper understanding of links and connections between content within topics, and to form a global understanding of topics (Dukhan et al., chapter 3). This practice on the part of the teacher unintentionally results in a lack of generative learning opportunities on the part of the students.

Table 5.2: First and second language students' note-making experiences at school

		2009	2010	2011	Combined average
First-language English students	Number that received notes from the teacher	5	4	5	14
	Number that had some experience in making their own notes	7	13	9	29
Second-language English students	Number that received notes from the teacher	11	5	8	24
	Number that had some experience in making their own notes	7	8	8	23

In comparison to the first-language students, more of the second-language students in the current study enter first year having had a school experience where teachers provided them with complete sets of notes (Table 5.2). Findings from my study - like the findings in studies by Craig (2001) and Slonimsky and Shalem (2006) - show that when students are actively taught to be self-regulated learners they are better prepared for University compared to students who have experienced authoritative teaching models. Thus students' school experience can form the basis of their practice when they enter first year.

5.3.2 First-language English students capture more detailed and compose better structured notes than their second-language peers

When students entered University, those who were accustomed to receiving notes from the teacher at school used the lecture slides as their study notes in their first year. This was because their previous school experience had led them to conclude that the slides provided all the information that they were required to know and memorise. But at University lecturers usually only use slides as an aid to their teaching, and to provide key points and the structure of a lecture, so that students can use them to focus and extend their learning after class (Dukhan et al., chapter 4).

In my study the detail that lecturers provided verbally (i.e. material that was not on the slides) ranged from 8% to 76% of the total information provided during the lecture. This makes it essential that students should know how to use the lecturers' slides to enhance their learning at University. However, from the interviews it became clear that second-language students did not seem to understand that the lecture slides were just a guideline which they needed to expand on. They stated that they struggled with noting content from the slides and from the lecturers' verbal explanations while also having to decode biology and English vocabulary, this impacted on the quality of notes that they took in class and the depth of notes they made after class.

In semester 1 the second-language students captured only half the quantity of notes from the verbal and visual aspects of the lectures compared to their peers (Table 5.3). The first-language students also noted more content from resources other than that provided in the lecture (Table 5.3). And, the notes that second-language students made was not as coherent in terms of the development of ideas and organisational structure of lecture content, as reflected by the 'notes score' (Table 5.3). Although there were differences observed when quantitatively and qualitatively analysing the students' notes (Tables 5.3 and 5.4), these differences were not statistically significant (Appendix 10).

Table 5.3: Comparison of Semester 1 note-making averages for first and second-language students

	Semester 1											
	*L1		*L2		*L1		*L2		Combined average			
	2010		2010		2011		2011		*L1		*L2	
	**E1	**E2	E1	E2	E1	E2	E1	E2	E1	E2	E1	E2
Total number of facts	69	36	87	44	52	43	72	36	62	41	80	42
Number of verbal aspects	66	28	84	39	40	39	70	38	55	35	78	38
Number of visual aspects (content on slide/board/overheads)	59	28	82	39	40	39	69	39	51	34	76	38
Additional information from other resources (e.g. textbook)	17	7	5	1	11	6	3	2	18	7	5	1
Notes score	18	15	21	14	19	16	21	17	19	15	21	14

* 'L' denotes 'lecturer', the number that follows distinguishes one lecturer from another.

** 'E1' denotes English first-language students, and 'E2' English second-language students.

However in semester 2, the situation changed in that second-language students captured more facts for lecturer 3's sections in 2009 and 2010 than their first-language peers (Table 5.4).

Lecturer 3 provided mostly key words, and due to their comprehension of English, the first-language students probably did not take down as much content because they better understood the concepts that the lecturers explained. In contrast, second-language students are likely to feel more compelled to capture what the lecturer was saying. For lecturer 4's section, when students had to note key points (as opposed to key words only) from the slides, second-language students noted less than first-language students (Table 5.4), probably simply because they could not keep up. Lecturer 4 based much of the lecture content on personal research in the field, and lectured in a conversational manner; the second-language students thus also had difficulty in deciphering what content needed to be noted and captured less material than their first-language peers.

Table 5.4: Comparison of Semester 2 note-making averages for first and second-language students

	Semester 2											
	L3 2009		L4 2009		L3 2010		L4 2010		Combined average			
									L3		L4	
	E1	E2	E1	E2	E1	E2	E1	E2	E1	E2	E1	E2
Number of facts	83	90	33	24	139	144	64	39	115	112	35	18
Number of verbal aspects	83	90	31	22	127	140	57	39	69	57	31	17
Number of visual aspects (content on slide/board/overheads)	83	90	31	22	133	140	62	39	111	110	47	30
Additional information from other resources (e.g. textbook)	1	0	2	0	6	4	1	0	6	4	1	0
Notes score	10	9	9	9	16	12	17	9	16	12	17	9

* 'L' denotes 'lecturer', the number that follows distinguishes one lecturer from another.

** 'E1' denotes English first-language students, and 'E2' English second-language students.

By semester 2 second-language students realised the importance of the lecturers' verbal explanations in relation to the content that was tested, and therefore knew that the material provided on the lecturers' slides did not provide sufficient facts for their studying. They learned that they needed to listen to, and understand the lecturers' verbal explanations, as shown in a comment from a second-language student:

'for first semester it was difficult, it was difficult, I had a problem in like taking down notes so now [i.e. semester 2] ... I've realised that what the lecturer is saying now is more important than going through the notes [slides] because they realise that everyone can read the notes [slides] so like, talking in the lecture, they would go through the slides but they would explain, add a little bit and I've realised that those are the things that they ask you in the test or exam.' O4810

The first-language students, from the beginning of the year, were aware that the verbal aspect of the lectures contained the detailed material that would be examined, and consequently acted to capture some of this information in their notes. In 2010 and 2011 the first-language students not only noted more content from the verbal lecture than the second-language students, but also made more coherent notes as shown by the 'notes score' (Table 5.3 and

5.4). Thus as much as Storch (2009) reported that students should write more coherent and personalised notes as they gain experience and a better grasp of English within University, my data showed that in contrast to second-language students, first-language students continue to have a distinct advantage in composing better-structured notes throughout their first year.

Additionally, compared to the second-language students, their first-language peers noted almost twice the amount of information from the textbook (Table 5.3). During interviews it emerged that second-language students lacked experience in using textbooks at school, and therefore found it difficult to know how to deepen their learning using the prescribed textbook at University. Due to their lack of command of English second-language students identified issues with understanding the textbook:

‘I read here in the textbook and make my own summary, but I find it easier to understand something that was written by me, with **my own simple English**’ R5710

The second-language students also had a poorer conception of what was appropriate and relevant material in the textbooks, which as noted by the following student, was made even more difficult when international textbooks were prescribed:

‘...it is an international [text]book, its not in a way that you’d think you’d get it, maybe if it was a South African book it would have been simpler to understand, like it also affect how you acknowledge [comprehend] according to English, how you understand English cos [because] the terms can be very not understandable...’ O1709

Working with textbooks has been shown to develop the students’ ability to engage with material in a manner that allows for the construction of cognitive learning (Haggis, 2006; Slonimsky & Shalem, 2006). But a major barrier to learning science is the grammar of science (Fang, 2004). The inability to have a good command of scientific vocabulary not only influences the students’ ability to read and write in a scientific manner but also their ability to understand (Wellington & Osborne, 2001). The range of vocabulary that the students had developed prior to their first year at University influenced how much they understood during the lecture, and when they read lecture slides and their textbooks:

‘usually most of the time if I’m using the textbook, I write it in the way the textbook gives it but then I would, you know, not only just try to put in my mind so to regurgitate exactly what is said, but to make myself understand it better, cos **I realised that when I got here there was this vocabulary gap**, so in order to familiarise myself with the vocabulary I have to somehow incorporate the vocabulary the textbook uses, which is **University vocabulary** into my work because if I don’t then I will be stuck in an exam just not knowing what they are asking.’ G709

Biology in particular has many terms that do not have an equivalent in any of the African languages, therefore second-language students experienced more challenges when they attempted to understand the meaning of unrecognisable terms:

‘...I’d think background knowledge, like simple stuff, I don’t know like very simple basic stuff you need to understand, like in biology alone, I find it’s very difficult sometimes to understand what the lecturer is saying cos [because] of so much **jargon** they expect you to know...’. O4110

‘...sometimes when somebody teaches you, I don’t know, okay the thing is some of the words in English, I don’t know the meaning I just say oh this might mean this, but like when we are saying “twitching, twitching” – must be something like this [demonstrates], but when I saw the video, I thought oh it does like this, that is “twitching”...that means when he was talking about twitching and all of that, and what has happened to the body temperature and metabolic rates and all of that, **now I know what he is talking about cos [because] I’ve seen the video** of what is happening’ R5410

Compared to their first language-peers, the second-language students entered University with expectations and practices that were less-aligned to the University’s expectations of student practice and ability. However, by the time that second-language students had got to semester 2 they adjusted their practices and better understood the importance of independent and self-regulated learning to success at University. This finding is in support of Morrow (1994) who states that in order for students to become successful they need to understand the practice within the academic discipline. The findings in my study show that students need to gain experience within the academic environment of the University in order to understand the level of self-regulation that is required, and this understanding enables them to achieve epistemological access. Morrow explains that as much as the students are key to their success at University, their quality of learning can be facilitated by their lecturers. Thus according to him, as much as both the teachers and students have a substantive role to play within the learning environment, teachers need to provide ‘tools’ which students could use to develop their understanding. In the context of my study, the findings show that as much as students need to take charge of their learning, the University also has an obligation to support these students become academically successful.

The next section looks at the function of workshops in improving student academic success.

5.3.3 An ILS initiative to support students become more successful academically

The semester 1 co-ordinator of the ILS course recognised that students' ability to critically engage with text needed attention. Therefore, for the first time in this course, a series of workshops that focused on developing the students' ability to critically read, write and develop an argument (Brenner & Nichols, 2013) was offered to all first-year students in 2010. These workshops were offered again in 2011. Once second-language students were trained to make meaning of content when they constructed notes, it was possible for them to see the value of a personalised set of notes that had structure and coherency. Additionally, when these students were taught the value of using their notes as a vehicle for the process of learning and knowledge transformation they improved their academic performance.

5.3.4 Language affects the quality and quantity of notes and academic performance

There was a narrower gap in the academic performance of first and second-language students in 2010 and 2011 compared to 2009. Compared to their second-language peers in 2009, the first-language students performed better on all assessments. However, in 2010 the gap in performance between the groups decreased. There was a further decrease in this gap in 2011, and in some tests and examinations the second-language students performed slightly better, on average, than the first-language students (Table 5.5).

Table 5.5: Assessment averages for first and second language students

	2009		2010		2011		Combined average	
	E1	E2	E1	E2	E1	E2	E1	E2
Test 1	52	41	68	66	57	58	68	66
Test 2	73	65	50	44	49	52	51	44
Exam 1	50	39	60	56	56	52	60	56
Exam 2	45	35	48	39	45	48	50	39
Test 3	52	44	49	44	47	44	50	44
Test 4	62	52	59	55	40	36	60	55
Exam 3	59	43	50	47	44	45	50	47
Exam 4	59	52	62	53	48	48	64	53

While it is possible that the University changed their selection criteria and accepted more academically-capable students in 2010 and 2011 compared to 2009, or that there may have been changes in the teaching and learning environment at school which facilitated the second-language students to develop a higher level of skills relevant to the university academic environment, it is also likely that the increased performance of the first-year second-language students in 2010 and 2011 was due to the implementation of the workshops. The workshops enabled students to see that the lecturers' slides were not the product that needed to be learnt, rather the slides represented a guideline. The students became aware that they needed to read further and personalise the notes with more details. This is evident in the notes scores that the 2010 and 2011 cohorts received compared to the 2009 cohort (Tables 5.3 and 5.4).

During the transformation of notes there was the likelihood of a transformation in the students' knowledge and understanding as well, which then results in better comprehension of lecture content. This is because when students revise and personalise their notes they engage more deeply in finding how their understanding of content aligns with what is presented on the lecture slides, i.e. the content that the lecturer expects students to comprehend. Thus, during the process of revising their notes students identify gaps in their knowledge and can then seek information from other resources such as textbooks to better their understanding.

When comparing test and examination grades that the first and second-language students achieved there was generally statistically no significant difference – only one test and one examination score in 2009 was statistically significant when using KyPlot to analyse data (Appendix 11). It is likely that in 2010 and 2011 this lack of significant statistical difference was due to the improvement in note-taking and note-making and writing as a result of the workshops that were offered to students in these years, or that the University changed its selection criteria to accept students who were more academically capable. It is also possible that due to the small sample size statistically significant differences did not show up.

If students are taught to critically analyse texts and arguments, then the understanding and critiquing of the scientific discourse will be more accessible to them (Fang, 2004). When the 2010 and 2011 second-language students were taught the value of using note-making as a vehicle in the process of learning they performed better academically than the 2009 second-language students (who had no training in writing). More importantly in 2011 these students

did almost as well as, and in some instances better, than their first-language peers on some tests and examinations (Table 5.5).

5.4 Conclusion

The purpose of this study was to identify whether there were any differences in the notes that first and second-language students constructed in a first-year biology course at a South African University, and whether these differences had an effect on the academic performance of these two groups.

The data obtained for this study indicated that first and second-language students experience of, and competence in English influenced the depth of meaning they were able to achieve in class and when reading their textbook; and that this had an impact on the quality of notes that they constructed. The grades that students achieved on tests and examinations were found to be related to English as a first or second language. However, when the second-language students were provided with workshops that focused on writing as a means to promote critical thinking, and thus when note-making was used as a means to deepen comprehension, this contributed to a general increase in the standard of notes that second-language students made, and hence to their academic performance. Their experience of the University academic environment resulted in an increased awareness of how to learn and make notes. This increase in experience was another factor that contributed to their performance. But the significant factor contributing to effective learning was the workshops, especially in the case of the second-language students.

Through lecturers being cognisant of the challenges that second-language students face in terms of the language of both English and biology they could scaffold their lectures to be more inclusive of students who present with these issues. It is essential that training should be given at the beginning of the year if second-language students are going to gain epistemological access to subjects like biology when they enter University.

CHAPTER 6:

DISCUSSION

Research has shown that the quality of note-taking (the students' capturing of content in class) and of note-making (their revision of notes after class) is linked to the grades that undergraduates achieve (Bonner & Holliday, 2006; Crawford, 1925; Di Vesta & Gray, 1972, 1973; Kiewra, 1991, 2002). In light of concerns regarding undergraduate throughput rates, this study investigated the factors that influenced the quality of notes that first years used when studying for tests and examinations in the context of a biology course.

Many factors, both at the level of the lecturers and the students, have been shown to have an influence on the type of notes that students make (Biggs, 1989; Clark, 2008; Kane et al., 2002; Verloop et al., 2001; Virtanen & Lindblom-Ylänne, 2010; Wecker, 2012). Drawing on this research, this study took into account the following factors: 1) the students' expectation of their grades at university; 2) the students' experience in constructing notes at school; 3) the influence of student access to lecture slides on the intranet as well as the level of detail provided on these slides; and 4) the impact of language, i.e. whether English was a first or second language for the students. This research study was initiated to find ways to enrich the students' learning experience in their first year with a view towards improving student learning and hence the throughput rates. The starting point was to determine how the grades that the students' anticipated they would receive at university compared to the grades that they actually achieved in their first year. This paved the way to engage with both students and lecturers in establishing how the quality of the students' notes may be impacting on their academic performance. The main research question to guide the investigation thus was:

Considering that the link between the construction of notes and academic performance has been well-established, what factors influence the students' construction of their notes?

To answer this over-arching question, a subset of questions was developed, as presented below:

- 1) To what extent does the students' expectation of how they will perform align with their actual grades received in semester 1 and 2 in first year?
- 2) To what extent does the students' practice of constructing notes at school influence their expectations and practices of this task in first year?
- 3) What connections exist between the students' expectations of the learning environment and their practices in constructing notes in their first year?
- 4) What changes, if any, occur in the students' expectations and practices of constructing their notes as they gain experience of the university academic environment?
- 5) To what extent do the provision of lecture slides, and the level of detail on these slides, influence the ways in which students construct their notes?
- 6) In relation to the lecturers' practice of making slides, and the students' expectations and practice, as noted in points 1-5 above, can any conclusions be drawn about these factors and the students' academic performance?

The answers to these questions have been addressed in the chapters 2-4 presented in the thesis. The investigation did not initially take language into account, but it became apparent during interviews with students and lecturers that when first-year students were required to produce written work, their language ability was critical. Among the concerns that emerged were the students' comprehension and use of English and biology vocabulary. As a result, the fifth chapter presented as part of this thesis focuses on the students' note-making practices and academic performance in relation to English as a second language, within the context of biology teaching and learning.

6.1 Overall Findings From The Research Presented in Chapters 2-5

The grades students anticipated they would receive in their first year were higher than the grades that they actually achieved, which was disappointing and distressing for them. The misalignment between expectations and reality in terms of grades achieved has also been reported in the literature (Jensen & Moore, 2008). In my study, this misalignment can be attributed to the academic under-preparedness of students; student under-preparedness has often been reported in South African studies (e.g. Brits, 2013; Feltham & Downs, 2002;

Matoti & Shumba, 2012; Miller et al., 1998; Subotsky & Prinsloo, 2011). However, findings from my study show that, within the context of this study, as students progress through first year, their approaches to learning become better aligned with the university's expectations of students as independent learners. Their use of notes (in relation to the grades which they expected to achieve and actually achieved) could help them identify gaps in their knowledge, and the depth of learning that they need to achieve. Thus their notes could be a 'sign' that could help them attain the standard of learning that would allow them to improve their performance. Vygotsky explained that a 'sign' is meant to change the individual in some way, unlike a 'tool' which is meant to have an effect on, and change the external environment. Thus, when students make their notes, the process of paraphrasing and transforming their notes into a more personalised form would mean that their revised notes act as a reminder to them of their understanding. Also, in this process since students determine how their new knowledge fits into prior knowledge by making links between new content and their relevant background knowledge they would be able to identify gaps in their understanding. Thus the process of note-making, and specifically the use of notes as a 'sign' of their depth of comprehension, allows students to engage generatively with content. However, the students' approach to learning and their expectation of their role within the University academic environment is influenced by factors such as social and cultural capital.

The study showed that there was a difference between how students expected they would perform academically based on their social capital (Coleman, 1988) and cultural capital (Zweigenhaft, 1993). While social capital refers to the knowledge the student has access to from members of their family (Coleman, 1988), cultural capital refers to the knowledge that is available to individuals as a result of the communities to which they belong (Zweigenhaft, 1993). Second generation students had an advantage in terms of the social and cultural capital which they had access to in contrast to first generation students. In terms of social capital the parents of second-generation students have experience of the university learning environment and therefore can provide the necessary support which students require in their transition into first year. Additionally, in light of cultural capital second generation students, in comparison to first generation first-years, usually attended better-resourced schools and therefore had a learning experience at school that was more aligned to the university academic environment. In the context of this study the students' social capital was dependent on their interactions with family members, while their cultural capital was based in the communities in which they interacted, including experiences gained in the context of their

previous schooling. Their school experience provided them with the skills that they drew on when they entered university, i.e. the approach they used to construct their notes at school was found to dictate the way in which they approached capturing and revising content in their first year at university.

As students gained experience of the university academic environment they came to realise that the approach which they had used at school might not be effective for them within the university context. By semester 2 of first year they realised that the lecturers' slides represented only guidelines and not a comprehensive set of notes. However, it was found that the notes which the majority of first years used when studying for tests and examinations were still (i.e. after 6 months experience) a close reflection of the points on the lecturers' slides. Few students realised that these slides were a guideline which required fleshing out to provide an in-depth understanding of the material they needed to master. However, the students who did transform and personalise their notes performed better academically than students who used only the lecture slides as study notes. From the data it appeared that second generation students had the advantage of parents' and siblings' experience to guide them, whereas first generation students did not have this advantage.

The opportunities for learning and developing academic skills related to note-taking and note-making also influenced how students perceived the level of content on the lecture slides and how they responded to access to these slides. Students reported that they took the most notes and paid more attention when they had access to the lecturers' slides only during the lectures, **and** when slides were skeletal, i.e. containing only key points or key words. But analysis of their notes did not show more than that provided on the lecturers' slides, and despite their growing experience during the course of the year, the students' grades were only slightly different for semesters 1 and 2. It is possible that students believed that they captured more content in class when they had access to slides during the lecture only, because then they were noting the content on the slides (as opposed to only listening to the lecture and not capturing notes when they knew slides were provided on the intranet). By their own admission, noting material meant that they were active and therefore more attentive during the lectures in which they had to take notes in order to have the content on the lecture slides. But by semester 2 they also understood the standards expected by their lecturers. Also, when slides were skeletal students felt compelled to review and revise their class notes since they believed that the slides did not contain 'all' the content that would be assessed.

While most students reported that their note-taking and note-making skills were not developed to the level that was actually required in first year, some students faced an additional challenge: second-language students in first-year biology had to decode both English and scientific vocabulary independently in order to make meaning of the content that they were taught. This indicated that the medium of instruction emerged as another barrier that some students needed to negotiate. Statistical analysis of the data indicated that language significantly affected the quality of the students' notes, and subsequently their grades on tests and examinations. There might be confounding factors that affected this result obtained in the study: it is possible the University's selection criteria changed and students who were more academically capable were accepted into first year in 2010 and 2011 compared to 2009; or that the teaching and learning environment within schools changed in order to further develop the students' critical thinking abilities and/or the ownership students felt towards self-regulated work. And, this study entailed purposeful sampling with regard to students' voluntarily participating, thus it is likely that those students who had a vested interest in finding a way to improve their learning and academic performance chose to participate. It is also possible that as second-language students gained experience at first year they better understood their role within the University academic environment and thus made the necessary adjustments in their approach to learning which lead to them being more successful than at the beginning of the year. However, when students were trained to capture and personalise notes there was an improvement in the quality of notes and in the grades that second-language students achieved. Thus, by being trained in the skills to capture and personalise their notes it was clear through the results obtained in tests and examinations, that especially the second-language students had experienced an enriched learning environment which lead to an improvement in their skills.

6.2 The Interrelationship Between The Factors Investigated

Students who are more acutely aware of how their note-making, and the learning approaches associated with this, match the expectations of the university academic environment, and who have a better handle on the medium of instruction, achieve higher grades. There is clear interconnection between the factors identified in this study i.e. the students' school experience in note-taking and note-making; their access to lecture slides and the level of detail on slides; and language, each of which influence note-making in their first year. Analysis of the data revealed that second generation students usually more easily adapt to

first year and perform better than their first generation peers. One might assume that this is because of their greater social and cultural capital, as this would help them in making the transition from school to university (Collier & Morgan, 2008; Pascarella et al., 2004; Terenzini et al., 1996). Terenzini et al. (1996) and Pascarella et al. (2004) have also reported that because of the greater challenge they face in the transition from school to university, first generation students are more likely to underperform in their first year at university. Findings from my study show that the first generation students (comprising 'first-in-the-family' students and students who had the benefit of sibling, but not parent experience of university) had less realistic expectations of the grades that they would achieve compared to second generation students. Moreover, results from my data indicate that since 'first-in-the-family' students did not have even the benefit of sibling experience at university they had the least realistic expectations of all. Shields (2002) reported that the only difference between students with and without sibling experience of university is that those without sibling experience studied for fewer hours than their peers. My study has shown that first-in-the-family students are at a disadvantage in terms of realising the importance of expanding on class work when they get home. They had no know-how in terms of an indication from family experience of the self-regulation and independent work that needed to be accomplished outside university contact hours. Hence, they do not budget sufficient time to generatively engage with their class notes, and therefore tend to use only what they received in class as their study notes. Unlike the notes that mostly second generation students made when revising their class notes, the notes that first-generation students made to study from did not have the same depth and transformation or personalisation, and therefore did not act as a 'sign' of their understanding.

The majority of second generation students were self-regulated in terms of their expectations of their role in constructing their notes, and thus their approach to learning involved making a personalised set of notes. This means that these students saw the value of transforming their class notes into a set of notes that reflected a 'sign' of their understanding. In this case, the students' social and cultural capital gave them an advantage in not just identifying that this practice would be valuable, but that their school experience gave them the added advantage in providing them with an appropriate approach and the skills to revise and personalise their notes (i.e. the 'know-how' of this practice). The first generation students' approach to making their own notes at university did not follow this pattern: as much as the first generation students - even those with sibling experience at university - understood that they needed to revise their class notes to suit their understanding, these first generation students

had not established the necessary practice to know how to effectively do this when they entered first year. Thus, first generation students often considered their class notes to be the product that needed to be learnt. In contrast, as second generation students work through the process of personalising their notes, they made connections between new and prior knowledge; they organised the material in their notes according to their preferences; and this enabled them to have a better comprehension of content. The work put in by second-generation students usually resulted in them performing better than their first-generation peers.

In my study the first generation students were also generally the ones who were second-language speakers. Many of these students had attended schools where they were taught in their mother-tongue, or where they regularly experienced code-switching. When they entered university, they were faced with having to comprehend content at all times in a foreign language: during the lecture, when reading the textbook, and when answering test and examination questions. My study has shown that the students' language skills had a significant effect in determining their level of engagement during the lecture and their level of generative learning during note-making. Second-language speakers also needed to negotiate the scientific terminology specific to biology. These terms usually have no equivalent in an African language. Thus considering that the demands on working memory are greater for second-language students than their first-language peers, they generally did not have as much opportunity during the lecture to form connections between prior knowledge and new knowledge. Consequently note-making became their first real opportunity to generatively engage with the content provided during the lecture. This is because instead of attempting to deepen their understanding of content during the lecture, this stage often represented the first time that they had to decode the content on the lecturers' slides as well as try to capture this content in their class notes. First-language students (who often are also the second-generation students) have the advantage of a deep approach to learning simply because the necessity for 'decoding' is considerably reduced. However, my findings show that when lecturers actively sought to determine where students' were struggling, and provided training to develop specific skills, students had a more enriched learning experience and got higher grades. Crucially, this was shown to be particularly true for second-language students, highlighting that active responses by lecturers to developing such skills can be significant in assisting students to perform better.

The third influential factor that contributes to the quality and quantity of notes students produce is the access they have to the lecture slides, and their perceptions related to the level of detail that is provided on the slides. Findings from this study established that at first year level, **some lecturers' practices facilitated the students' adjustment** to note-taking and note-making. *'Teaching-centred'* and *'student-directed'* lecturers focused on completion of the syllabus, and provided students with slides that had detailed content. *'Student-centred'* lecturers aimed to promote critical thinking and self-regulation to note-making and learning, and thus provided only key points or keywords on their slides. The type of access that students had to slides and the level of detail impacted on the students' level of generative learning within and outside the classroom. When students perceived that they did not have sufficient content from the lecture slides, and when they had access to slides only in class, they generatively engaged with their learning. It is thus vital for lecturers to be aware of the match between their and their students' views of learning (Virtanen & Lindblom-Ylänne, 2010). Lecturers need to understand that they can use teaching strategies to move students to a deeper approach to studying. However, Richardson (2005) also points out that for students' to achieve a deep approach it is necessary for them, i.e. the students, to perceive that they need to change their approach to learning. The analysis of my data shows that although students anticipate that the university academic environment would be tougher compared to their school experience, they still unwittingly believed that the study approaches which they had applied at school would continue to serve them in their first year. Thus, it was only when they received their examination results at the end of semester 1 that they realised their expectations had not been met. The findings of my study indicate that there has been a mismatch between their learning practice and the approach required in first year.

The results from my data have provided a practical approach that lecturers can use to develop their students' approach to learning and thus improve first-year performance. Through university lecturers explicitly identifying their areas of academic concern regarding the first-year students' skills, and by directly addressing these issues during tutorials for instance, students can learn what practices are required, and how to apply a more self-regulated approach to their studies. Within the context of my study, when students perceived that there was not sufficient material on the slides for them to study from, they attentively listened to the lecture and reported capturing more content. Importantly, when students were trained to critically think, read and write, they produced personalised notes and their grades improved. Hence, once students are provided with the awareness that they needed to actively and deeply

engage with the content that is taught in class, they produced a better quality of notes. These notes were evidence of students' changing their approach to one of generative learning. The students' notes then reflected their understanding of content, and provided a 'sign' of their comprehension of the topic.

Two crucial factors to emerge from this study clearly indicate that the university staff can take a prominent role in the level of ownership that students feel towards their learning, and in particular in facilitating the development of skills lacking in the first-year students. The first is that first years have to adjust to become self-regulated in their note-making and learning, and that they have to develop an approach to learning that centres on higher order, critical thinking skills (as opposed to recall). Thus if the university provides a training programme at the start of the academic year to increase the first-year students' level of skill in generative learning, i.e. in terms of teaching them how to transform their class notes into a personalised set of notes, the students are likely to better understand what it means to have a deep approach to learning. However, it is recognised that students only feel the 'need' to change when they fail their examinations. Thus it is only after this experience that students might truly grasp what it means to be a self-regulated learner. However, if a training programme was provided at the start of the year then students would have the necessary resources to fall back on when they realised the need to change their approach to their learning.

Secondly, even though literature (e.g. Annis & Davis, 1975; Kiewra, 1985b, 1991; Thomas, 1978; Williams & Eggert, 2002) clearly shows the advantages that having a complete set of lecture notes has for the students' learning, my study shows that within the South African situation, where 1) students are usually accustomed to rote-learning at school, and do not usually deeply engage with content, and 2) rely heavily on guidance from the teacher – and less on their own construction of knowledge – *the ownership* that students' take in constructing and personalising *their own notes* at university is vital to their learning and to their grades.

Thus this study shows that within this South African context there is a 'middle-ground' in the level of support that lecturers should offer to students in terms of note-taking. The advantage of skeleton notes is that it provides students with links for sub- and super- ordinate ideas and themes (DeWinstanley & Bjork, 2002; Sweeney et al., 1999). In this regard the lecture slides

represent a ‘tool’ that students can use to extend their notes, thus taking on responsibility for their learning. Ideally they should use the slides to generate a set of notes that become a ‘sign’ of the links they have made between the key points lecturers have identified on lecture slides and their own understanding of the content. This study has shown that the ‘ownership’ of their notes is what triggers first-years to critically think about how well their level of understanding matches up to the understanding that is expected by their lecturer (- and will be assessed in tests and examinations).

Although the transition to first year is challenging, especially for second-language students, this study has shown that if the lecturers set out to develop the students’ skills to be able to critically read, comprehend and write, then students’ grades improve. However the most significant finding was that the grade gap between first and second-language students is vastly reduced after this kind of support – and at times the second-language students benefited to such an extent that they performed just as well, and in some cases better than their first-language peers. This is crucial in showing that the academic staff have a pivotal role to play in gearing students for academic success. If they do not take on this responsibility they play a gate keeping role, whether this is intentional or not.

6.3 Helping University Students To Be Academically Successful

Training in academic writing was seen to positively influence how students engage with their notes. Such training resulted in the first years constructing a better quality of notes. Results from my study showed that students who were trained to write, and who thus engaged in generative learning while they revised their notes, performed better academically as a consequence.

As students learnt that they had to understand, and not simply recall the content in their notes, and had to engage and extend their notes after class, they became engaged in generative learning. Entwistle and Entwistle (1991) note that students who revise notes with the aim of meaning-making are less reliant on the lecturers’ notes and more focused on producing a personalised set of notes. In relation to findings by Entwistle and Entwistle the results from my study clearly indicate that when students had the ‘know-how’ of how to make a good set of notes, and used note-making as a means to learn, they performed better academically.

This applied particularly to the second-language students – a significant finding in the context of South African Universities.

My aim in this study was to identify an aspect which could be used as a means to help students determine their level of understanding. It offers a novel approach to understanding the link between the factors selected for this study that influence the type of notes that students construct: connections are shown between the students' schooling background and their expectations and practices in constructing their notes in first year; the lecturers' practice influences student practice; and the type of notes students made was closely linked to English as a first or second language. It is evident that the students' prior practice in the construction of their notes at school, their language background, as well as the level of support that they perceived they had received from their lecturers contributed to their expectations, and affected their approach to the type of notes that they constructed for their learning in first year. When students were trained to identify and fill in the gaps in their understanding they made a more personalised set of notes. The more personalised the notes, the better the academic performance. Therefore, note-taking and note-making is closely related to the extent of learning and the academic performance of the students in their first year.

The factors that influence academic performance are extremely complex, but when first-years are trained to make a good set of notes they move to taking charge of their learning.

6.4 Recommendations

The recommendations that emerge for students and lecturers from this research study include:

6.4.1 For the student

Students should revise notes after class, and as soon as possible after the lecture. By reviewing and adding onto their class notes they would be able to synthesise the information better. When they construct a personalised set of notes, the process enables them to actively reorganise their knowledge, determine what the main points of the lecture were, and identify gaps in their understanding. When students review and revise their notes in order to better understand less well-understood concepts, they would then more deeply understand the content, and would likely perform better on tests and examinations.

6.4.2 For the lecturer

- Lecturers need to take cognisance of first-year students' limited skills in note-taking and note-making, and provide guidance in note-taking, note-making and on how first-years could use these processes to deepen their understanding. Lecturers should ideally provide only key points on slides and then explicitly explain to students that the points on the slides are guidelines which they will verbally elaborate on during the lecture and that the students need to supplement by referring to the textbook after class. This practice would ideally encourage students to actively listen and capture notes during the lecture, and personalise class notes after the lecture. If they read the textbook in order to understand concepts better, as opposed to simply gathering facts during class, then students would have generated meaning of the content. This recommendation would ideally encourage students to engage more deeply in their learning.
- Students, and particularly second-language students, who have a limited vocabulary of the discipline, are limited in their understanding when reading textbooks. To address the problem of having limited vocabulary lecturers should provide key terms or definition of words that are used frequently at the onset of their teaching. If lecturers were to provide definitions of key terms frequently used in lectures, students would have the opportunity to prepare better for lectures. By focusing more attention then on understanding the content rather than new terms, students, especially second-language speakers, would have the opportunity of engaging more generatively during the lecture. Note-making would also become more meaningful because these students would focus on deepening their understanding when personalising their notes instead of attempting to understand concepts for the first time. Lecturers need to be mindful of how their lecture practice influences student note-taking and note-making practices, because these factors influence the students' approach to learning and ultimately their performance.

CONCLUSION

There are many factors that impact on the quality of notes that students make. This thesis has argued for these factors.

Firstly, the students' school background influences their expectations and practice of their role in constructing their own notes when they enter first year. As they gain experience within the university academic environment they realise the importance of being attentive during the lecture, and the value of adding content from the textbook into their notes. Crucially, they recognize that the lecture slides are a guideline and not a complete set of notes.

Secondly, students report that the detail on lecture slides and the access to slides outside the classroom influences the quality of notes they make. Lecturers construct the lecture slides according to their perception of the students' role in learning. The students' claim that their access to slides and the amount of content on the slides affect their attentiveness during lectures, and their grades. However, analysis of the data has shown that as much as the availability of the slides, either on the intranet or only in class, has no influence on the grades that students achieve, the level of content on the slides influences the students' perception of the 'completeness' of content that the lecturers have provided on the slides. Thus, when students perceive that they do not have sufficient content to learn for tests and examinations they get involved in their construction of their own notes, and thus engage in learning generatively as opposed to the instance when they anticipate that the lecturers' slides contain 'all' the content that they need to know. In other words, as much as the access to slides does not have any impact on the grades that the students achieve, the level of detail on the slides does have an influence on the effort that the students feel they need to put into making their own notes.

Thirdly, second-language students face more challenge than their first-language peers in making sense of the lectures. These students experience teaching in a 'foreign' language and in decoding scientific vocabulary. Both influence the quality of notes that second-language students produce in class and after class. Students who have a better background understanding of content presented in class take better notes, and transform and personalise these notes after class. However, students who struggle with understanding the content of the

lectures usually only make sense of their notes for the first time during note-making, and therefore lose out on the opportunity to deeply engage with the content during class time.

Hence this study has shown that school background; the students' perception of the detail on lecture slides; and challenges associated with language influence the notes that students make in first year. Their understanding is impacted by the level of their engagement with their notes; and this in turn affects their depth of learning and academic performance. When students use notes as a 'sign' – in the Vygotskian sense – of their understanding, then the process of note-making becomes a means for them to generatively engage in learning. It is during this process that students are able to identify the gaps in their knowledge and thus work on making links and connections between prior knowledge and new content in order to come to an understanding of the topic. It is vital that students are able to identify gaps in their understanding because if they adopt a surface approach to their learning, then it is only when they write the test or examination that they become aware of their level of comprehension. Therefore, the note-making process can be used as a vehicle, by students, to personalise and transform their notes as they generatively engage with content - and this process enables them to gauge their depth of understanding. Students who use notes in this way get higher grades.

Lecturers also have a pivotal role to play in the learning environment: as noted above, this is because the slides that they construct impact on the students' perception of their involvement in making their own notes. Lecturers thus have a fundamental role to play in assisting students in developing academic skills: the careful construction of their slides, through understanding how these impact on student learning serves as a worthy pedagogic contribution to deepening student learning.

In addition, the relevance of lecturers identifying skills that are lacking in students, and providing academic programmes such as tutorials or workshops that promote these skills has been made clear. The development of critical thinking by using writing as a teaching tool is clearly supported by the current findings. Not only do underprepared students, and the second-language students gain in becoming aware of their lecturers' expectations, but first-years also are explicitly shown the practice that they need to use within the university academic setting. Following training, students are likely to have a better approach **and**

practice in making notes, and this causes them to engage more deeply with their work. This research study has shown that when students receive such support their grades improve.

The evidence from this study suggests that the first-year students' perception and skills in the taking and making of notes when they enter university must be taken very seriously by staff. This is because the students' perception of their role is not usually well-aligned with the expectations that staff have of the students' role. But, by staff addressing this problem from the beginning of the year; when students' realise that their note-taking, note-making and learning practices are not yielding the results that they had hoped for; and are looking for a way to improve their approach to their work they would have the university 'support' programme to assist them in developing such skills. Also, by staff providing this level of support from the onset of first-year, students should ideally get an indication that the approach used at school mostly does not work at university. They therefore ideally become aware of any mismatch between their approach and the practice that their lecturers' expect. It is only when students feel the need to change that they look for means to better their approach to learning.

However, although the study has successfully demonstrated that the students' school background, their perception of the detail on lecture slides, and language all influence the quality of their notes, the generalisability of these results is subject to certain limitations. For instance, the cognitive level of test and examination questions would also have influenced the grades that students achieved. Furthermore, as the students' gained experience of the university academic environment they would have learned to better situate themselves (i.e. their approaches and practices) within their role as expected by their first-year lecturers.

However, the findings from this study enhance our understanding of the South African context, where student 'preparedness' for university has often been an issue of concern. The disparity in experience between students in terms of successful transition into university is based on the inconsistency of experiences they had at different schools and their contrasting levels of experience with English. The findings confirm the findings of Brenner and Nichols (2013) by showing how a practical approach – designed by staff – can enable students to more deeply engage with their comprehension of material, and enrich the students' university learning experience. Nevertheless, it is clear that all factors investigated in this study can be

mitigated by a lecturer who is aware of their implications for learning in the first year of university.

What is now needed is a cross-faculty and a cross-national study involving first year-staff and students to determine the extent to which the findings in this study are applicable in enriching the students' learning experience and increasing throughput within the tertiary academic context.

Future research

The findings from this body of research stimulate further questions which are aimed at extending existing knowledge on deepening the students' approach to their learning and construction of notes, and thus their academic performance. Firstly, seeing that the workshops could be a factor in influencing the students' performance, how has the provision of workshops at first year influenced the lecturers' perception of the level of skills that students have when they enter second year? Is the scaffolding that the workshops provided enough to support independent learning when students move on to the following year, or do they require an extension of this type of support in their second year? Secondly, if students are provided with a rubric similar to one used to analyse notes in this study, to what extent can this be used as a measure for students to assess and improve on their quality of notes and deepen their learning? Thirdly, it would be very informative to determine the extent to which lecturers are aware of their teaching philosophies and the influence of this on the students' approach to their learning.

APPENDICES

Appendix 1: Student questionnaire

STUDENT NAME:

STUDENT NUMBER:

DATE:

1.1. General:

Why did you choose this degree?

What marks do you consider good at University? Why?

What mark do you think you will achieve in biology at the end of the semester? Why?

1.2 Note-taking and note-making views:

What, do you believe, makes a good set of notes?

What thought process do you go through when constructing your notes?

1.3. Notes at school:

What style of notes did you have at school (was it mostly written by you or handouts from your teacher)? Please tick appropriate answer.

	Yes	No
Handouts provided by the teacher most of the time		
Notes copied from the board or overhead projector most of the time		
Notes written by yourself while the teacher taught		
Notes written by yourself, use was made of the prescribed textbook		
Other: (please specify)		

How did you use these notes in preparation for tests or exams?

1.4. School versus University beliefs:

What are your expectations of your University lecturers in terms of providing you with handouts?

How do you use any handouts that your lecturers provide you with?

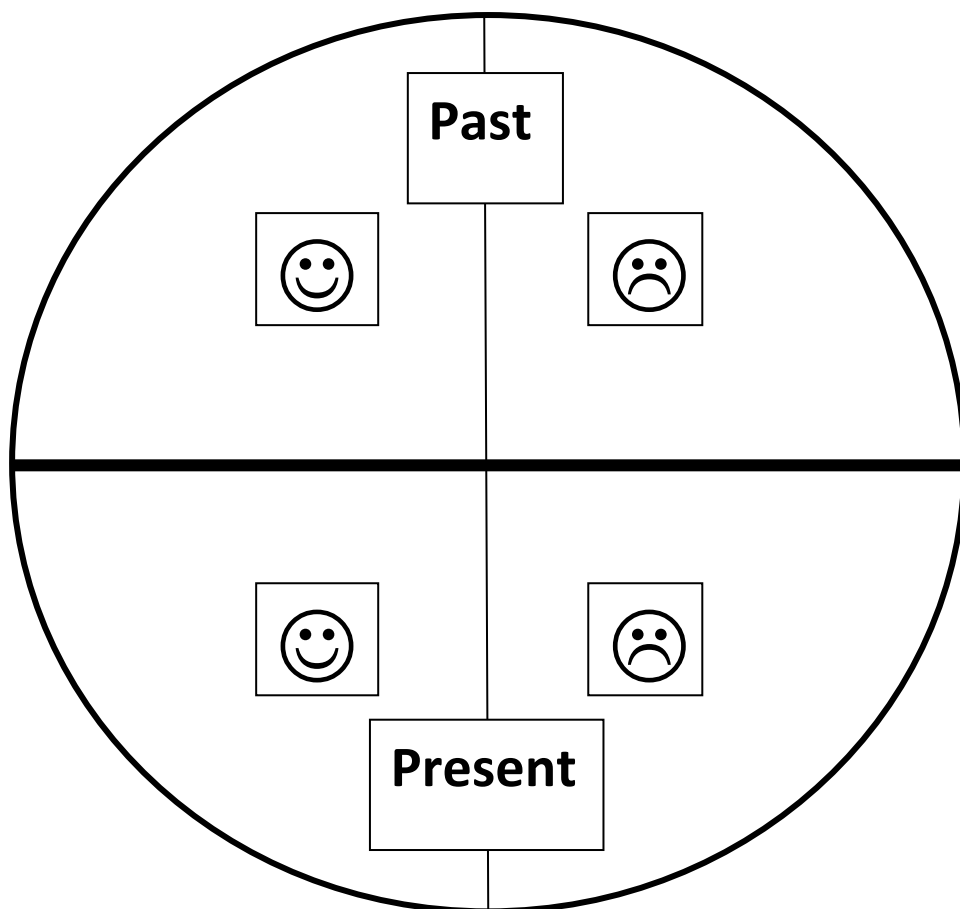
If you do add to these notes, what resources do you use for this purpose?

How do you record the content lectured during class?

Why do you record notes in class?

Please tick the appropriate response:

Your ability in note-taking:



Possible Training in note-taking (past and future experiences):


For each option provided in the table below, please write down the opinion that best suits your experience. Please elaborate on these experiences:

Have you been taught how to take notes when somebody speaks:

	<u>Yes/no</u>	<u>Comment</u>
at school?		
at University?		
other?		

Do you think note-taking training will assist you in note-taking during the lecture?

(Please tick the appropriate opinion)

<input type="checkbox"/> 	<input type="checkbox"/> 
---	---

Thank you for answering this questionnaire.

Mrs. Shalini Dukhan

Appendix 2: Questions for student interviews

Student Interview 1 and 2

General:

Can you explain the note-taking strategy that you had in school? (Interview 1 only)

Has your transcription and note reviewing strategies changed since the beginning of the year, if so how? Why? (Interview 1 and 2)

Before you entered University this year, what did you think University would be like? (Interview 1)

How do you find your University experience compared to what your expectations were? (Interview 1+2)

How much of time do you spend studying at University compared to the amount of time you spent studying at school?

Follow-up from previous expectations:

How do the handouts you received at school compare to the ones you receive from the lecturers in this topic?

How do you use the lecturer handouts with regard to note-taking?

If I were to look at the notes that you have directly after class versus the notes that you study from for the test, how would those two compare?

Student engagement during lecture

Explain what kind of material you have usually noted down by the end of a lecture.

What kind of material do you leave out of your notes during the lecture?

How do you use these notes for study purposes?

Note-taking views:

Is it easier to take notes on a topic that you have some background knowledge on, or to take notes on an entirely new topic?

Do you note any links with previous background knowledge and new knowledge?

How did your note-taking strategy work for you?

How did your marks influence your note-taking strategy?

Do you feel you need training with note-taking?

Can you explain how you learn for tests and exams?

How would you evaluate your success in the ILS course thus far?

Is there anything else you would like to add regarding transcription?

If there was some advice you wished someone gave you at the beginning of the year regarding University what would it be?

If you could go back and change anything this year, what would it be?

Student Interview 3 (at the beginning of their second year at University)

What factors do you believe contributed to your performance in first year?

Did your transcription and / or reviewing style change during your first year of study? If so, how did it change?

Do you think student learning and note-taking relate to one another?

Do you think your notes would give a good indication of how well you understand your work? Why?

What skills did you pick up in first year that you thought were important for your learning?

Do you feel you had enough time to study and prepare for all courses and tests?

If you could go back and improve your performance what would you do differently?

Appendix 3: Rubric for analysis of students' notes

	SURFACE	EMERGENT	DEVELOPING	FLUENT/ EXPERIENCED
RATING	1	2	3	4
DEVELOPMENT OF IDEAS	Replica of lecturer's visuals.	1 + verbatim copy of verbal lecture Direct quotes of verbal lesson used.	Paraphrased notes from lecturer's visual and verbal lesson.	3 + Own thoughts added into notes (personal voice), shows connections to prior knowledge/other concepts. Development of ideas.
ACCURACY AND ORGANISATIONAL STRUCTURE	Direct copy of visuals.	Verbal lesson is noted as a continuous 'story'.	Able to show clear structure and sequence of topics, includes examples provided by lecturer.	3 + links to examples or elaborations that lecturer did not mention in class. More structure provided.
FLUENCY AND FLOW OF WRITING	Only keywords/ideas from lecturer's visuals.	Included some short sentences or quotes from the verbal lesson.	Examples and elaborations the lecturer mentioned are provided.	3 + evidence of information added in from source other than the lecturer. Clear connections and narrative.
WRITING CONVENTIONS	Fills the entire page with only writing (as a direct copy of the visual lesson).	Adds in supplementary notes from the lecturer's verbal lesson only.	Adds in supplementary notes and or pictures from lecturer's verbal and visual lesson to notes.	Adds in information and diagrams from other sources to form more comprehensive notes. Creates summaries or mind-maps for purposes of overview.

ADD ON'S	none	Distinguish between how much is highlighted (the more highlighted the fewer distinctions made of key concepts), summaries (concept maps, bulleted points), references to figures/tables made by the lecturer.	
HANDOUTS FROM LECTURER	No additional notes on handouts	Additional information added onto handouts.	3+ integrated information on notes and handout, reflection of the use of the handout in position to written set of notes.

Appendix 4: Copy of notes from self-regulated category of students

Protein-coupled receptor	Receptor tyrosine kinases	ion channel receptors
<ul style="list-style-type: none"> - plasma membrane receptor → G protein - G prot = on/off switch - if GDP bound to G protein → inactive - when ligand activates receptor → changes shape - ATP displaces GDP ∴ active (on) - goes to enzyme & activates it → response - abnormal function → diseases <p><u>*key difference</u></p> <ul style="list-style-type: none"> - ability of single ligand binding = many pathways - diff G protein & tyrosine 	<ul style="list-style-type: none"> - plasma mem - attach phosphate to tyrosines - can trigger multiple signal transduction pathways at once - two signal molecules → causes to form dimer - activate tyrosine kinase region - phosphates ATP molecule - activates multiple proteins - abnormal function → cancer added 	<ul style="list-style-type: none"> - acts as a gate when receptor changes shape - closed gate - ligand binds - gate opens - allows ions thru channel - cellular response - when ligand dissociates → gate closes - NB: nervous system
- second messengers	- second messengers	- let through 2nd mess

4 added

Appendix 5: Copy of notes from developing category of students

Mechanoreceptors sense physical deformations caused by forms of mechanical energy such as pressure, touch, etc.

- Physical deformation - They sense
 - movement - maintain balance
 - Pressure - measure tension
 - Hearing - sense vibrations
- A lot of mechanoreceptors are concentrated in the skin.

Chemo receptors

- general - transmit info about total solute [I]
- specific - respond to individual kinds of molecules.

- They can be general or specific
- Osmoreceptors in brain - detect changes in the total [solute] of the blood & stimulate thirst when osmolarity increases (general)
- Pheromones - hormones that are released by the body to affect outside world
 - air-borne hormones
 - moths
 - humans?

Electromagnetic receptors

- detects various forms of energy including light, temperature
- measures temp from a distance & relies on electromagnetic wave

- Light/magnetic/electric fields
- Photoreceptors - detect energy in the form of light & are often organised into eyes.
- Viper pits - can detect the body heat of the prey
- Magnetic field perception - magnetite crystals

Thermoreceptors - measures heat ^{temperature} directly

- Hot or cold _{located in the}
- Skin & anterior hypothalamus
- Affected by chemicals - capsaicin (chillies) tastes hot
- menthol - "cool" flavour

Nociceptors / Pain receptors - detect stimuli that reflects pain

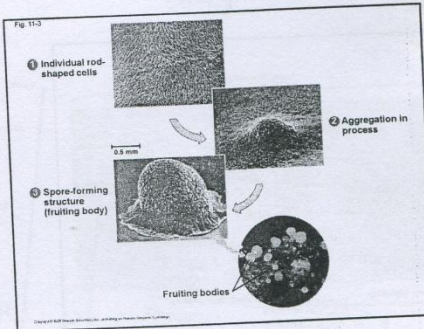
- Pain detection
- Skin & other regions
- tend to be new dendrites - capsaicin detect the pain
- Analgesics

✓ Sacked
58

Appendix 6: Copy of notes from underprepared category of students

- Pathway similarities suggest that ancestral signaling molecules evolved in prokaryotes and were modified later in eukaryotes
- The concentration of signaling molecules allows bacteria to detect population density

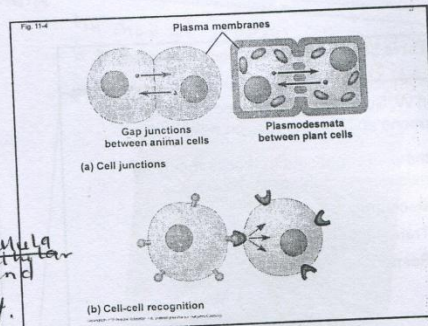
Pathway concentration of signaling molecules allow bacteria to detect population density.



Local and Long-Distance Signaling

- Cells in a multicellular organism communicate by chemical messengers
- Animal and plant cells have cell junctions that directly connect the cytoplasm of adjacent cells
- In local signaling, animal cells may communicate by direct contact, or cell-cell recognition

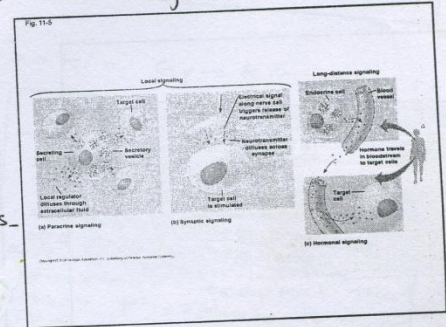
chemical messengers are means of which multi and organisms communicate by.



Cells in multicellular organism allow communicate by chemical messengers. Local signaling: animal cells may communicate by direct cell to cell contact. recognition.

- In many other cases, animal cells communicate using local regulators, messenger molecules that travel only short distances
- In long-distance signaling, plants and animals use chemicals called hormones

*Animals use local regulators. * A lot of local regulators are used by many cells, for messenger molecules travel short distance.*



Appendix 7: Questions for lecturer interview

How many years have you been involved in first year lecturing?

How do you feel your practice has changed over the years?

How do you feel students have changed over the years?

Do you provide students with any advice/framework on lecture note-taking?

How would you describe your lecturing style?

What are your expectations in terms of students recording of notes during lecture sessions?

What are your views about students receiving handouts/diagrams/additional readings/references/homework questions?

Define what you think a good set of notes would be.

In your experience, how do students know what is important to take down?

Appendix 8: Levels of significance (p-value) for academic performance when students had access to and did not have access to lecture slides outside the lecture from ANOVA

	2010	Combined average
Tests	2.21E-06**	0.115532
Exams	0.000383**	0.405881

** $p \leq 0.01$

Appendix 9a: p-values for comparison of students' note –making averages in the presence (semester 1) and absence (semester 2) of lecturer slides on the intranet from ANOVA

	2010 Semester 1 compared to Semester 2	Combined average results (Semester 1 2010 and 2011 compared to Semester 2 2009 and 2010)
Total number of facts	8E-10**	2.43E-14**
Number of verbal aspects	6.14E-09**	0.002775*
Number of visual aspects	1.53E-10**	5.83E-17**
Additional information	0.044761*	0.000702**
Notes score	0.081702	3.36E-08**

* $p \leq 0.05$

** $p \leq 0.01$

Analysis on KyPlot based on results from ANOVA is provided on Appendix 9b below. Students took significantly more notes for lecturer 3 than for any of the other lecturers in 2010 (for lecturer 3 and lecturer 1 $p=1.63E-6$; lecturer 3 and lecturer 2 $p=7.91E-6$; lecturer 3 and lecturer 4 $p=1.64E-6$). With regard to the combined data, there were significant differences in the total number of facts between lecturer 3 and all of the other lecturers in 2010 (for lecturer 3 and lecturer 1 $p=1.63E-6$; lecturer 3 and lecturer 2 $p=1.84E-6$; lecturer 3 and lecturer 4 $p=1.64E-6$). In terms of the number of verbal aspects in 2010 students took a larger quantity of notes when they entered semester 2 (2010: lecturer 1 and 3 ($p=1.7E-6$), 2 and 3 ($1.94E-5$), 3 and 4 ($p=1.82E-6$); combined data: lecturers 2 and 4 ($p=0.01$) and lecturers 3 and 4 ($p=0.003$)). The same pattern that was between semester 2 noted for the verbal aspect of the lecture was also noted for the visual aspects of the lecture (2010: lecturers 1 and 3 ($1.61E-6$), lecturers 2 and 3 ($p=2.9E-6$), and lecturers 3 and 4 ($p=1.64E-6$); combined data: lecturers 1 and 3 ($p=1.64E-6$), lecturers 2 and 3 ($p=2.34E-6$), and lecturers 3 and 4 ($p=1.64E-6$)). Students noted more content from the visual aspect of the lecture (i.e. the slides, the board and/or overheads) in semester 2 compared to semester 1. This result is expected seeing that in semester 1 students had access to slides outside the lecture, therefore within the classroom they only had to note the additional verbal and visual information

provided by the lecturer. Compared to semester 2, in semester 1 students also added more information to their class notes from resources such as the prescribed textbook. Students significantly noted more information from other resources in 2010 for 1 than for 4 ($p=0.04$). There was an even more marked difference in the combined data set between lecturers 1 and 3 ($p=0.01$), 1 and 2 ($p=0.01$), and 1 and 4 ($p=0.001$) in this regard. It is plausible that when students entered University they had the impression that they did not have the necessary background knowledge that lecturers expected them to have, and therefore students put effort into adding information from other resources (such as the textbook) into their notes. But, as the course progressed and the workload increased over the year they had less time to engage with extra reading after class. Students significantly made a better quality of notes in semester 1 than they did in semester 2, as reflected by the notes scores (lecturers 1 and 3 ($p=0.0006$), lecturers 1 and 4 ($p=0.0001$), lecturers 2 and 3 ($p=2.9E-5$), and lecturers 2 and 4 ($p=6.65E-6$)).

Appendix 9b: Kyplot p-values to show which categories differed between factors that were found significantly different on ANOVA from appendix 9a

		Mean				Standard deviation				p-value ≤0.05
		L1 (1)	L2 (2)	L3 (3)	L4 (4)	L1	L2	L3	L4	
Total number of facts	2010	54.8	70.6	141.56	53.8	56.08	54.13	46.47	22.49	(1-3) 1.63E-6 (2-3) 7.91E-6 (3-4) 1.64E-6
	combined	51.43	62.29	113.77	41.21	50.71	51.79	46.14	22.03	(1-3) 1.63E-6 (2-3) 1.84E-6 (3-4) 1.64E-6
Number of verbal aspects	2010	49.52	65.29	132.88	50.3	54.04	54.02	50.42	23.45	(1-3) 1.7E-6 (2-3) 1.94E-5 (3-4) 1.82E-6
	combined	44.4	58.63	64.03	25.76	44.81	50.80	75.31	30.32	(2-3) 0.01 (3-4) 0.003
Number of visual aspects	2010	45.84	64.08	136.52	52.17	52.73	54.58	43.65	21.65	(1-3) 1.61E-6 (2-3) 2.9E-6 (3-4) 1.64E-6
	combined	38.34	51.54	97.86	32.48	43.57	51.34	54.58	24.63	(1-3) 1.64E-6 (2-3) 2.34E-6 (3-4) 1.64E-6
Additional information	2010	12.65	3.75	6.22	1.17	25.8	4.61	12.12	2.03	(1-4) 0.04
	combined	10.51	3.24	2.94	1.32	21.34	4.54	7.93	1.79	(1-3) 0.01 (1-2) 0.01

										(1-4) 0.001
Notes score	combined	17.59	18.77	12.17	11.5	7.11	6.53	7.29	6.99	(1-3) 0.0006
										(1-4) 0.0001
										(2-3) 2.9E-5
										(2-4) 6.65E-6

Appendix 10: p-values for comparison of first and second language students' note-making averages using ANOVA

	First and second language students			Combined results (2009, 2010 and 2011) for first and second language students
	2009	2010	2011	
Total number of facts	4E-11**	2.49E-09**	0.308	6E-16**
Number of verbal aspects	0.544	1E-08**	0.187	0.001**
Number of visual aspects	2E-11**	4E-10**	0.206	1E-16**
Additional information	0.016*	0.114	0.245	0.097
Number of diagrams	3E-08**	5E-09**	4E-04**	4E-08**
Number of misconceptions	0.697	0.711	0.752	0.743
Notes score	0.983	0.001**	0.448	9E-04**

On Kyplot no significant differences were established when comparing the quality and quantity of notes first and second-language students had made.

Appendix 11: p-values for comparison of first and second language students' test and examination averages using ANOVA

	First and second language students			Combined results (2009, 2010 and 2011) for first and second language students
	2009	2010	2011	
Test	6E-08**	2E-05**	0.003**	4E-05**
Exam	3E-06**	3E-04**	0.364	2E-04**

With the exception of test 1 in 2009 ($p = 0.01$; mean E1 test 1 = 52.7 and SD = 14.9; mean E2 test 1 = 41.67 and SD = 4.98) and examination 3 in 2009 ($p = 0.04$; mean E1 exam 3 = 59.29 and SD = 9.5; mean E2 exam 3 = 43.5 and SD = 13.14), there was no significant difference between marks that first and second-language students received on tests and examinations when analysis was conducted using Kyplot.

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