

Impact of mother tongue on construction of notes and first-year academic performance

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The purpose of this study was to identify whether there are any differences in the quality of the notes constructed in English between students for whom English is a first language and those for whom it is a second language. Subsequently we assessed whether this difference, if any, affected their grades. Unsurprisingly, the first-language students produced better structured and more detailed notes; they also 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, there was an improvement in the personalisation of their notes. The improvement in grades was significant for second-language students. Thus the university has a pivotal role to play in preparing students for academic success by providing them with supportive measures to aid their transition into first year.

Significance:

- The work illustrates that writing can be used as a tool for students to improve their learning and their academic performance.
- Second-language students' grades improve when writing interventions are provided early in the year.
- Students need to take on the responsibility for their learning; lecturers also have a responsibility in scaffolding learning.

Introduction

In 1994, educational opportunities were opened to previously disadvantaged populations, which resulted in increasing numbers of black students gaining entry into universities.¹ Teachers at previously 'black' schools often teach by means of code-switching.^{2,3} (Code-switching refers to the alternation between learners' home language and English in order to make complex concepts more understandable to learners.) When students from these schools enter a university at which the medium of instruction is English, they may not have developed the English competency which is required and which is fundamental to their academic success. In this study, we focused on first- and second-language students' experiences of note-taking and note-making at school and in their first year of university, and the impact of their writing strategies on their grades at an English-medium university.

There are a number of compounding factors which influence second-language students' proficiency in English, and thus their academic success. Firstly, when students enter the university academic environment they navigate their approach to learning and their student identity, i.e. in terms of their cognitive and linguistic experiences.⁴ This means that undergraduates navigate the ways in which they are 'behaving, interacting, valuing, thinking, believing, speaking...reading and writing'^{4(p.111)}. Thus, as they navigate their identity they begin to identify with the discourse and develop their identities within the discourse. Schools in South Africa are mostly teacher driven, and rarely provide the opportunity for students to develop an identity within the discourse.⁴

Secondly, any underperformance of second-language undergraduates is usually attributed to limited language proficiency, but underdeveloped reading skill also plays a part. While Weideman and van Rensburg⁵ support the argument that language proficiency is related to academic success, Pretorius^{6,8} has shown that even though there is a relationship with language, reading proficiency has a stronger connection to the students' grades. Reading ability is based on decoding and comprehension of texts. At primary school the focus is on decoding.⁶ As students progress through their schooling it is generally assumed that they will independently learn to deconstruct and make meaning of texts. The scaffolding of relational thinking receives little attention at school, with little done to assist students to move towards deep levels of comprehension.⁶

Previous studies^{5,7} have shown that students who develop fluent reading ability in their mother tongue are able to transfer their reading skills when they learn in a second language. Therefore, emphasis should lie in the development of reading ability in the mother tongue. Within the South African context, however, English is seen as a language of status compared to African languages⁵, therefore parents usually desire their children to learn English early in their schooling^{3,7}. The level of skill in reading ability is associated with the students' skills in expressing themselves in their writing.^{8,9} Thus the development in relational thought during the process of learning to read is believed to be related to the level of skill in writing. Most academic assessment at university is based on a student's ability to communicate their understanding via their writing; it is therefore critical to place a spotlight on the students' writing skills.

Thirdly, research has been published on whether the conception of learning that students develop is cognitively appropriate for the university academic landscape. Because of their prior schooling experience,⁵ second-language English students usually have not developed the necessary level of skill in their reading^{6,7} and writing abilities^{8,10}. Reading and writing abilities hinge on the development of inferential processing (i.e. the ability to link ideas and concepts in a text to other areas of the text or to relevant concepts in one's memory)¹¹ – this phenomenon is also known as anaphoric resolution¹². Students who can resolve anaphoric ties satisfactorily have a better comprehension of their texts, and therefore are likely to perform better on assessments. The level of student

engagement with anaphoric resolution is likely to be evident in the notes that they make. Undergraduates who paraphrase, and whose notes contain accurate content not provided by the lecturer, are more likely to consider links and connections with different content areas in the text, and are more likely to relate their new knowledge to their current knowledge structure. Poor inferential reading can be evidenced in poor inferential writing; thus a student's writing can give clues to their cognitive level of engagement. More importantly, the process of writing can assist students identify gaps in their understanding.

Carstens and Fletcher¹⁰ noted that writing interventions which focus on the development of understanding and handling of content, structure and style, and on language development, can enrich learning experiences and students' grades. We hypothesise that – as writing is an individual activity which students are expected to master before they enter university, and is central to university assessment – by focusing on the development of writing abilities students would be able to self-identify gaps in their learning. The process of compiling study notes could provide the mechanism for students to develop a deep approach to learning, and thus improve their grades. Training disadvantaged students in the skill of writing has been shown to improve their academic literacy¹³, but there is a dearth of literature on whether a focus on the development of the students' skill in constructing their notes is likely to influence first-year students' writing abilities, *and* the depth of their study notes, *as well as* their academic performance.

Undergraduates need to comprehend a lecture taught in English, including making sense of the terminology of the discourse and being able to capture sufficient content in their notes.¹⁴ The students' understanding of the vocabulary within science is important because it influences their comprehension of the material presented during fast-paced lectures. Biology is particularly rich in specialist terminology, so the issue of language support is important in this context. Students who have not had sufficient experience using English to converse may require additional guidance to be able to understand scientific terms.¹⁵

When students have difficulty with the vocabulary of the discipline, the quality of the notes they capture in the lecture will be affected. Most students take notes to aid lecture recall, to improve their understanding, and to capture information that is required for assessments.¹⁶ But the cognitive overload that second-language students face in lectures could compromise the opportunity for learning. Concerns about the limited support that second-language students have received in developing academic language skills provided the motivation for investigating the impact of language on note-making and hence on academic performance. Because the literature has shown that the quality of students' notes is linked to grades,¹⁷ the question that guided this study was whether the practice of writing could be used to enrich the second-language students' learning experience and improve their grades.

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.¹⁸ Generative learning refers to the students' creation of links between prior knowledge and new knowledge.^{19,20} 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 miss generative learning opportunities. The lack of generative learning will then impact on the grades that students achieve.

It was surmised that by analysing and comparing the notes prepared by first- and second-language students, in comparison to the content lecturers provide, insight should be gained regarding the differences in the ways in which these students approached their note-making and learning. The results were then viewed in relation to the grades that students received in tests and examinations in their first year.

Methods

This study forms part of a larger one which focused on the relationship between the notes that first-year students constructed and their grades.

The study was conducted in a biology course at a South African university, and extended from Semester 2 in 2009 to Semester 1 in 2011. Two lectures per semester were identified for this research. A 45-minute lecture was observed and video-recorded for each of four lecturers per year. The video-recorded lectures were transcribed for analysis and compared to data collected from students. In each year of the study, between 43% and 60% of the participants were second-language students.

Students voluntarily completed the questionnaires. The return rate of completed questionnaires for each year was about 25%. The questionnaire probed note-taking and note-making experience at school and university. The students' responses to the questionnaire were analysed according to:

- prior schooling experience in constructing notes
- use of notes for assessment preparation at school
- their expectations of university lecturers
- additional information provided on the lecturers' slides
- how students captured notes
- the reasons for note-taking and note-making

In each year, 30 students per year (i.e. 90 students in total) were randomly selected from those who completed the questionnaire. These students participated in one-on-one, face-to-face interviews. The first interview was conducted 2 months into Semester 1, the second interview 1 month into Semester 2, and the third at the beginning of the following year. 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.

The notes which participating students used for study purposes were photocopied, and analysed in terms of the quantity and quality of content. A total of 240 sets of notes (from eight lectures for 30 students each) was analysed. A rubric developed by us (Appendix 1 in the supplementary material) was the starting point for the qualitative analysis of students' notes; this rubric was based on SOLO taxonomy. SOLO taxonomy is used to evaluate a student's cognitive ability on certain tasks, and defines different cognitive levels and knowledge dimensions.²¹ Cognitive abilities are defined at the structural, conceptual and procedural level, and an increase in mental abilities is observed as one moves up each of these cognitive levels. Other researchers (e.g. Reed et al.²² and Granville and Dison²³) have modified SOLO taxonomy so that it could be used within a disciplinary context or generically. Our study outlines how SOLO taxonomy can be used in nuanced ways. In this 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' input, the higher the cognitive level of the student in that piece of work. The qualitative results from the analysis using the rubric are referred to as the notes score.

Students' notes were also analysed quantitatively according to a comprehensive set of notes made by one of the authors (S.D.). The number of information units provided in students' notes was calculated. Information units are blocks of information or whole ideas, and comprise a sentence, clause or stand-alone phrase.²⁴ Numerous other authors²⁴⁻²⁷ have used the measure of information units as a method of analysis of notes. By looking at the number of information units in the students' notes, 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 captured from other resources 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.

Students' grades were obtained from departmental records. Data were quantitatively analysed using a single-factor analysis of variance and KyPlot version 2.0.

Ethics clearance was granted by the university's Human Research Ethics Committee (HREC Non-Medical Protocol number: 2009ECE114). Informed consent was obtained from all participants, and the principles of the Declaration of Helsinki were adhered to.

Results and discussion

Undergraduates at the university at which this study was conducted had experienced some communication in English at school. In this study, first language refers to students whose mother tongue is English, while second language refers to students whose mother tongue is not English.

Data obtained from the interviews support previous findings (e.g. Rollnick² and Kapp³) that code-switching continues into secondary school. A comment from a second-language first-year student was that because code-switching was not practised at university, language posed a barrier to her understanding of the content presented during lectures:

I used to go and ask my teacher; she used to explain in my language; but here [at university] everything is done in English; I'm far from home; there's no one to ask.

A total of 10% of the students commented that their level of competence in English affected the depth of meaning that they were able to construct, and thus affected their quality of notes. Students with low levels of vocabulary associated with the language of instruction and with the discourse struggle with anaphoric resolution.^{12,13} Moreover, when second-language students do not have opportunities to practise anaphoric resolution, there is an impact on the depth of understanding that they are likely to access and thus the time that it takes for them to form a deep understanding of lecture content.¹³

Two international studies have reported that South African learners are ranked amongst the lowest in international standards in reading, and that the language in which learners were taught at school and the language of assessment most likely contributes to the students' poor academic performance.^{28,29} As students progress through school, it is essential that they learn to formulate a cohesive representation of their texts⁶; thus the focus should lie in the development of language proficiency^{3,6,7,30} and reading ability⁵⁻⁷. Because the expectation is that students would have developed the required level of skill at school, lecturers at university do not generally focus on developing reading skills.^{3,9,13,31}

School experience influences transition into first year

Compared with first-language students, on average 11% more of the second-language students reported that, unlike the situation at university, they had been provided with comprehensive notes from their teachers at school (Table 1). These students reported that they usually did not engage further with the material other than to memorise the content. This approach results in surface learning because students are not compelled to resolve anaphoric ties within topics, and to form a global understanding of topics.

Table 1: First- and second-language students' note-making experiences at school

Year	First-language English students		Second-language English students	
	Received notes from the teacher	Some experience in note-making	Received notes from the teacher	Some experience in note-making
2009	5	7	11	7
2010	4	13	5	8
2011	5	9	8	8
Combined	14	29	24	23

This practice on the part of the teacher results in a lack of generative learning opportunities on the part of the students. Teachers who provide comprehensive 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. However, when teachers scaffold inferential processing activities in their classroom then students are more likely to engage in higher cognitive processes and in constructing meaning.¹¹ This also means that practice in reading and writing would enable more efficient anaphoric resolution.¹²

Mother tongue influences the quality of students' notes

Data from this study show that when students entered university, those who were accustomed to receiving notes from the teacher at school used the lecture slides as study notes, because their previous school experience had led them to conclude that the slides provided all the information that they were required to know. But at university, lecturers usually use slides as an aid to their teaching, and to provide key points so that students can use them to focus and extend their learning after class.

Based on data from the analysis of the video-recorded lectures, 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 proportion makes it essential that students should know how to use the lecturers' slides to enhance their learning. However, from the interviews it became clear that second-language students did not seem to understand that the lecture slides were a base on which they needed to expand. They stated that they struggled with copying content from the slides and noting material from the lecturers' verbal explanations while also decoding biology and English vocabulary, which impacted on the quality of their notes in class and the depth of the notes they made after class. These findings support Wildsmith's³⁰ assertion that, although they are able to read and understand, students struggle with writing in the formal academic context. It is likely that because students' learning experiences have not usually involved higher cognitive processing (i.e. relational thinking²³), they do not have the know-how or inclination to formulate extended notes at university.

In Semester 1, the second-language students captured half the quantity of notes from the verbal and visual aspects of the lectures that their peers did (Table 2). The first-language students also noted more content from resources other than that provided in the lecture (Table 2). And the notes that second-language students made were not as coherent in terms of the development of ideas and organisational structure, as reflected by the notes score (Table 2). Although these observations were made when quantitatively and qualitatively analysing the students' notes (Tables 2 and 3), there were no statistically significant differences.

In Semester 2, the situation changed: second-language students captured more facts for Lecturer 3's sections in 2009 and 2010 than their first-language peers (Table 3). Lecturer 3 provided keywords, and probably because of their comprehension of English, the first-language students did not capture as much content because they better understood the concepts that the lecturer explained. In contrast, second-language students were more likely to feel compelled to capture in entirety what the lecturer was saying. For Lecturer 4's section, when students had to note key points (as opposed to keywords only) from the slides, second-language students noted fewer points than did first-language students (Table 3). Lecturer 4 based the lecture content on personal research in the field and lectured in a conversational manner; the second-language students may have had difficulty in deciphering what content needed to be noted and therefore captured less material than their first-language peers.

By Semester 2, second-language students had likely 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 was not sufficient 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 the first semester it was difficult; I had a problem in taking down notes, so now [Semester 2] I've realised that what the lecturer is saying is more important than going through the notes [slides], they would go through the slides but they add a little bit and I've realised that those are the things that they ask you in the test.

However, first-language students were aware, from the beginning of the year, 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 noted more content from the verbal lecture than did the second-language students, and made more coherent notes, as shown by the notes score (Table 2 and 3). Storch¹⁴ reported that students should write more coherent and personalised notes as they gain experience and a better grasp of English within university; our data show that language of instruction can impact on the quality and quantity of the notes that are made.

Compared with the second-language students, the first-language students noted almost twice the amount of information from the textbook (Table 2). 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 and class notes using the textbook at university. Students are expected to read their texts, class notes and library books so that they can extend the knowledge which is provided in the lecture. But students are not reading at levels that show mastery.^{5-7,12} Students are able to decode but are not able to comprehend texts at the required levels.^{5,6} This inability stems from issues around literacy prior to the students entering tertiary education. These issues include limited access to books at schools, lack of encouragement to read for pleasure, and limited printed resources in African languages.⁶

Using textbooks develops the students' ability to engage with material in a manner that allows for the construction of cognitive learning.³² But a major barrier to learning science is the grammar of science.³³ Not having a good command of scientific vocabulary not only influences a student's ability to read and write in a scientific manner but also their ability to understand the scientific content.³⁴ The range of vocabulary that the students had developed prior to their first year at university influenced how much they understood when they read lecture slides and their textbooks:

Most of the time if I'm using the textbook, I write it in the way the textbook gives it but then I would make myself understand it better, [because] I realised that there was this vocabulary gap, so 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.

Students who have limited vocabulary struggle with anaphoric resolution, and this impacts on their ability to paraphrase.¹³ 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 have realistic expectations of their role in first year. Additionally, to improve academic performance, there should be adequate exposure to written texts at school.¹³ As the schooling system currently stands, the majority of students has not been groomed to use writing to critique texts or as a vehicle to explore their understanding, yet at university they are expected to have developed the required skill to use writing as a way of communication and to evidence higher-order cognitive skills.³ Our findings show that as much as students need to take charge of their learning, the

Table 2: Comparison of Semester 1 note-making averages between first- and second-language students

	L1 2010		L2 2010		L1 2011		L2 2011		Combined			
	E1	E2	E1	E2	E1	E2	E1	E2	L1		L2	
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, lecturer; E1, English first-language students; E2, English second-language students

Table 3: Comparison of Semester 2 note-making averages between first- and second-language students

	L3 2009		L4 2009		L3 2010		L4 2010		Combined			
	E1	E2	E1	E2	E1	E2	E1	E2	L3		L4	
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, lecturer; E1, English first-language students; E2, English second-language students

university also has an obligation to support these students become academically successful.

A series of workshops that focused on developing the students' abilities to critically read, write and develop an argument³⁴ was offered to all first-year students in 2010 and 2011. These workshops aimed to show students how to make meaning of content when they constructed notes. When second-language students saw the value of using their notes as a vehicle for the process of learning and knowledge transformation, their academic performance improved (Table 4).

Language affects the quality of notes and academic performance

There was a narrower gap between the academic performance of first- and second-language students in 2010 and 2011 compared with those in 2009. Compared with 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 assessments the second-language students performed slightly better, on average, than the first-language students (Table 4).

Table 4: Assessment averages (%) for first- and second-language students

Assessment	2009		2010		2011		Combined	
	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 than those in 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 improved performance of the first-year second-language students in 2010 and 2011 was a result of the implementation of the workshops. The workshops enabled students to see that the lecturers' slides were not the product that needed to be learnt, but rather that the slides represented a guideline. The students became aware that they needed to read further and personalise their notes with more details. This is evident in the notes scores that the 2010 and 2011 cohorts received compared with the scores of the 2009 cohort (Tables 2 and 3). This finding corroborates that of Pretorius¹² that there is a strong link between an increase in resolution of anaphoric references and proficiency in English. Moreover, in agreement with Carstens and Fletcher^{9,10}, writing interventions can improve academic performance. This study provides some insight into how the use of writing can scaffold second-language learning (and enhance academic performance) within an English-medium university.

During the transformation of notes there was the likelihood of a transformation in the students' knowledge and understanding as well, which then resulted in better comprehension of lecture content. This is because when students revise and personalise their notes they engage more deeply in determining 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. If students are taught to critically analyse texts and arguments, then the process of understanding and critiquing the scientific discourse will be more accessible to them.³³

Conclusion

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 textbooks; this influence had an impact on the quality of notes that they constructed. The grades that students achieved on assessments were found to be related to the medium of instruction. However, when the 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, there was a general improvement in the standard of notes that second-language students made, and hence in their grades.

By being cognisant of the challenges that second-language students face in both English and biology, lecturers could scaffold their lectures to be more inclusive of these students. It is essential that training 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.

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Authors' contributions

S.D. conceptualised and designed the project as part of her PhD research; she collected and analysed the data and wrote the manuscript. A.C. and E.B. were supervisors and provided guidance on the study design, data collection, data analysis and write-up.

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