Fast-tracking Concept Learning to English as an Additional Language (EAL) Students through Corpus-based Multilingual Glossaries[1]

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> The road leading from the initial familiarity with a new concept to the moment when the word and the concept become the child's property, is a complex internal psychological process (Vygotsky 1986).

Abstract

The aim of this article is to discuss the corpus-based Multilingual Concept Glossaries project at the University of Cape Town (UCT) and to show how multilingual glossaries can be used to fast-track concept literacy among English as Additional Language students (EALs). In South Africa, it is an accepted fact that most of EAL students from poor academic and family backgrounds enter higher education with limited English proficiency which makes it difficult for them to learn and understand concepts in different content learning areas (cf. Kapp 1998; Council on Higher Education 2007; National Benchmark Tests

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Project Progress Report 2009). Thus, the development of the multilingual glossaries is aimed at providing academic support to these students. It is the contention of this article that the development of these glossaries constitutes an important intervention strategy to optimize concepts learning in different content areas to EAL students. The pedagogic value of glossaries is widely acknowledged by many scholars in the field of academic literacy (cf. Hüllen 1989; Marzano 2003, 2004; Graves 2006; Beck, McKeown & Kucan 2008; Hiebert & Kamil 2005; Farstrup & Samuels 2008; Sauer 2009). However, as the Project is still in its initial stage, the article mainly provides a conceptual argument based on two theories, namely, the theory of conceptual difficulty (cf. Perkins 2007; 2009), which provides a theoretical framework for analysing EAL students' conceptual difficulties, and Vygotsky's socio-cultural constructive theory which provides a framework of pedagogic intervention to fast-track concepts learning.

Keywords: multilingual glossaries, concept, zone of proximal development, Basic Interpersonal Communication Skills, Cognitive/ academic language proficiency, hypermedia

Introduction

South African universities are faced with a humongous challenge of improving throughput rates, especially among the English as Additional Language (EAL) students. This problem is alluded to by the recent Report of the Council on Higher Education published in *Higher Education Monitor* No.6 (Council on Higher Education 2007) which was focussed on students' throughput in South African universities over a period of five years from 2001 - 2005. The Report shows that although access to higher education has improved over the last few years, throughputs are not satisfactory, particularly with Black African students. In this survey African students performed worse than White students in most disciplinary fields (Council on Higher Education 2007:2). Although the report attributes this poor academic performance among African students to several factors, it identifies language as one of the main contributory factors. This fact is also supported by the results of the *National Benchmarking Test (NBMT)* (*NBMT Report* 2009) recently conducted at a few selected universities. The results of the NBMT show that most of the EAL students who enter higher

education have not developed the required language and numeracy skills essential for academic success in higher education. Thus the use English only as the medium of instruction unequivocally creates a barrier to learning for these students.

To address the language problem of the EAL students, government has adopted in 2002 the Language Policy for Higher Education. Central to this policy, is the need to promote multilingualism in teaching and learning programmes. The policy recommends the development of resources such as glossaries and dictionaries to support students for whom English is not the first language and to promote the intellectualisation of the indigenous African languages. Accordingly, several universities have over the last few years embarked on multilingual glossaries projects. However, the development of these glossaries raises questions of theoretical, methodological and practical nature. Theoretically, there is still a dearth of research that has focussed on the pedagogic value and use of multilingual glossaries at university level in South Africa. Thus, the question of crucial concern to this article is to what extent multilingual glossaries can be used to optimize concept learning to EAL students.

The aim of this article is to address this question with a special focus to the corpus-based multilingual glossaries that are being developed at the University of Cape Town as part of the Multilingualism Education Project. The development of these glossaries is aimed at providing academic support to EAL students. It is the contention of this article that the development of these multilingual glossaries constitutes an important intervention strategy to optimize concepts learning to EAL students in different content areas. However, as it will be shown later, some South African scholars such as Mesthrie (2008) are not convinced about the pedagogic value of multilingual glossaries that are being developed in different universities in the country. Contrary to this view, the article will argue for the use of corpus-based multilingual glossaries which overcome most of the shortcomings of traditional glossaries raised by Mesthrie (2008). Furthermore, the article will show how multilingual glossaries can be used to fast-track concepts learning to EAL students in higher education. However, as the Project is still in its initial stage, the article mainly provides a conceptual argument based on two theories, namely, the theory of conceptual difficulty (cf. Perkins 2007, 2009), which provides a theoretical framework for analysing EAL students' difficulties in mastering concepts in different content

areas, and Vygotsky's socio-cultural constructive theory which provides a framework of pedagogic intervention to fast-track concepts learning.

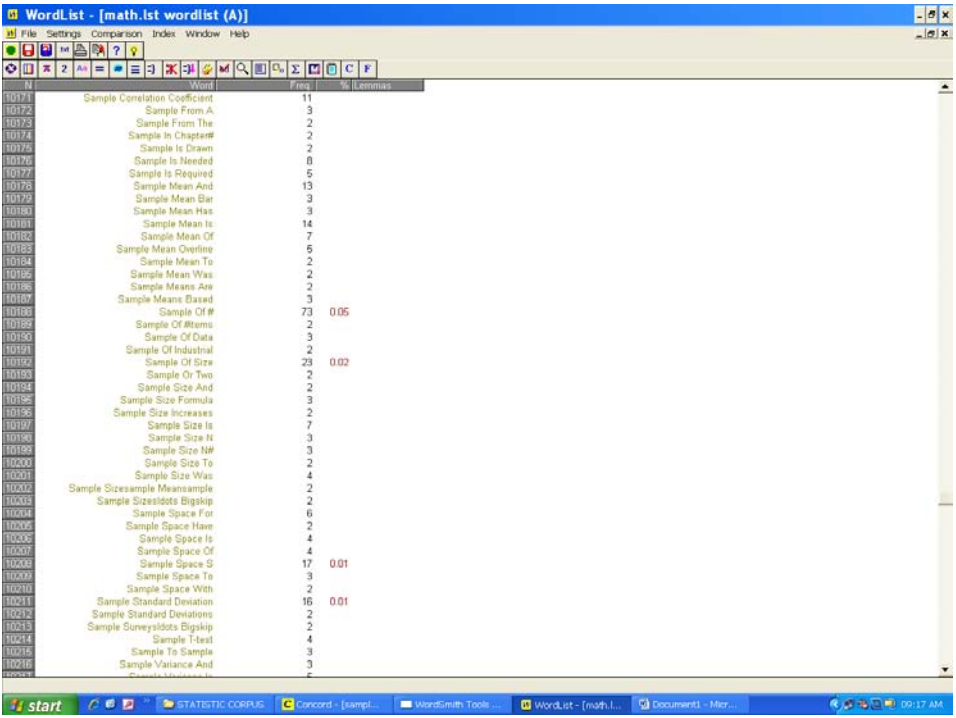
The article begins by describing the Multilingual Glossaries project at UCT and then discusses theories underlying their pedagogic use to optimize EAL students' concept learning in different content areas.

The Multilingual Glossaries Project at the University of Cape Town (UCT)

The Multilingual Glossaries Project at UCT was launched in 2007 as one of the university's strategies to implement its Language Policy (adopted 1999 and revised in 2003) and the Language Plan developed in 2003. The Language Plan requires that multilingual glossaries be developed to support students for whom English is not the first language (Language Plan 2003). Thus, the glossaries are aimed at optimizing EAL mastery of concepts and vocabulary of different content-learning areas. As the Project is on its pilot phase, the development of glossaries was only focussed on five disciplines, namely, Statistics, Economics, Law, Physics and Health Sciences. All these glossaries are based on the Special Language Corpora constructed for this purpose. The focus of this article is only on Statistics Multilingual glossary as it is the only one that has so far been completed.

The Statistics Glossary is based on the small Corpus constructed according to the generally accepted criteria and principles of designing a corpus, namely, size, text types, publication status, text origin, constitution of the texts, authorship, external and internal criteria (for a detailed discussion of these principles see Madiba 2004).

With regard to size, the corpus has about 118 000 running words made up of instructional texts such as prescribed and recommended books, course manuals and tutorials. Although the size of this corpus is small, it offers a huge resource for term mining. As Sinclair (2001:x) points out, the advantage with small corpora is that they can be analysed or mined right from the beginning either manually or using term extraction tools. The WordSmith Tools was used for term extraction and concordancing. The following are examples of terms extracted from the Statistics corpus using WordSmith Tools:



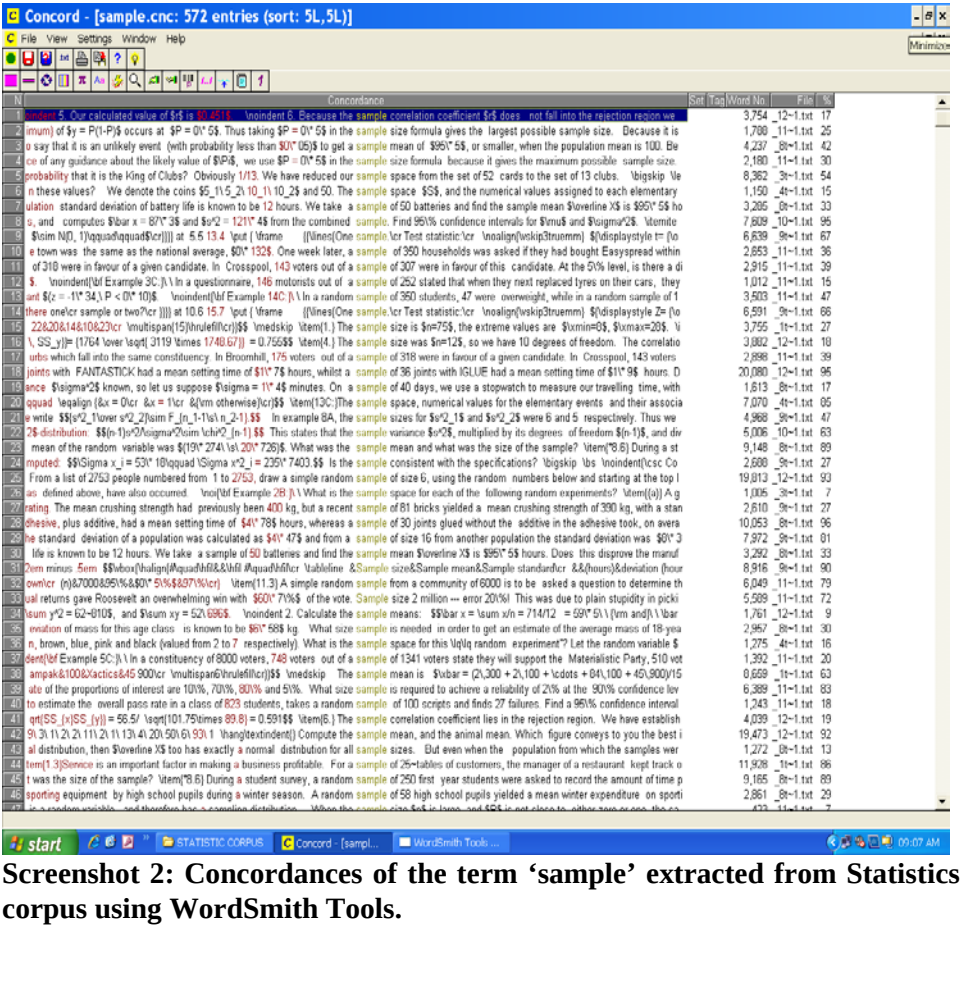
Screenshot 1: Examples of terms extracted from Statistics corpus using WordSmith Tools.

About 3689 terms were extracted from the corpus. Out of this number, about 472 terms were selected according to their frequency, difficult level and conceptual richness. The final word list was made in collaboration with the Statistics lecturer.

After the compilation of the final word list, concordances were generated using WordSmith Tools to identify the meanings or senses of the terms in contexts. The Screenshot 2 shows the concordances of the term ‘sample’ generated by using WordSmith Tools.

The concordances in the examples below provide different contexts of the term ‘sample’. In WordSmith tools, these contexts can be expanded to a paragraph or full text to provide a better understanding of the concept which is necessary for the development of definitions.

After the terms were defined, they were then translated into all the nine official indigenous African languages of South Africa and Afrikaans.



Screenshot 2: Concordances of the term 'sample' extracted from Statistics corpus using WordSmith Tools.

Theoretical Framework for the Pedagogic Use of Multilingual Glossaries

The pedagogic use of multilingual glossaries at university level raises questions of theoretical and methodological nature. Theoretically, the main question, as

pointed out at the beginning of this article, is to what extent can the use of multilingual glossaries optimizes EAL students' mastery of discipline concepts and registers. In South Africa, there seems to be no consensus among scholars on the pedagogic value of multilingual glossaries at university level. This is not surprising as the professionalization of multilingualism in higher education is a new phenomenon in South Africa and the world over. For example, scholars such as Mesthrie (2008) argue that though the development of multilingual glossaries or word lists is a necessary condition, they are not a sufficient condition for the use of indigenous African languages at university level. To support this view, Mesthrie (2008) advances the following two arguments. The first argument is that the mastery of discipline knowledge at university level does not only involve the learning of terms, but the mastery of registers. The second argument is that registers cannot be artificially created or transferred from another language through translation. Rather, they are developed in use by experts or a community of practice. Thus, the lack of discipline experts who are native speakers of the different indigenous languages is viewed as a serious constraint to the development of multilingual registers in different content areas. However, what Mesthrie's (2008) second argument fails to take into account is that EAL students are an important resource for developing terms and registers in African languages. As Paxton (2009) indicates, these students constitute a community of discourse which is important in developing terminology and registers in their own languages. Furthermore, Mesthrie's view on the non-transference of registers seems to be mainly based on traditional glossaries. As Madiba (2008) points out, most of the shortcomings of traditional glossaries may be easily overcome by corpus-based multilingual glossaries. What distinguishes corpus-based multilingual glossaries from the traditional ones is that they make use of contextual examples of terms. Literature abounds with studies that emphasise the importance of contextual examples in concepts and vocabulary instruction (cf. Nagy 1987, 1988, 2005). As Stahl and Fairbanks (1986:76), rightly point out,

> a method that gives multiple exposures to a word would have a greater effect on vocabulary learning than one that gives the student one or two mentions of the word paired with a definition or used in a sentence.

Although glossaries have from time immemorial been used as pedagogic

tools to promote concepts learning (cf. Hüllen 1989; Sauer 2009), their pedagogic use at university level should be based on well-researched theories of conceptual difficulties and pedagogic intervention. Accordingly, the focus of the next section will be on these theories.

Theories of Conceptual Difficulties

Although the problem of concept learning among EAL students is highly marked, there are not yet well-researched theories of conceptual difficulties that help to explain their difficulties. Without a good theory of conceptual difficulty, it is easy for lecturers to apportion blame to EAL students for their under-preparedness and their lack of academic English proficiency. Thus, Perkins (2007, 2009) argues that any intervention to address concept learning should be based on a good theory of conceptual difficulties. Such a theory should provide an explanation on what makes the learning of scientific concepts hard to students (Perkins 2007, 2009). Perkins' theory of conceptual difficulty identifies the following four factors as the main cause of students' conceptual difficulties: 1) their level of academic development versus the cognitive demands of the discipline (developmental theories), 2) the nature of the discipline knowledge or epistemological knowledge, 3) the troublesome nature of threshold concepts, and 4) conceptual difficulty related to language. As all these four factors are crucial to the understanding of conceptual difficulties of EAL students in South African universities, they will be discussed separately with a view to identify pedagogic strategies for using glossaries to overcome them.

The first factor is informed by learning theories of scholars such as Piaget and Vygotsky who viewed learning to be developmental and constructive (Fosnot & Perry 2005:22). Piaget learning theories locate the learners' conceptual difficulties to the lack of well-developed mental structures or certain logical schemata that allow encoding of aspects of content and their learning at deep level (cf. Piaget 1959; 1977). Accordingly, the learners' conceptual difficulties may be viewed to be due to a 'mismatch between the schematic repertoire of the learner and the often hidden structural presupposition of the content' (cf. Perkins 2007). Thus, according to Piaget, unless learners have reached a certain stage of internal development, instruction from outside may not be effective. This theory of conceptual difficulty is useful in explaining the lack of preparedness of most EAL students because of their poor schooling and

family backgrounds. However, as Lev Vygotsky, who was a contemporary of Piaget argues, this problem can be overcome by means of direct instruction of scientific concepts. Contrary to Piaget, Vygotsky (1986) argues that the learning of scientific concepts precedes the development of an established logical structure, and that such a development can be optimized through direct instruction. According to him, instruction need not wait for development. Rather, the instruction of scientific concepts should precede the development of an established logical structure. Vygotsky maintains that the development of mental structures is influenced by internal factors as well as external factors such as social and cultural factors. Thus, the conceptual difficulties of EAL students need not be viewed as an inherent internal problem in their psychological make-up. These are conceptual difficulties that can be overcome by direct instruction of scientific concepts that takes into account the socio-historical and socio-cultural contexts of EAL students.

The second factor that gives rise to conceptual difficulties to students at university level is the nature of epistemological knowledge (cf. Perkins 2007). The mastering of the epistemology of different disciplines and their distinctive patterns always poses a challenge to students. According to Perkins (2007:98-99) concepts are by their very nature difficult to master as they are

> more abstract rather than concrete, continuous rather than discrete, dynamic rather than static, simultaneous rather than sequential, or organicism rather than mechanism, interactiveness rather than reparability, conditionality rather than universality and nonlinearity rather than linearity.

Furthermore, disciplinary concepts in higher education are difficult to EAL students because they also come to the discipline with other kinds of conceptual knowledge such as ritual knowledge, inert knowledge, foreign knowledge, tacit knowledge, and so on (Perkins 2007, 2009). As several studies have shown (cf. Young *et al.* 2005), for EAL students in South Africa to master concepts of the different content areas and to undergo conceptual change or transformation, they need direct instruction of concepts or concept literacy.

The third factor has to do with the nature of *threshold concepts.* According to Meyer and Land (2006), threshold concepts may be described as ‘akin to a portal, opening up a new and previously inaccessible way of thinking

about something'. Each discipline has concepts that are keys to its mastery and learners often find these concepts difficult and also troublesome to learn (Meyer & Land 2006). These concepts are important for learners to master them as they are not only key to understanding the discipline, but also represent a transformed way of understanding or interpreting the subject matter, subject landscape or world views (Meyer & Land 2006). Thus the development of multilingual glossaries should be focussed on threshold concepts to make them more visible to EAL students. These concepts should be taught more explicitly rather than implicitly. As research has shown, students tend to understand and remember better threshold concepts that are explicitly taught than those that are taught implicitly (Davies 2006; Cousin 2006).

The last factor that contributes to EAL students' conceptual difficulties is language. The role of language in concept learning and conceptualization is widely recognised (cf. Vygotsky 1986; Cummins 1979, 2000). Vygotsky (1986), for example, maintains that there is a direct relationship between thought and language. In his essay entitled '*Thought and word'*, he noted that word meaning is an instance of the unity of thought and word, and as such one cannot be separate from the other. According to him the 'meaning of a word represents such a close amalgam of thought and language that is hard to tell whether it is a phenomenon of speech or a phenomenon of thought' (Vygotsky 1986:212). This relationship question between language and conceptualization is important for a better understanding of the conceptual difficulties experienced by EAL students in learning scientific concepts through a language which is not their first language.

It is an accepted fact that students who learn concepts in a language in which they have limited proficiency experience much difficulty as they also have to deal with the special subject language of the discipline. Cummins's (1979; 2000) studies provide a better understanding of the relationship between language proficiency and conceptualization. According to him, learners who have low proficiency in a language which is used as the medium of instruction may struggle to understand concepts through that language which may then result in poor academic achievement. Cummins (1979; 2000) maintains that concepts are learned better in one's first language or a language in which one has a high proficiency. In fact, recent neurolinguistic studies (cf. De Groot 1992, 2002; Kroll & Stewart 1994; Kroll & Tokowicz 2005; and Pavlenko 2009) clearly show that students with low proficiency in additional language tend to

access concepts in this language via their first language (L1) in which they have high proficiency. It is only students who have achieved high academic language proficiency in an additional language who may access concepts directly through it. The following Figure (1) adapted from Kroll and Stewart (1994) shows how EAL students access concepts:

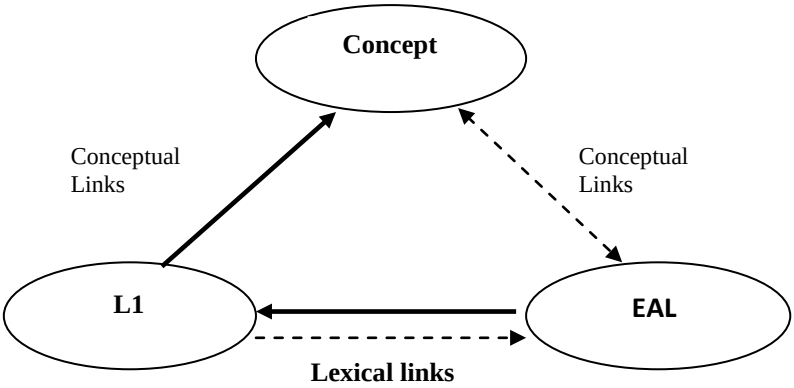


Figure 2: Revised Hierarchical model (adapted from Kroll and Stewart 1994)

From the foregoing, it is clear that EAL students with low academic English proficiency would access concepts through their L1 instead of English which is the medium of instruction. The question, however, is how this access to concepts through L1 can be optimized through the use of multilingual glossaries. In the next section, an attempt will be made to show how such problems can be addressed through multilingual glossaries. In fact, the theories of conceptual difficulties discussed in the foregoing, do not only provide a framework to analyse and to understand EAL's students' conceptual difficulties, they also help to identify strategies to deal with these conceptual difficulties.

Using Multilingual Glossaries to Overcome Conceptual Difficulties

As already mentioned, it is the argument of this article that conceptual difficulties of EAL students can be overcome by corpus-based multilingual glossaries. Vygotsky's (1986) socio-cultural constructivist theory provides a useful framework of pedagogic intervention. According to this theory, the

capacity of any student to learn scientific concepts can be optimized through direct instruction which takes into consideration the Zone of Proximal Development (ZPD). In accordance with the ZPD theory, Vygotsky argues that it is not enough for the teacher to merely determine what a child knows as the child is able to copy a series of actions which surpass his or her capacities. Instead, the teacher should determine what a child is able to learn. He further indicates that a child is able to perform much better by means of copying when together with or guided by an adult than when left alone (Vygotsky 1986). With regard to EAL students, the ZPD seems to provide a strong basis for scientific concepts instruction to fast-track their academic development. To expand students' ZPD with regard to scientific concepts, Vygotsky believed in the kind of direct instruction which should go beyond memorisation or rote learning of concepts. He has the following to say in this regard:

> the teacher who attempts to use this approach [simple transmission] achieves nothing, but a mindless learning of words, an empty verbalism that stimulates or imitates the presence of concepts in the child. Under these conditions, the child learns not the concept but the word, and this word is taken over by the child through memory rather than thought. Such knowledge turns out to be inadequate in any meaningful application. This model of instruction has the basic defect of the purely scholastic verbal modes of teaching which have been universally condemned. It substitutes the learning of dead and empty verbal schemes for the mastery of living knowledge (Vygotsky 1986:170).

Vygotsky believed that the student's, development of scientific concepts requires deep learning processes, that is, the understanding of concepts and their relationship with other concepts which may be hierarchical, subordinate and coordinate in the content domain. He argued, for example, that a student who has understood the concept 'triangle', should be able to (a) determine that the sides of pyramids are triangles, (b) subdivide hexagons and other polygons into a particular number of triangles, (c) relate triangles to other polygons, and so on instead of just simply defining the concept or matching the concept with examples (Gredler & Shields 2008:126-127). For Vygotsky, it is this kind of deep learning of concepts that leads to the development of high mental functions or thinking order.

As already mentioned corpus-based multilingual glossaries are conducive to EAL students' developmentof high mental functions or thinking order. Unlike traditional glossaries, corpus-based glossaries provide contextual examples that enable students to develop high mental functions or thinking order such as decontextualization and generation skills. The contextual examples allow EAL students to have multiple exposures to the term and to analyse its different senses in different contexts, and in doing this analysis, students develop decontextualization which involves deep learning processes essential for conceptualization and academic development. In fact, according to Nelson and Nelson (1978; cf. Stahl & Fairbanks 1986:76),

> children learn to form a flexible and decontextualized notion of a word's meaning through successive refinement of the rules of meaning developed through multiple exposures to the word used in different contexts.

The following is an example of how the term 'sample' in Statistics can be learned or taught using a corpus-based approach which begins by analysing the meaning of the source concept in context.

	Concordance	Set	Tag	Word No.
1	It can be shown that if a **sample** is drawn from a population having a normal distribution, then a simple transformation of the **sample** variance s^2 has exactly the χ^2-distribution: $$(n-1)s^2/\sigma^2\sim \chi^2_{n-1}.$	4,990	c:\specia ~1\tim_1 0~1.txt	63
2	We consider a **sample** to be a small number of observation taken from the **population of interest**. We hope that the **sample** is **representative** of the population as a whole, so that conclusions drawn from the **sample** will be valid for the population. We consider methods of obtaining a representative **sample** in Chapter 11.	2,638	c:\specia ~1\tim_1 t~1.txt	19

3	A **sample** of 47 drivers each drive the car under a variety of conditions for 100 km, and the fuel consumed is measured.	2,552	c:\specia ~1\tim_8 t~1.txt	26
4	If the **sample** is smaller than 30, then $\oX$ will have a normal distribution if the population from which the **sample** is drawn has a normal distribution.	6,904	c:\specia ~1\tim_9 t~1.txt	70
5	With a large **sample** size, the **sample** mean is likely, on average, to be closer to the true population mean than with a small **sample** size.	1,372	c:\specia ~1\tim_8 t~1.txt	14
6	In a random **sample** of 350 students, 47 were overweight, while in a random **sample** of 176 businessmen, 36 were overwight.	3,503	c:\specia ~1\tim_1 1~1.txt	47
7	This states that the **sample** variance s^2, multiplied by its degrees of freedom $(n-1)$, and divided by the population σ^2 has the $\chi^2{\rm-distribution}$ with $n-1$ degrees of freedom.	5,006	c:\specia ~1\tim_1 0~1.txt	63
8	What was the **sample** mean and what was the size of the **sample**? \item{*8.6} During a student survey, a random **sample** of 250 first year students were asked to record the amount of time per day spent studying.	9,148	c:\specia ~1\tim_8 t~1.txt	89

From the examples above, it may be observed that the term ‘sample’ is used in different contexts or concordances. These concordances introduce different meaning or senses of the term. Students can be systematically led to develop definitions or explanations of the term ‘sample’ by analysing the different contexts in which the term occurs. Sometimes it is possible to find a full definition of the term in the very list of concordances. A good example of this is concordance no 2 above which provides a generic definition of the term

'sample' in Statistics. In this concordance, the term 'sample' is defined as

> a small number of observations taken from the population of interest [which] is representative of the population as a whole, so that conclusions drawn from the sample will be valid for the population.

An analysis of the other concordances gives rise to different senses or meanings of the term 'sample'. These different contexts provide the student with multiple exposures to the concept. Such multiple exposures to the concept are essential for a student to understand its different meanings or senses. As already mentioned, in analysing the meaning of the term in different contexts, students develop decontextualization skills which involve deep learning processes essential for conceptualization and academic development. To help EAL students develop decontextualization skills, they should be first introduced to the scientific concepts in their simplified form at the beginning, and then progress to learning more complex versions of the same concept and learn how to apply it in a range of contexts and to translate it into their first languages (Davies 2006:72). For example, from the concordances given above, students can be led systematically to construct the following definitions or explanations of the term 'sample' using the different concordances:

1. A **sample** of people is a number of them drawn from a larger group which has a normal distribution.

   *~ We consider a **sample** to be a small number of observations taken from the **population of interest**.*
   *~It can be shown that if a **sample** is drawn from a population having a normal distribution*

2. A **sample** of a people can be of a small size or a large size that shows you what the whole is like.

   *~With a large **sample** size, the **sample** mean is likely, on average, to be closer to the true population mean than with a small **sample** size.*

3. A **sample** of people is number of people selected from the overall population for tests or to be examined and analysed scientifically.

*~This states that the **sample** variance s^2, multiplied by its degrees of freedom $(n-1)$, and divided by the population σ^2 has the $\chi^2{\rm-distribution}$ with $n-1$ degrees of freedom.*

4. A **sample** of people can be done randomly (a random sample), but it has to be representative of the distribution of the total number if the sample is smaller than 30)
   *~We consider methods of obtaining a representative **sample** in Chapter 11.*
   *~ In a random **sample** of 350 students, 47 were overweight, while in a random **sample** of 176 businessmen, 36 were overweight.*
   *~ If the **sample** is smaller than 30, then $\oX$ will have a normal distribution if the population from which the **sample** is drawn has a normal distribution.*
   *~ We hope that the **sample** is **representative** of the population as a whole, so that conclusions drawn from the **sample** will be valid for the population.*

5. A **sample** of the population has to be calculated in relation to the total population to get sample mean and sample variance.
   *~It can be shown that if a **sample** is drawn from a population having a normal distribution, then a simple transformation of the **sample** variance s^2 has exactly the χ^2-distribution: $$(n-1s^2/\sigma^2\sim \chi^2_{n-1}.$*

From the foregoing, it is clear that definitions based on concordances are more elaborate and helpful to EAL students than dictionary definitions, especially dictionary definitions that are not based on corpus. Providing students with mere definitions to memorize, results in superficial understanding of a concepts. 'Students must have both definitional and contextual information about words, as well as repeated exposures and opportunities to learn and review them' (O'Hara & Pritchard 2009:11). Once students understand the meaning of terms in different contexts, it becomes easier for them to generate their own definitions and the translation equivalents in their first language. The following table show the translation equivalents of the term 'sample' and other related terms in different African languages. However, these translations were done by professional translators instead of students.

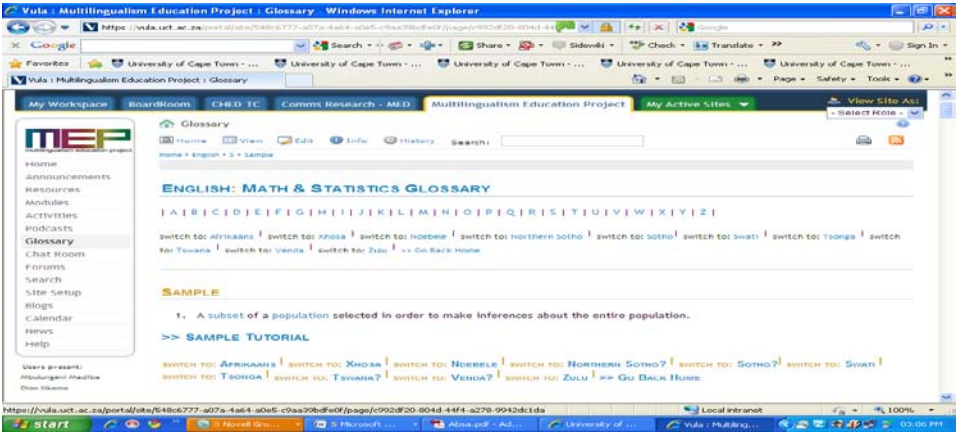
English	**Afrikaans**	**Xhosa**	**Tswana**	**Sotho**	**Pedi**
Sample	Steekproef	Isampula	Sampole	Sampole	Sampole
Sampling	Steekproef-neming	Ukuthatha isampulu/ ukwenza isampulu	Go dira sampole	Ho etsa sampole	Go dira sampole
Sample correlation coefficient	Steekproef-korelasie-koëffisiënt	Inani elandisayo lesampulu yonxulumano	Bokalo jwa nyalanyo ya sampole	Papiso ya sampole	Bokaalo bja nyalanyo ya sampole
Sample maximum	Steekproef-maksimum	Eyona sampulu inkulu	Makisimamo ya sampole	Palo e phahameng ya sampole	Maksimamo wa sampole
Sample mean	Steekproef-gemiddelde	Umndilili wesampulu	Palogare ya sampole	Palohare ya sampole	Palogare ya sampole
Sample size	Steekproef-grootte	Ubukhulu besampulu	Saese ya sampole	Boholo ba sampole	Bogolo bja sampole
Sample space	Steekproef-ruimte	Isithuba sesampulu	Sepeisi sa sampole	Sebaka sa sampole	Sekgoba sa sampole
Sample survey	Steekproef-opname	Uphando lwesampulu	Sampole ya patlisiso	Patlisiso ya sampole	Tekanyetšo ya sampole
Sample variance	Steekproef-variansie	Ukungavani kwesampulu	Pharologano ya sampole	Phapano ya sampole	Phapano ya sampole
Sample standard deviation	Steekproef-standaard-afwyking	Ukuphambuka komgangatho wesampulu	Phapogo ya maemo a sampole	Phetolo e tlwaelehileng ya sampole	Phapogo ya maemo a sampole
Sampling distribu-tion	Steekproef-verdeling	Usasazo lokuthatha isampulu	Tlhagiso ya sampole	Kabo ya sampole	Kabo ya go dira sampole
Sampling variability	Steekproef-veranderlik-heid	Ukutshintsha kwesampulu	Go farologana ga go dira sampole	Phetoho ya sampole	Phapano ya go dira sampole
Sampling with replacement	Steekproef-neming met terugplasing	Ukuthatha isampulu ngokuthathela indawo	Go dira sampole ka go tsenya sengwe mo boemong jwa se sengwe	Sampole ka phetolo	Go dira sampole ka go bea ye nngwe legatong la ye nngwe

Sampling without replacement	Steekproef-neming sonder terugplasing	Ukuthatha isampulu ngaphandle kokuthathela indawo	Go dira sampole ntle le go tsenya sengwe mo boemong jwa se sengwe	Sampole ka ntle ho phetolo	Go dira sampole ntle le go bea ye nngwe legatong la ye nngwe

Figure 1: Draft list of terms taken from our Statistics Glossary

It is evident that certain terms have no equivalent indigenous terms in African languages. As such, translators have used either loan words or paraphrasing. As Wildsmith-Cromarty (2008) points out, the translatability of academic discourse from English into African languages poses a serious challenge. However, it is important to note that although translation equivalents are important for our project, we are aware that simply giving word lists in African languages does not give EAL students access to academic concepts. What is more important for EAL students is how they are made to engage with the different concepts in ways that promote the development of high thinking order skills.

Once completed, the glossaries are uploaded to MEP Online Learning Environment on Vula which is the University Online Environment developed by the Centre for Education Technology and powered by Sakai. This networked Online Learning Environment provides EAL students with easy access to the multilingual and other online courses. The MEP Online Learning Environment on Vula is shown in Screenshot 3 below.



Screenshot 3: Vula Multilingual Glossaries Hypermedia

As may be observed from the Screenshot above, Vula Multilingual Glossaries Hypermedia provides several other functions such as Chat room, Forums and Blogs which are quite useful in allowing EAL students to engage interactively with the terms and concordances. Students can also give comments in the comment spaces provided for each term.

Conclusion

The aim of this article was to show how corpus-based multilingual glossaries can be used to promote concept literacy to EAL students in South African universities and UCT in particular. Perkins's (2007, 2009) theories of conceptual difficulty were used to provide a theoretical framework for analysing EAL students' conceptual difficulties. Vygotsky's constructivist socio-cultural development theory was used to develop a theoretical framework of intervention. Drawing from this theory and the subsequent Zone of Proximal Development, the article argues that given good academic support such as direct vocabulary instruction and explicit concept teaching which involves learners first languages, new zones of learning possibilities can be created for EAL students.

Contrary to Mesthrie (2008) who maintains that the development of terms and registers is mainly the prerogative of special subject experts, the article argues that EAL students are part of the community of discourse in their fields of study and as such they are instrumental in developing terms and registers in their different indigenous African languages (cf. Paxton 2009). In fact, as Paxton (2009) observes, EAL students are already doing this at UCT as they discuss with friends and tutors about concepts of the different disciplines in their own primary languages. What these students need are linguistic resources such as corpus-based multilingual glossaries that may assist them to engage with concepts in different content areas in their primary languages. As already indicated, corpus-based multilingual glossaries enable students to engage with concepts in their different contexts and in doing so they develop deep learning processes such as decontextualization and generation which are pivotal to academic success.

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