



Teaching and learning specialized terminology with a mobile glossary in higher education

Michele F. van der Merwe 

Assoc. Prof. Dr., Stellenbosch University, South Africa, michelevdm@sun.ac.za

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ABSTRACT

The intersection between technology and pedagogy is explored in a higher education setting with particular reference to language teaching and learning in the digital age. Students from different linguistic and cultural backgrounds in South Africa find themselves in a higher education sector which is monolingually orientated, and language is consequently experienced as a barrier to access and success. Learning specialized terminology has an important role to play in the success of undergraduate students at university. The focus of the article is to explore the teaching of specialized terminology with the support of a mobile glossary. The article first explores which process will most effectively embed a glossary in a teaching and learning framework. Secondly, it describes a programme in which specialized terminology could be taught and learned with a multilingual glossary. Principal results include a formalized teaching and learning framework for integrating a glossary into teaching programmes and a description of processes and participants. The conclusion is that a multilingual glossary should form part of the academic repertoire of a university community.

Keywords

terminology, vocabulary, glossary, dictionary use, teaching and learning framework, learning outcomes, dictionary functions.

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Introduction

The digital age in which we live and the associated technologies are developing at a rapid pace. These innovative technologies create new opportunities and conditions for teaching and learning in the higher education environment. Language teaching for the digital age has seen considerable growth in recent years, with the use of mobile technologies becoming increasingly common. With the massive development of these mobile technologies, mobile-assisted language learning models have emerged that utilize mobile devices to facilitate and support language learning. According to Kukulska-Hulme and Traxler (2005), the design of mobile-assisted language learning (MALL) programs could include a variety of contents, such as learner-centred and personalized content, which could create a teaching and learning environment more suitable for a constructivist approach to education. Kern (2006) states that

the rapid evolution of communication technologies has changed learning pedagogy and language use, enabling new forms of discourse, new forms of authorship and new ways to create and participate in communities. Javornik Čubrić (2024) notes that today's students prefer visual information, are highly media-oriented, and that the practice of video and audio materials is successful and well-received.

Mobile technologies (for example, smartphones and tablets) have the potential to be used effectively in pedagogical contexts adopting a constructivist approach in higher education. One category of technological aids that can be used includes reference works, namely glossaries, dictionaries, and grammar and style checkers. Mobile reference works designed for specific target users, such as students in higher education, are regarded as learner-centred when they have been adapted to make provision for meeting users' needs in the specific teaching environment. Learner-centred mobile reference works could be employed in a constructivist teaching approach as part of a framework for the acquisition of specialized terminology in language learning. For example, a mobile reference work called MobiLex is a glossary of specialized terminology; it is learner-centred, because it was developed for a specific group of users, namely undergraduate students at a university in South Africa. MobiLex is a mobile glossary, and because it is a progressive web application, it can be used on smartphones and tablets.

The acquisition of specialized terminology in language learning in higher education is essential for student success in the academic environment. Students function in an academic environment within which they are expected to communicate in appropriate academic language and master the specialized terminology associated with their subject discipline and discourse for the sake of precise expression. Teaching the relevant vocabulary in subject-specific language forms an integral part of the acquisition of specialized terminology and it would therefore be beneficial to incorporate this into a formal framework of teaching that includes a mobile reference work such as MobiLex.

This article therefore focuses on mobile-assisted teaching and learning of terminology with the aid of the mobile reference work MobiLex. Teaching the terminology is incorporated into the formal framework for undergraduate students in a faculty of education who formed the user research group. Lexicographic user research is conducted specifically within the context of user situations. This study is consequently conducted with the aim of assessing the use of a mobile glossary embedded in a teaching and learning framework. This is one way of addressing the development of content literacy: not only do students face challenges with regard to learning new concepts at university, but they also have to deal with their often inadequate language proficiency in the tertiary teaching and learning environment. The major aim of the study is to present a framework for embedding a mobile reference work for teaching and learning specialized terminology in their courses. A secondary aim is to describe the process of implementing such a framework at a university. The study was guided by two research questions:

Research question 1: How would specialized terminology be taught using a multilingual mobile glossary in a faculty of education?

Research question 2: What process is necessary to embed such a mobile glossary in a teaching and learning framework?

The article is structured as follows: (i) an introduction to the context by referring to policy documents dealing with English as the language of teaching and learning; (ii) current research in teaching and learning specialized terminology; (iii) a teaching and learning

framework for mobile dictionary use; (iv) research methodology; (v) description of a mobile glossary embedded within the teaching and learning programme; (vi) a description of the implementation process in a faculty of education; and (vii) a discussion and conclusion.

Context for Language of Teaching and Learning in South Africa

The context of language of instruction at tertiary institutions in South Africa is explained with reference to policy documents pertaining to higher education, namely the *Language Policy for Higher Education* (2020) and *The Minimum Requirements for Teacher Education Qualifications* (MRTEQ 2015). These documents also specifically help to elucidate the teaching situation at Stellenbosch University with reference to the teaching of specialized terminology with the use of a mobile reference work. The documents specify the use of language of instruction in South Africa's higher education institutions. South Africa has 12 official languages, namely Afrikaans, English, isiNdebele, isiXhosa, isiZulu, Sepedi, Sesotho, Setswana, siSwati, Tshivenda, Xitsonga, according to Article 6(1) of the Constitution of SA (1996), and in 2023 South African Sign Language was recognized as the 12th official language (Netwerk 24).

Despite the official recognition of these languages by the government, the students and staff find themselves in a higher education sector which is monolingually orientated. The *Language Policy for Higher Education* (2020) in South Africa recognizes the *de facto* status of English as the language of instruction across South African higher education institutions and calls upon universities to adopt a flexible approach in the implementation of English as the language of learning and teaching. This is because English is very much the lingua franca in South Africa. The *de facto* status of English as the language of instruction in the policy recognises the idea that universities make use of English to include and not exclude students on the grounds of their understanding of a language. In requiring “a flexible approach in the implementation of English as the language of instruction”, the implication is that the concept of multilingualism and the recognition that students' first language may not be English are acknowledged.

Despite the “flexible approach” mentioned in policy documents, most universities throughout South Africa opt for the choice of English as the language of instruction, which in turn therefore means that most students study in their second or even third language at university. There is a growing body of literature on the difficulties experienced by students studying in their second language at higher education institutions (Mashiya, 2014). According to Hibbert and Van der Walt (2014), higher education is becoming increasingly multilingual as a result of the drive towards internationalization, the expectations of transnational students and the desire to counter the effects of colonial forms of education.

According to *The Language Policy for Higher Education* (2020), one of the roles of higher education is “to prepare language teachers, interpreters, translators, and other language practitioners, to serve the needs of a diverse South African multilingual society”. This statement acknowledges the multilingual and diverse nature of South African society, and emphasises that universities would need to take language diversity into account in their teaching. This has consequences for teacher education programmes in South Africa, as faculties of education also need to adhere to the language requirements of undergraduate teaching programmes, because multilingualism is also specified as a requirement in the policy regarding teaching qualifications. According to *The Minimum Requirements for Teacher*

Education Qualifications (MRTEQ 2015), all teachers who successfully complete an initial professional qualification should be proficient in the use of at least one official South African language as a language of learning and teaching (LoLT), and be partially proficient (i.e. sufficient for the purposes of basic conversation) in at least one other official African language, or in South African Sign Language, as the language of conversational competence (LoCC). If the LoLT is English or Afrikaans, then the LoCC must be an African language or South African Sign Language. This means that students take different language modules on different language levels, for example, first language, second language and third language, but that the language of instruction in other modules in their programme is English. There are some exceptions; for example, at the University of Stellenbosch, where students have the option to take some of their first-year modules in Afrikaans and Afrikaans is then the language of instruction. As they progress in their teacher training, during their senior years English is the medium of instruction, with Afrikaans as an option for communication, class assignments and assessments.

Despite English being the medium of instruction at universities, according to *The Language Policy for Higher Education* (2020) in South Africa, indigenous languages should be developed and strengthened as languages of scholarship, teaching and learning, and communication at higher education institutions. Indigenous languages could come to be valued as sources of knowledge, capable of informing the learning of different disciplines in higher education (*Language Policy for Higher Education*, 2020). One vehicle for sourcing such knowledge could be a mobile reference work compiled specifically for South African students as target group. *The Language Policy for Higher Education* (2020) acknowledges that the promotion of indigenous African languages for use in scholarship would require the development of dictionaries and other teaching and learning materials.

In compliance with the principle of promoting multilingualism described in the two policies above, a mobile reference work was compiled for South African students at Stellenbosch University (Van der Merwe, 2016). A project team at the University developed a mobile glossary in three South African languages, namely Afrikaans, English and isiXhosa (Van der Merwe, 2016). These languages were chosen because they are the official languages of the Western Cape, the province in which the University is situated (Van der Merwe, 2016). As three languages are included in the glossary, it can serve as a source of knowledge on indigenous languages (Afrikaans and isiXhosa) and on the language of instruction (English) for students and lecturers alike (Van der Merwe, 2016). Mobilex is a key enabler to promote multilingualism at Stellenbosch University, as the project is directly aligned with the *Language Policy of Stellenbosch University* (2021) as well as the new *Strategic Framework of Stellenbosch University* (2019-2040). As students have to cope with the demands of multilingualism, one way of facilitating this could be with the support of a multilingual glossary. The glossary could ensure a more inclusive teaching and learning environment for students by providing language support in three languages. The next section describes teaching and learning specialized terminology as part of vocabulary learning in a teacher education environment.

Teaching and learning specialized terminology in vocabulary development

As the major aim of the study is to present a framework for use of a mobile reference work in teaching and learning specialized terminology, it was necessary to include research on the role of vocabulary development as well as the use of a glossary as a resource in the process. Firstly, the precise meaning of the term “terminology” in this context needs to be defined, as it forms a central part of the topic of the paper. According to the *Cambridge English Dictionary* (2021), “terms” are special words or expressions used in relation to a particular subject or activity. Alberts (2017) defines “terminology” as terms or lexical items belonging to specialized areas of language usage in one or more languages. “Terminology” also refers to a “technical vocabulary” – a collection of terms that has a certain coherence owing to the fact that the terms belong to a single subject area (Alberts, 2017). The term is also used to refer to the compilation of systematic glossaries, term lists and technical dictionaries or dictionaries for special purposes and term databases (Alberts, 2017). This account of the term “terminology” makes it clear that “terms” are not general words with a wide semantic range, but they are attached to a specific subject and one would need to have specialised knowledge of such a subject field to be able to understand the specific meanings of words associated with it. Words used in a teacher education environment, e.g. *codeswitching, multilingualism* in language education; *photosynthesis, respiration, genes* in Biology; and *atoms, elements, cations* in Chemistry, could thus be classified as technical terms. Students would have to know the terminology to be able to understand the concepts associated with subject terms. Research has shown that students’ word knowledge is linked to academic success. De Wachter, Heeren, St. Marx and St. Huyghe (2013) indicate a connection between language proficiency in the use of (academic) vocabulary and success in university studies.

According to Webb and Nation (2017) words are the building blocks of language, because words are central to listening, speaking, reading and writing – essential components of almost every aspect of our lives. According to Webb and Nation (2017), different words have different values for people and these values are typically indicated by their frequency in language. More frequently used words tend to have a greater value than less frequently used words because, according to Webb and Nation (2017), they are more likely to be needed for general communication. The more relevant point here is that words may also be classified according to their frequency in different types of discourses: the most used vocabulary categories being high-frequency usage and low-frequency usage (Webb & Nation, 2017). Webb and Nation (2017) view technical vocabulary and academic vocabulary as involving words that have a higher-frequency usage within specific discourse types.

Webb and Nation (2017) recommend that students learn the specialized vocabulary of a discourse to learn and communicate about it more effectively and precisely. According to Alberts (2010), terminology is a determining factor in academic language development. The conveying of information, assimilation and recall should ideally take place in the first language, because it has been proven that information is best conveyed (encoding process) and received (decoding process) when communicated in the first language (Alberts, 2010). Precise subject terminology (also referred to as subject jargon) ensures unambiguous communication, and miscommunication and communication gaps are avoided.

Language users at university level are expected to reach an appropriate level of technical and academic literacy to be successful in their studies. Brooman-Jones, Cunningham, Hanna and Wilson (2011) are of the opinion that academic literacy, and especially language competence, can be improved through subject-specific academic activities and assessment tasks. Academic vocabulary, and subject-specific vocabulary in

particular, underpins in-depth learning, i.e. in-depth learning cannot take place if the student does not know the precise meanings of certain terms and how to use the terms in specific contexts.

Furthermore, there is a strong relationship between vocabulary and comprehension. Students who do well on vocabulary tests also do well in tests measuring reading comprehension. Systematic vocabulary learning is critical to students' understanding and learning from context-area texts. Research on subject-specific literacy includes identifying the different aspects of language use specific to the unique nature of specific subjects to better understand the nature of the subjects and to adapt reading and writing strategies accordingly (Anker, 2020). In a content-literacy approach students learn reading and writing processes that are common to certain subjects. Uccelli et al. (2015) define academic language proficiency as the highly useful literacy skills that serve as a tool for precise communication in the learning process of all the learning areas to support and develop reading comprehension in all the subjects.

Dictionaries are an essential resource that can be used to increase knowledge of the vocabulary that we encounter in the first or other languages (Webb & Nation, 2017; Van der Merwe, 2017). Alberts (2010) states that terminology, and by implication subject-specific dictionaries and glossaries, is a strategic resource which has an important role to play in the functional development of languages and their users' language skills. This notion is in line with the policies on language discussed above, while the MobiLex glossary is an example of a digital language resource.

Glossaries serve several purposes in teaching and learning a language: they can be used as resources for building vocabulary (Khani & Tazik, 2013); they could serve to provide guidelines for designing curricula and courses, as well as for selecting reading and listening materials (Jin & Ying, 2013); and they could act as guidelines for teachers in organising their explicit vocabulary teaching (Khani & Tazik, 2013). As such, the MobiLex glossary may be purposefully used as a resource, but also to provide a guideline in the teaching and learning environment by lecturers in a faculty of education as part of a teaching and learning framework to teach technical and specialized vocabulary (America & Van der Merwe, 2017).

The MobiLex glossary can support undergraduate student teachers' specific language needs in Afrikaans, English and isiXhosa, as the glossary on specialized terminology was compiled purposefully by members of a faculty of education. The glossary was designed with an educational purpose in mind, namely to provide support in a multilingual environment with regard to meeting content-specific needs as well as linguistic needs. Glossaries in general provide users with translations of terms only, but the MobiLex glossary has a more hybrid character; it provides students with translations of terminology in three languages as well as definitions of terms in three languages (Van der Merwe & Horn, 2018). The next section explains the research methodology.

Methodology

A qualitative approach is followed in the research. According to Punch and Oancea (2014), qualitative research is considered as empirical research not conducted in the form of numbers. For many researchers qualitative research means more than just research not in the form of numbers, but it points to a heterogeneous set of approaches to research, drawing on different ways of thinking about social reality and involving a collection of methods for working with data that are in non-numerical or qualitative form (Punch & Oancea, 2014). According to

Punch and Oancea (2014), qualitative researchers typically study cases and processes, rather than variables.

The social reality of the context of language of instruction in South Africa's higher education landscape is described by drawing on official policy documents. Through a close-reading of these documents, the author focused on the official languages of South Africa and the fact that English is the language of instruction in higher education, although not the first language of the majority of speakers in the country. The role of reference works as a source in language instruction is also investigated.

A literature review was undertaken to identify trends in the teaching and learning of vocabulary, with an emphasis on specialized terminology. The integration of a mobile reference work into the teaching is illustrated by means of a framework model that describes the process of integration. Different components of the process and the role-players involved in the process are described, in accordance with the qualitative nature of the research.

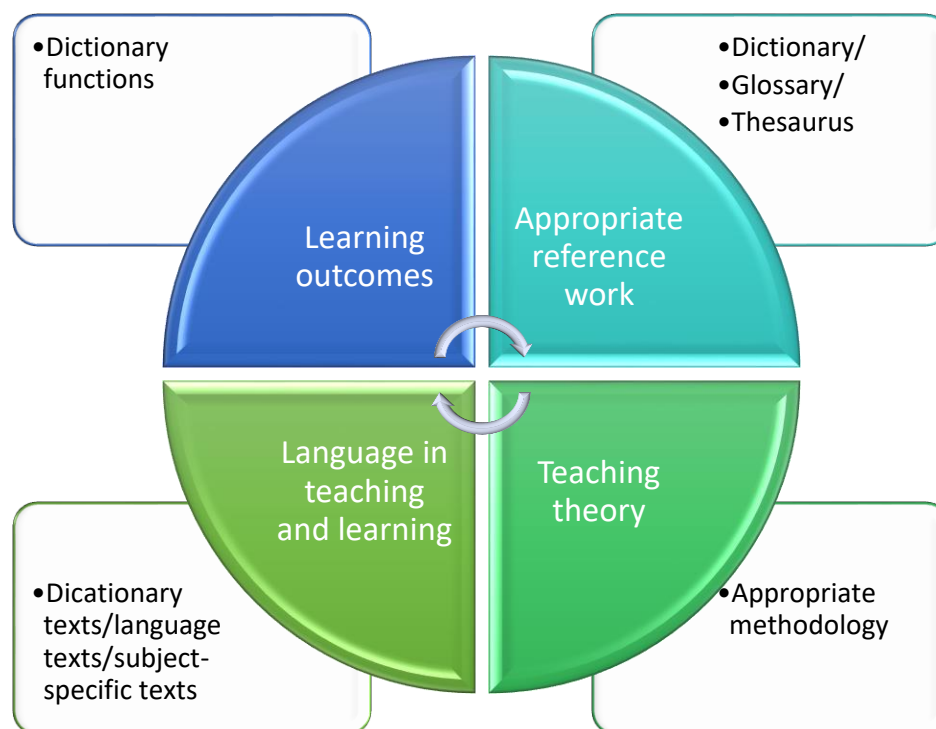
Ethical clearance and institutional permission for conducting the research was obtained from the University of Stellenbosch. The next section describes how a purposefully designed mobile glossary is used in teaching and learning specialized terminology in a teacher education environment.

Teaching and learning framework for digital reference works

In describing a planning cycle for integrating digital technology into literacy instruction, Hutchison and Woodward (2014) highlight the following reasons for the incorporation of digital tools into the literacy classroom; such tools can support literacy skill development, enhance literacy practices and support differentiated learning opportunities. These benefits are also applicable to the integration of a mobile reference work as a valuable tool in teaching. The integration of a digital reference work (in this case a mobile glossary) into teaching is illustrated by means of a framework model. In designing a framework for teaching and learning with a glossary, the author adapted an existing framework purposefully to streamline the process (Van der Merwe, 2009). The purpose of the framework is to guide the use of mobile reference works during language teaching (Figure 1).

The process could be explained as follows. During the teaching and learning process certain *learning outcomes* need to be achieved by students regarding language usage in different communication situations. An example of a learning outcome could be the ability to make use of the appropriate specialized term in a given language communication situation. Students can also be assessed on these outcomes; in language usage situations, for example, they have to choose the appropriate term or meaning in a subject-specific text. In this scenario, outcomes pertaining to teaching and learning of specialized terms would be identified. Glossaries (like dictionaries) have specific functions, for example communicative and cognitive (as highlighted in section 2) and if we examine and apply these functions, they can be linked with specific outcomes during the teaching process. Functions of glossaries provide the opportunity for lecturers to make a connection with learning outcomes, as these outcomes are clearly identifiable, for example, to link a communicative function with a learning outcome.

Figure 1. Functions and methodology of reference works embedded in teaching and learning



In identifying an *appropriate reference work*, MobiLex served the purpose well as it was compiled purposefully with the target group in mind. Since it is open-access and freely available to students, it could change the way they learn by giving them access to a reference work whenever it is needed. Being mobile, the reference work offers learning opportunities whenever needed. In this way the reference work can support differentiated learning opportunities.

With regard to the *theory of teaching*, it would be the facilitator's responsibility to make an *appropriate* choice with regard to a suitable *methodology* of teaching with a mobile glossary. In this case a student-centred approach with a tutorial system was followed, including the use of peer-learning. A socio-constructivist approach to teaching and learning was followed, where students could construct their own learning by contributing towards the discussion of terms in the mobile glossary from their own perspectives and background, but also learning from their peers. With social constructivism (Vygotsky, 1978) as a theoretical underpinning, teaching and learning is seen as a collaborative, social and cultural process of knowledge-building that occurs in the context of human relationships and activity and is not only a cognitive activity of individual students. Teaching and learning as a social process also does not merely refer to the location of learning (i.e., physical spaces), it affects how people learn (through interaction and participation in social and cultural activities), what is learned (social practices including the curriculum) (Priestley & Philippou, 2018), and becoming an integral part of their own and others' learning processes.

The focus is on integrating the mobile technology into the *language in teaching and learning* of specialized terminology, be that in the home language or additional language environment, or in content-specific classrooms. Facilitators in the classroom can make use of a variety of texts, namely dictionary texts (where glossary entries are viewed as free-standing texts), language texts and subject-specific texts. As these texts display specialized

terminology in different contexts, they can be used in communicative situations and cognitive situations.

When one considers integrating a mobile glossary into a teaching framework, the starting point can be that of so-called dictionary functions, i.e. what is the “work” of a glossary or what can be achieved by referring to a glossary? Tarp (2008; 2009) distinguishes between communicative and cognitive dictionary functions. The distinction between dictionary functions is described in the next two paragraphs to explain how these functions can be incorporated into the mobile glossary.

Communicative functions include, for example, addressing text comprehension, text production and translation. According to Tarp (2008; 2009), communicative functions could assist with reception of texts into the native language, the production of texts in the native language, reception of texts in a foreign language, production of texts in a foreign language, translation of texts from the native language into a foreign language, and the translation of texts from a foreign language into the native language. The description of functions of a glossary can purposefully be linked to the identification of learning outcomes.

Tarp (2008; 2009) describes cognitive dictionary functions as their ability to provide general cultural and encyclopaedic information, special information about the subject field or the discipline, and to provide information about the language (e.g. when studying a foreign language). In using MobiLex, students receive cognitive support with definitions of subject concepts to assist with reading and understanding concepts in academic texts in their L1. It could also assist with the use of terminology in writing tasks and preparing for assessments. Communicative support is provided with translation equivalents of terms as well as definitions in the L2 and L3.

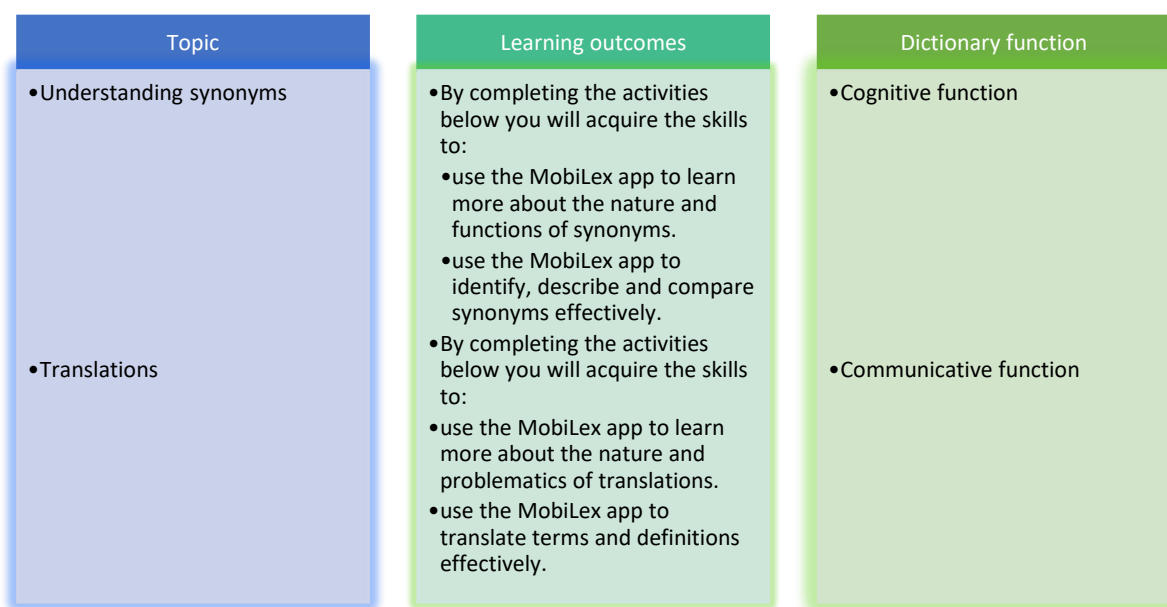
Bilingual techniques for vocabulary teaching and learning, including dictionary practice, are closely linked to the concept of extensive reading and the development of literacy skills in addition to communicative skills (Augustyn, 2013). Augustyn (2013) argues for the use of a bilingual dictionary in digital format to support vocabulary acquisition with techniques such as translation and contrastive analysis. MobiLex would be most suitable to be used in translation and contrastive analysis, as it is trilingual. The glossary is thus suited to support vocabulary acquisition.

After establishing the functions of a mobile glossary, topics and learning outcomes are linked to dictionary functions. Planning of teaching opportunities in the programme entailed identifying topics and learning outcomes where the glossary can be used. Two topics for teaching, namely understanding synonyms and translations, are discussed as examples. During the teaching and learning process a total of 8 topics were taught, ranging from understanding synonyms, antonyms, definitions, translations, finding and comparing examples, concepts and educational experts. Once topics have been identified, the desired learning outcomes can be formulated. Two learning outcomes regarding understanding synonyms were developed, namely to learn more about the nature and function of synonyms and to identify, describe and compare synonyms effectively making use of the MobiLex app. These learning outcomes are linked to the cognitive function, as they relate to understanding the language.

Two learning outcomes concerning translations were developed, namely to learn more about the nature and problematics of translations and to translate terms and definitions effectively making use of MobiLex. These learning outcomes are linked to the communicative function, as they relate to translation of texts.

The use of a mobile glossary in teaching and learning specialized terminology in a teacher education programme is illustrated in Figure 2. The figure provides examples of topics and learning outcomes and they are linked to (dictionary) functions of a glossary. The connection to relevant dictionary functions was made to illustrate the use of a glossary in the teaching and learning process.

Figure 2. Dictionary functions, learning outcomes and topics in teaching with a mobile glossary



The first research question, what is the process of embedding a glossary in a teaching framework, was answered by providing a framework for the integration of reference works and describing the process. Topics, learning outcomes and dictionary functions were linked to teaching with a glossary.

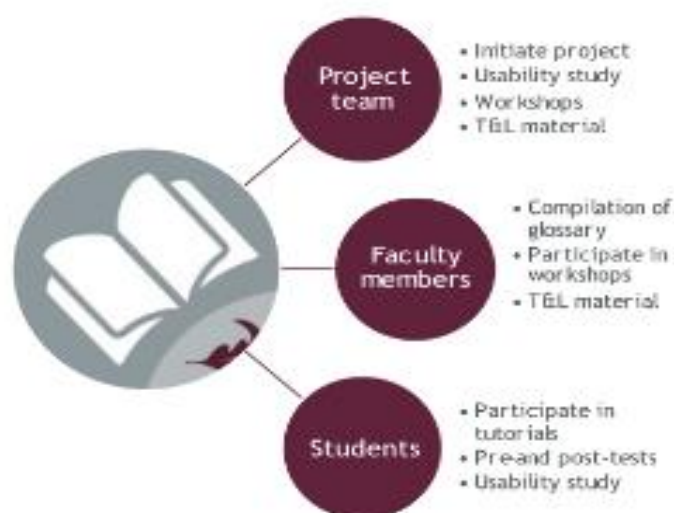
In the next section the focus is on the design of the teaching and learning programme using a mobile glossary within a faculty of education.

Teaching and learning programme with a mobile glossary in a faculty of education

The benefits of a glossary could be maximized if it forms an integral part of the academic programme. According to Campoy-Cubillo (2015), the incorporation of dictionary use into a curriculum demonstrates its value as a learning tool. A programme for teaching with a glossary, which forms part of a three-year project, was thus designed to integrate the language resource into the teaching and learning framework of a faculty of education. According to Holdt, Kosem and Gantar (2016), incorporating online dictionary use into the process of education has two goals. On the one hand, it aims to meet the didactic needs of teachers, e.g. by providing an appropriate format for the use of a readily available resource, providing data that can be easily adapted for teaching purposes or even ready-made teaching materials, and providing “motivational” content, such as different types of visualisations of language data, interactive content, links to external resources, etc. On the other hand, dictionary data need to be appropriately adapted to the cognitive capabilities of pupils and students, which of course change with age and the level of education (Holdt et al., 2016).

The process of integration within the teaching and learning environment was initiated by a project team who managed the glossary project, conducted the usability study, held workshops, managed the tutor system, and developed learning materials to compile a *How to guide*. Faculty members contributed to the glossary during the compilation phase, and participated in workshops as well as in the development of teaching and learning material. Students in two teacher education programmes, namely the Bachelor of Education (BEd) and the Postgraduate Certificate in Education (PGCE), took part in the programme. They participated in tutorial sessions, wrote pre-tests and post-tests and participated in a usability study. (Discussion of the results of pre-tests, post-tests and the usability study does not fall within the scope of this article). Figure 3 provides a schematic representation of integration of a mobile glossary in a teaching and learning environment.

Figure 3. Schematic representation of embedding a glossary in a teaching and learning environment



The process of integration of the glossary into the teaching and learning environment entailed presenting two online workshops to lecturers in the faculty. Lecturers were introduced to theoretical concepts of multilingualism and conceptual literacy, such as using direct instruction to model word-solving in content areas and to turn academic word learning into a relevant experience through peer collaboration activities with the use of the MobiLex glossary. The focus was on scaffolding of conceptual knowledge, for example, how to introduce concepts in class, to make students acquainted with concepts, how to use concepts, and understand and critically engage with concepts through using mobile technology. The example task below illustrates the point.

Teaching and learning with a mobile glossary

During the tutorial sessions the *How to guide* was used for instruction in class. The introductory tutorial was designed to inform students about glossaries; the tasks of this tutorial are presented in the following example.

Example: Tasks of introductory tutorial on MobiLex

By reading the information below and then answering the two questions, you will acquire the skills to:

- understand the origin of a glossary;
- understand the goal and function of a glossary;
- understand the difference between a glossary and a bilingual dictionary;
- understand the purpose and correct use of terms;
- understand the function of a dictionary workbook;
- understand the term *academic literacy*;
- understand the term *subject specific literacy*;
- understand the importance of strategies to read with comprehension.

The introductory tutorial initiated a basic understanding of the origin of glossaries, the goal and function of glossaries, as well as grasping concepts such as *academic literacy*, *subject specific literacy* and *reading strategies*. Understanding the above-mentioned concepts enables students to be aware of these concepts in their learning and teaching process. It could also form part of students' wider pedagogical knowledge as future teachers.

A second theme, namely "Understanding translations" was taught in tutorials. The purpose was to teach students to use the glossary during translations of texts encountered during their coursework. The tutorial starts with a probing question to initiate discussion, for example:

Why do you think it is important to be able to translate terms and definitions in an academic environment? Explain and provide an example.

As a second task, students are asked to use the MobiLex app to translate the following terms into English and use the translations in sentences to explain their meaning.

- a. *stromatoliet / istromatholayithi* (translation in English: *stromalite*)
- b. *obsidiaan / i-obsidiyeni* (translation in English: *obsidian*)

After students had used the glossary to translate certain terms, the task is intensified with the reading of the following adapted extract from their textbook, *Geletterdheid in die Grondslagfase* (Joubert, 2016, p. 4-5) and answering the questions. To answer the questions, they would have to make use of their translation skills, using MobiLex.

Menslike taal het die volgende eienskappe:

- *Dit is oneindig – ons kan 'n oneindige aantal uitinge produseer wat almal betekenisvol is.*

- *Dit word binne kultuur oorgedra – menslike babas leer taal aan van diegene wat met hulle praat.*

Translation in English:

Human language has the following characteristics:

- *It is infinite – we can produce an infinite number of utterances which all are meaningful.*
- *It is transmitted within culture – human babies learn language from those who converse with them.*

Students are then asked to use the MobiLex app to translate the following terms.

a. kultuur / inkcubeko (translation in English: culture)

b. kodifisering / ukwenza imithetho nemigaqo (translation in English: codification)

The last task in the tutorial is intended make the process relevant to the world of work, referring specifically to a teaching situation.

How would you translate the following terms for your learners? In your explanations you must also provide definitions of terms. Mention the age of your learners (Foundation Phase or Intermediate Phase) and take their age into account in your explanation.

a. bevolking / ibutho (translation in English: population)

b. oorerflikheid / eyemfuza (translation in English: hereditary)

Students actively worked in groups of three or four during tutorials. Group work was beneficial because students could work in monolingual or multilingual groups whilst referring to the MobiLex app in class. In this way they could provide more support to each other in their preferred language – especially when they encountered difficult concepts.

The second research question – What process is necessary to embed such a mobile glossary in a teaching and learning framework? – was answered by describing the process, the role of participants and the contents of learning materials.

Discussion

This article presented a framework for embedding a digital reference work in teaching and learning specialized terminology. The framework was proposed to mitigate challenges that students in South Africa face in learning specialized terminology in a higher education environment that is dominated by English as medium of instruction. This dominance poses challenges in a multilingual country where English is not the first language of the vast majority of speakers. Language support in learning specialized terminology is proposed through the use of a mobile glossary.

A mobile glossary can open new possibilities in language teaching. Mobile learning or learning with mobile devices (Kukulka-Hulme & Traxler, 2005), is an expanding field of

research and practice, increasingly shaped by rapid technological and socio-cultural changes that are at odds with the more leisurely pace of evolving pedagogy, especially the formal pedagogy within higher education. With digital teaching, the digital tools remain in the hands of the lecturer, for example soft-ware driven, but with digital learning, the digital tool, in this case a mobile glossary, the digital tool and resource are in the hands of students. This ensures a more student-centred and transformative approach in a learning environment. The potential of resources is being more fully exploited by students. Students have more control over their learning, as they have 24/7 access on their devices and subsequently to the mobile glossary. They can choose where and when they want to make use of the learning tool. Students can also construct their own learning with the device, making for a socio-constructivist learning experience.

The new possibilities for language teaching promote inclusivity and access to learning tools. The glossary is open-access and any student has access to the resource. Students are made aware of the digital resource by taking part in the glossary project in the faculty of education and if students make use of the glossary on a frequent basis, this can promote learning with a glossary and instilling a culture of frequent dictionary use.

The framework is a means to describe appropriate learning outcomes, suitable digital glossaries in teaching terminology. Such a framework formalizes the process of teaching with digital glossaries. The issue of teaching with glossaries is not a prominent topic in the literature on language teaching and this article attempts to address that gap in the literature. It seems that researchers agree on the notion of providing support in language instruction, but the importance of glossaries is not highlighted and teaching with glossaries is not formalized in any sense.

This article described a systemized process for the teaching of specialized terminology. Different role-players, their roles and the content of learning materials were identified in the process. The process took place in a faculty of education, but it could be applied successfully in different settings. In fact, the process has been duplicated in other faculties throughout the university, but reporting on this does not fall within the scope of the article.

Implementation of the process was purposefully done in a faculty of education, partly because the researcher is employed in the faculty and terminology for education subjects was taken up in the glossary. Implementation of a framework for teaching with reference works in teacher education is, however, significant because students in education become the teachers of the future. They could play a very important role in the establishment of a culture of dictionary use in South Africa. Bae (2011) indicates in a study on teaching a training course in dictionary use for Korean teachers of English that teachers were largely as uninformed as their students and consequently wanted clearer guidance about dictionary use. Hopefully students in education at the university concerned would be more knowledgeable on the topic after completion of the training.

Limitations

The limitations of the study concern feedback on the proposed model and process. Feedback from participants in the teaching programme is not provided in this article. Lecturers were not given the opportunity for critical reflection on the process. Feedback should have been elicited before the next cycle of the programme. Feedback from tutors in the programme was obtained, but it is not described in the article. Feedback on the suitability of the glossary was obtained from students, but not on the teaching programme itself. To critically engage with feedback from all the participants in the programme would be a worthwhile research project for the future. Future research could also entail analysis of students' performance in pre-tests and post-tests on the use of specialized terminology with assistance of mobile technology.

Conclusions

The article described a coordinated approach towards the teaching and learning of specialized terminology in a multilingual environment. A coordinated approach and a formalized programme are recommended to ensure active participation and meaningful engagement by stakeholders. The formal integration of mobile glossaries has a two-fold purpose: it could open new possibilities in language teaching and learning, and promote inclusivity in language use and support. Awareness of the problem-solving and supportive potential of mobile glossaries by lecturing staff and student-teachers alike could lead to more frequent and knowledgeable use of such glossaries. This could in turn contribute to the establishment of a stronger culture of dictionary use.

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No potential conflict of interest was reported by the authors.

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