

# The use of LSP dictionaries in secondary schools – a South African case study

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This article reports on the results of a broad evaluation of the efficacy of the *Multilingual Explanatory Science Dictionary* and *Multilingual Explanatory Math Dictionary* in a multilingual educational environment. The aim of the investigation is to ascertain (a) whether the target users possess the necessary dictionary using skills to make use of the dictionaries effectively, and (b) whether the benefit of exposure to definitions of terms in the home language is significant in the decoding of the meaning of science and mathematical terms. Data were collected by means of two questionnaires that were completed by members of the intended target user group. Participants in the study revealed themselves inexperienced and untrained dictionary users with rudimentary dictionary using skills. They were able to perform simple look-up procedures but performed badly in cases where a more sophisticated approach is called for.

## Introduction

In 2004, a professional development programme for teachers, the Teacher Mentorship Programme (TMP), was initiated within the Department of Civil Engineering at the University of Pretoria. This programme addresses issues pertaining to the teaching and learning of mathematics and science in grades 8 to 12 at several township schools, the main thrust of the programme focusing on the individual mentoring of mathematics and science teachers. The aim of the TMP is to increase the number of matriculants from historically disadvantaged schools qualifying for and applying to study in the engineering fields at a tertiary level. Several support programmes supplement the teacher-mentoring strategy for both teachers and learners.

While the schools' required language of instruction and assessment is English, all of the learners and teachers at these township schools have English as their second or third language. The TMP thus attempts to address certain issues regarding the teaching and learning of mathematics and science at the schools, but the lack of English language proficiency amongst both the teachers and learners may have a significant negative impact on potential progress within these learning areas. This may be seen in, for example, the:

- learners' poor achievements in mathematics and science assessments that reflect their lack of understanding of the text, not necessarily their mastery of those learning areas
- teachers' language of instruction frequently being the more-comfortable vernacular
- teachers' poor use of language in designing the assessment material, which leads to the learners not understanding what is required of them.

With the permission of the Department of Education and school principals, English language proficiency tests were administered to sample groups of learners from grades 8 to 11 in the TMP schools, while benchmark tests were performed with Afrikaans and English home language learners in similar government co-educational schools

not regarded as being historically disadvantaged. Based on the norms expected per grade, the test results revealed that all TMP learners in the test samples had English language proficiency levels at least three to five grades lower than their school level, with an average of about 22% in terms of the learners' English language proficiency. This figure showed no improvement trend from the lower grades to the higher grades at the TMP schools (in contrast to that seen at the benchmark schools), indicating that the TMP schools' own daily English lessons have little impact on their English proficiency.

Mathematics and science explanatory dictionaries were compiled covering the grade 8 to 12 syllabi, where the stem word is given in English and the English definitions are translated into the African languages. The purpose of these dictionaries is to help the learners understand their mathematics and science terminology.

### **Aims of the investigation**

This article reports on the results of a broad evaluation of the efficacy of the *Multilingual Explanatory Science Dictionary* (henceforth MESD) and *Multilingual Explanatory Math Dictionary* (MEMD) in a multilingual educational environment. The focus of the investigation is to ascertain whether the:

- target users possess the necessary dictionary using skills to effectively make use of the dictionary
- benefit of exposure to definitions of terms in the home language is significant in the decoding of the meaning of science and mathematical terms.

Both these objectives are underpinned by dictionary quality and user skills, and in the terms of Hulstijn and Atkins (1998:11) 'the interaction between the language user and the print dictionary'. Data were collected by means of two questionnaires that were completed by members of the intended target user group.

### **Dictionaries and dictionary using skills**

The study of dictionary use, the proficiency levels of dictionary users and users' look-up skills and performance is a multifaceted research field. In-depth studies on dictionary use include De Schryver and Prinsloo (2011), on the issue as to whether dictionaries define on the level of their target users; Tono (2001), which deals with dictionary use in foreign language learning, focussing on reading comprehension; and studies by Lew (2002, 2004 and 2010) on the use of bilingual and monolingual dictionaries by Polish learners of English.

Müller (2002) reports on the use of dictionaries as pedagogical resources, whereas Ronald (2002) reflects on lexical growth through dictionary use. Dziemianko (2004) investigates the user-friendliness of sources of verb syntax in learners' dictionaries. McCreary and Amacker (2006) report on aspects of the usability of modern learners' dictionaries, and Lew and Galas (2008) investigate the teaching of dictionary skills.

Frequently cited pioneering works include dedicated volumes of *Lexicographica Series Maior 96, Pedagogical lexicography today. A critical bibliography on learners' dictionaries with special emphasis on language learners and dictionary users* (Dolezal & McCreary, 1999), and *Lexicographica Series Maior 88, Using dictionaries. Studies of dictionary use by language learners and translators* (Atkins, 1998c), which contain a variety of contributions on pedagogical lexicography and dictionary use. Many issues typically investigated in studies of dictionary use, however, fall outside the scope of this study. As stated in the aims, our focus is limited to the interaction of dictionary quality and user skills, or as succinctly put by Hulstijn and Atkins (1998:10):

We do not concern ourselves with research into reading, writing or language learning *per se*, nor with market research, but with research *which aims at bringing the dictionary to the user* (how can the dictionary best serve its users' needs?) and *bringing the user to the dictionary* (how can people be made better dictionary users?) (Emphasis added).

Thus, the question is whether users get the best out of their dictionaries, and if not, whether the problem lies with the dictionary, the user, or with both:

There is a general belief amongst those concerned with dictionaries that dictionary users do not get the best out of their dictionaries, and, conversely, that dictionaries themselves could be improved so as to serve their users better (Atkins, 1998a:1).

Bogaards (as quoted by Hulstijn and Atkins, 1998:10) makes the following relevant points when looking at dictionary use from the perspective of language learners:

- Learners do not like using a dictionary
- Learners do not know how to use the dictionary
- Dictionaries are too difficult for learners
- Dictionary use hinders reading comprehension.

De Schryver and Prinsloo (2011) conclude from a study amongst different user groups of Dutch monolingual dictionaries that dictionaries are not only too difficult for their target age groups, but also that the intended age group prefers the dictionary definitions compiled for the immediately lower age group.

It can safely be assumed that the situation in Africa is much worse compared to for example Britain, where learners grow up in a dictionary culture and where excellent learners' dictionaries such as MED, COBUILD and OALD are widely used on a daily basis. This presumed situation is close to the *perfect dictionary* and *ideal user* scenario as portrayed in the centre of the schematic design by Gouws and Prinsloo (2005) in Figure 1.

**Figure 1:** Towards the perfect dictionary and the ideal user

DICTIONARIES				USERS		
▶▶▶▶	▶▶▶▶	▶▶▶▶	▼▼▼▼	◀◀◀◀	◀◀◀◀	◀◀◀◀
Bad/useless dictionary or no dictionaries available	Dictionary of relatively low lexicographic achievement	Dictionary of relatively high lexicographic achievement	▼▼▼▼ <b>Perfect dictionary &amp; Ideal user</b> ▲▲▲▲	Relatively good dictionary using skills	Relatively poor dictionary using skills	Pre dictionary culture environment
▶▶▶▶	▶▶▶▶	▶▶▶▶	▲▲▲▲	◀◀◀◀	◀◀◀◀	◀◀◀◀

Gouws and Prinsloo (2005:42)

Atkins and Varantola (1998:83) describe the requirements for effective dictionary use in no uncertain terms:

There are two direct routes to more effective dictionary use: the first is to radically improve the dictionary: the second is to radically improve the users.

This goes to the core of the South African problem: lack of dictionary culture implies zero to little interaction between dictionary quality and user skills.

Enhancing the quality of dictionaries *en route* to the 'perfect dictionary' should be the mission of the lexicographer. However, even the 'perfect dictionary' in the hands of an unskilled dictionary user has

little gain. The ideal is to improve the dictionary skills of the target user with the mission to become an 'ideal user' (Gouws & Prinsloo, 2005:41).

Atkins (1998b:3), after having studied the South African situation, remarks as follows:

In their formative years the speakers of African languages did not have access to dictionaries of the richness and complexity of those currently available for European languages. They did not have the chance to internalize the structure and objectives of a good dictionary, monolingual, bilingual or trilingual.

The results of this study suggest that not much has changed during the past decade in South Africa with respect to the cultivation of a dictionary culture.

### ***Multilingual Explanatory Science Dictionary and Multilingual Explanatory Mathematics Dictionary: functions, structure and target user***

In an attempt to address the underperformance in mathematics and science of learners in so-called township schools and to assist them (and their teachers) to better understand the English text in their mathematics and science curricular material, mathematics and science explanatory dictionaries for the grade 8 to 12 curriculums were compiled. MESD and MEMD were made available to the township schools participating in the TMP project. In these dictionaries the terms, i.e. the lemmas, are given in English while the definition of each term is given in English and translated into the learners' home languages, viz. Northern Sotho (Sepedi), Tswana, Venda and Zulu. No translation equivalents are provided for the lemmas themselves with the exception of the Zulu section where some translation equivalents are indeed provided. Compare an excerpt from MESD and from MEMD in Figure 2:

Figure 2a: MESD articles for the lemmas *conductor* and *conjugate acid-base pair*

	ENGLISH	TSHVENDA	SETSWANA
conductor	a substance that will let electric current flow along it. A good conductor of heat will let heat spread through it	tshithu tshine tsha tendela lutsinga lwa mudagasi lu tshi fhira nga khatsho. tshirathisi tshavhuadi tshi tendela mufhiso u tshi fhira nga khatsho	Sere se se letlang kelo ya motlakase mo go sone. Sefetisi se se siameng sa mogote se letla mogote o phatlalale mo go sone.
conjugate acid-base pair	in an acid-base reaction, the acid reactant forms a base product. These two are called an acid-base pair. Similarly the base reactant and acid product constitute an acid-base pair.	kha thanganyiso ya esidi beisi, thanganyiso ya esidi i vhumba tshibweledzwa tsha beisi. Zwiithu izwi zwiwihili zwiwihidzwa phere ya esidi beisi. Zwaralo thanganyiso ya beisi na tshibweledzwa tsha esidi zwi vhumba phere ya esidi beisi.	Mo tshwaetsanong ya esiti le beisi, setshwaetsi sa esiti se tihola beisi. Bobedi jo bo bidiwa para ya esiti-beisi. Fela jalo kumo ya setshwaetsi sa beisi le esiti e dira para ya esiti-beisi.
conductor	ENGLISH a substance that will let electric current flow along it. A good conductor of heat will let heat spread through it	ISIZULU okokuhambisa; okokwedlulisa; okokuthumela into ezovumela ukuthi ugesi uhambe kuyo. Okokuhambisa ukushisa okuhle kuzovumela ukushisa ukuthi kusabalale kukho	SESO THO SA LEBOA Selo seo se ka dumelelago moela wa mahlagase go sepala ka go sone. Khontakthara e kaone ya phiso e tla dumelela phiso go phatlalala le yona
conjugate acid-base pair	in an acid-base reaction, the acid reactant forms a base product. These two are called an acid-base pair. Similarly the base reactant and acid product constitute an acid-base pair.	iconjugate acid-base pair (okokodwa kwepheya le-esidi-nebase) lapho kuhangana khona i-esidi nesisekelo, lokho okubandakanyeka lapho okuyi-esidi kwakha umkhqizo oyisisekelo (base). Lokhu okubili kubizwa ngokuthi kuyipheya le-esidi-nesisekelo. Ngokunjalo lokho okubandakanyeka lapho okuyisisekelo (base) nomkhqizo oyi-esidi kwakha ipheya le-esidi-nesisekelo.	Ka go phefoga ya peisi ya esiti, sefetoši sa esiti se hlama setšweletšwa sa peisi. Bobedi bjo bo bifišwa para ya peisi ya esiti. Go swana le mao, sefetoši sa peisi le setšweletšwa sa esiti di dira para ya peisi ya esiti.

Figure 2b: MEMD articles for the lemmas *abscisso – adjacent angles*

English	Sesotho Sa Leboa	Isizulu
<b>A</b>		
abscissa	The <i>x</i> - coordinate, measured parallel to the <i>x</i> - axis in a Cartesian coordinate system.	Selekanyo sa <i>x</i> , seo se elwago go bapala le ekasiti ya <i>x</i> ka go tshetsetsa ya selekanyo ya Cartesian
absolute value	a positive number that has the same magnitude as a given number; thus the absolute value of 6 is 6 and the absolute value of -6 is 6. The absolute value of a number <i>x</i> is written using the notation $ x $	Nomoro ya phosethifi ye e nago le bogolo bja gatlama go sana le palo ye e filwego; ka gore baleng bja mme bja 6 ke 6 e bile baleng bja mme bja -6 ke 6. Baleng bja mme bja <i>x</i> bo ngwalwa ka go somisa netheisane $ x $
accurately	very carefully	Ka tihakomelo kudu
achieve	carry out successfully	Go dina ka karlego
acronym	a word made up of the first letters of other words (e.g. AIDS: Acquired Immune Deficiency Syndrome)	Lentsu leo le dirilwego ka meleno a mathomo a mantšu a mangwe (mohlala, AIDS: Acquired Immune Deficiency Syndrome)
acute angle	an angle measuring between 0° and 90°	Khutlo ye e elago magareng ga 0° and 90°
acute-angled triangle	has three acute angles	E e na le dikhutlentha tše thano
addition	a mathematical operation performed on two numbers to give the sum	Opharisisano ya dipalo ye e diragatswago dipaleng tše pedi go fa palomoka
additive inverse	when a number is added to its additive inverse the answer is zero eg. $(-8) + (+8) = 0$ , so +8 is the additive inverse of -8 and vice versa	Go namoro e hlakanywa go etlhibinbese karabo ke lefela, mohlala, $(-8) + (+8) = 0$ , so +8 ke etlhibinbese ya -8 goba ka mkgwa o mongwe
adjacent	next to; alongside	Kgauzwi le; go bape le
adjacent angles	angles which are next to each other; angles which have the same vertex and a common arm	Dikhutlo tše di lego kgauswi le kgauswi; dikhutlo tše di nago le bethekse ya go swana le letsogwana la go swana

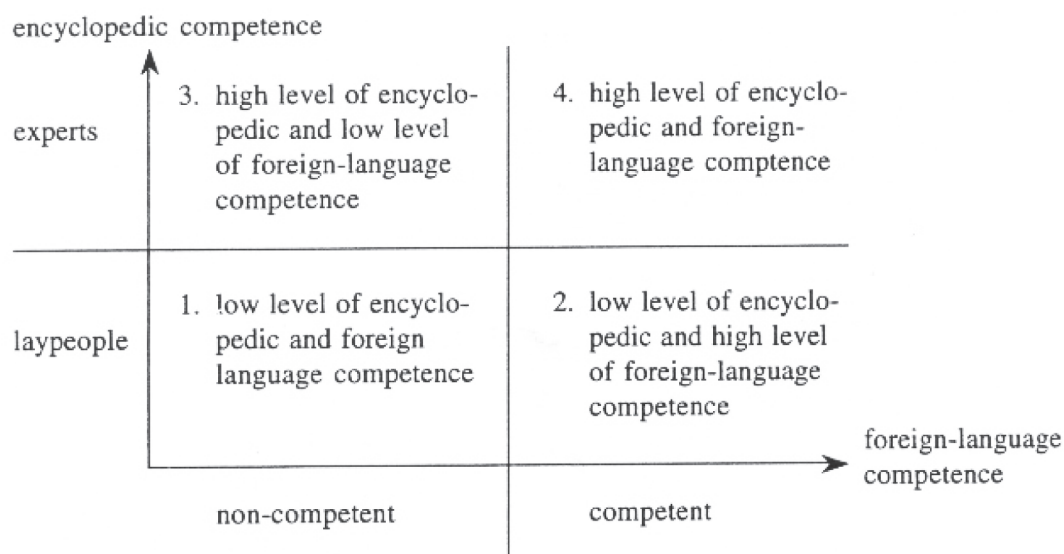
This study focuses mainly on data collected from those learners who have Northern Sotho as their home language. For the Northern Sotho case study, learners were provided with dictionaries containing only the English and Northern Sotho sections of the dictionary.

In a comment by the compilers, which appears in the front matter of the dictionaries, they indicate that the dictionaries intend to help learners understand their mathematics and science terminology. While they may have the simultaneous benefit of improving the learners' English language proficiency, it is clearly stated that the purpose of the dictionaries is not to promote the use of the home languages of the learners as media of instruction, but rather to assist the learners with internalizing basic science and mathematics concepts by providing them with access to the definitions of terms in their respective home languages. It is therefore clear that the communicative function of the dictionary is that of foreign-language text reception and, to a lesser extent, foreign-language text production, since tests and examinations are carried out through the medium of the foreign language, i.e. English.

The dictionaries are very rudimentary and compiled by subject field experts in mathematics and science with little or no lexicographic background. According to Gouws and Prinsloo (2005), these dictionaries can be placed in column two of Figure 1; they are thus dictionaries of relatively low lexicographic achievement. No serious attention was paid to basic lexicographic principles, but this does not detract from the value of these dictionaries as tools to aid teachers and learners who find themselves in a teaching and learning situation where very few resources are available. Although the dictionaries contain a section entitled *How to use the dictionary*, the explanation refers to the use of the dictionaries in the pedagogical situation, and does not represent a user's guide in the lexicographic sense of the word. No guidelines as to the actual use of the dictionary, e.g. ordering principles and the look-up procedure for multiword terms, are given. Furthermore, the dictionaries contain no middle or back matter. The ordering is strictly alphabetical, with multiword terms appearing in the alphabetical category with which the first part of the term starts. Thus, the lemma 'isosceles triangle' has been lemmatized under the letter I, which is possibly the appropriate strategy for these target users, since their conceptualization of the knowledge structure of the subject field is inadequate.

According to Bergenholtz and Tarp (1995:20–23), the profile of the intended target user of any bilingual (LSP) dictionary pivots around two issues, i.e. foreign-language competence and encyclopedic knowledge.

**Figure 3:** Four main user types



Bergenholtz and Tarp (1995:21)

With regard to the latter, it can be assumed that the target users' encyclopedic knowledge of mathematics and science is below par, since it is exactly the aim of the TMP project, of which the two dictionaries form part, to improve the learners' performance in these two learning areas. The deficiencies in the target users' English proficiency have already been pointed out, so in terms of Bergenholtz and Tarp's four main user types, the target users of these dictionaries can be defined as laypeople with little encyclopedic knowledge and a low level of foreign language competence.

Apart from low foreign language competence and below par encyclopedic knowledge, the target users of these dictionaries can, according to Gouws and Prinsloo (2005), be described as having poor dictionary using skills and possibly even as target users coming from a pre-dictionary cultural environment. This is even more relevant with regard to the use of LSP dictionaries, since there is an almost total absence of LSP dictionaries for the South African Bantu languages.

### Data collection

The data for this case study were collected by administering two questionnaires to 149 learners belonging to the target group. The first questionnaire, administered in May 2006, had a dual purpose i.e. to:

- establish the level of basic dictionary skills of the target user
- investigate whether learners benefited from having access to an LSP dictionary where terminological definitions were available not only in the language of learning and teaching, but also in the home language.

Since two of the authors of this paper are conversant with Northern Sotho, it was decided to focus our investigation on learners who had indicated that this language was their home language. For this questionnaire, a purposive sampling technique was used. Participants were drawn from six TMP schools. Included in the sample were all Northern Sotho speaking learners from grades 8 to 11 who take mathematics and science as a school subject. The second questionnaire was directed at grade 10 and 11 mathematics and science learners who had indicated that their home language was one of the four languages catered for in the two dictionaries, i.e. Northern Sotho, Tswana, Venda and Zulu. These 75 learners were drawn from one school only and had been using the dictionaries in the classroom for approximately nine months. The purpose of the second questionnaire was mainly to evaluate the affective aspects of using these dictionaries, but also to evaluate their dictionary-using skills. The questions therefore focus on the users' experiences and needs with regard to LSP dictionary use. However, as there is some overlap in the questions set in the two questionnaires, the analyses include the results from the relevant sections of the second questionnaire. The analysis of results will however concentrate on the first questionnaire, specifically on the impact of the availability of definitions and the language in which these are provided.

### Structure and content of the questionnaires

The first questionnaire (see Appendix) consisted of three sections that were administered separately and consecutively. The respondents were required to hand in their completed Section A of the questionnaire before Section B was distributed. The same procedure was followed with regard to Section C. The different sections of the questionnaire were linked by means of a unique number that was allocated to each respondent and attached to each section of the questionnaire so that the progression for each individual respondent could be traced.

Section A was answered without the aid of the dictionary itself and no definitions of terms were provided. The first three questions in Section A (A.1: 1.1–1.3) are aimed at obtaining biographical data, e.g. the grade in which the respondent is and his/her home language. The next three questions (A.1: 1.4–1.6) ask about dictionary use; whether learners ever use a dictionary, and if they do, what kind of dictionary/dictionaries they use; if they do not use dictionaries, they are asked to provide reasons why dictionaries are not used. These are followed by a question (A.1: 1.7) aimed at establishing whether the users can identify the lemma and the definition in the given dictionary article for *chemist*.



The next three questions in this section (A.1: 1.8–1.10) are aimed mostly at establishing how respondents conceptualize the use of a dictionary, in other words, what they expect to find in a dictionary and where and how they expect to find it. Questions are asked pertaining to the alphabetical ordering system within and across the alphabetical categories on both single and multiword levels.

Then follows a set of six multiple-choice questions (A.2: 2.1–2.6) which have a bearing on the natural sciences and mathematics curriculum. The questions are centered around six randomly selected physics terms, i.e. *insulator*, *dehydration*, *compass*, *acid rain*, *crystal* and *entropy*. The distracters of five of these terms consist of three statements pertaining to these terms, and respondents have to indicate whether the statements are true or not. In the case of *compass*, respondents have to identify the purpose of a compass by selecting one of five possibilities. The purpose of these questions is not to determine the respondents' level of knowledge of science and mathematics, but rather to establish a benchmark against which the follow up sections of the questionnaire can be measured.

In section B of the questionnaire, the first question (Question B.1: 1.1) is devoted to cross-referencing, where the respondents have to indicate whether they follow up on cross-references. The second set of questions in this section (B.2: 2.1–2.6) contains the same six multiple choice questions pertaining to science and mathematics posed in Section A, but here one group of the respondents is provided with the English definitions of the terms to which the questions refer, whilst a second group is provided with Northern Sotho definitions. The questions and distracters are still posed in English. The distracters are the same as for Section A, although the order in which they are presented has been changed.

Only when answering Section C of the questionnaire do learners have access to the dictionaries, and thus to definitions in both English and Northern Sotho provided that they can find the lemma in the dictionary. The first set of questions in this section (C.1: 1.1–1.7) is again aimed at establishing the level of dictionary using skills, and is thus similar to what is asked in Section A, but this set of questions ask for the actual application of these skills. One of the questions in this section is a control question, following up on the question posed in Section B where the respondents have to indicate whether they follow up on cross-references. The multiple-choice questions on science and mathematics are presented for a third time (C.2: 2.1–2.6), but this time learners have the definitions of terms in both English and their home language at their disposal. The inclusion of the definitions in English and Northern Sotho is aimed specifically at measuring the impact of having the definitions in the home language for the decoding process. Respondents are also provided with the opportunity to express their needs and preferences in this section (C.1 1.5–1.7).

## **Analysis of the data<sup>1</sup>**

### **Using a dictionary**

The response to the first direct question that refers to dictionary use indicated that respondents are not totally unfamiliar with dictionaries: 27% often use a dictionary, 66% indicated that they sometimes consult a dictionary, 5% almost never consult a dictionary, and only 2% responded that they never use a dictionary. As illustrated in Figure 4, these results pertain to both questionnaires.

Those respondents who had indicated that they do use a dictionary were then directed to the next question in which they had to indicate what kind of dictionary they usually consult. The majority of respondents (79%) use an English monolingual dictionary such as the Oxford English Dictionary, whereas 12% use a bilingual English–Sepedi one, and 9% a bilingual English–Afrikaans dictionary, as indicated in Figure 5.

Figure 4: Dictionary consultation

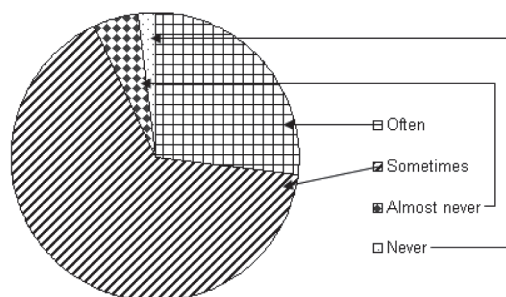
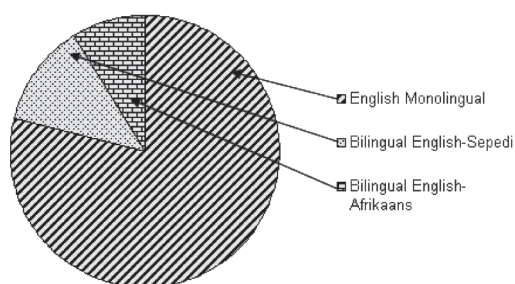


Figure 5: Preference of dictionaries



The preference for a monolingual English dictionary within this context is to be expected, since the language of learning and teaching is English. Of those who indicated that they almost never use a dictionary, 45% cited an absence of dictionaries in the school as the main reason.

### Conceptualization of dictionary using processes

An analysis of the responses to questions aimed at establishing how the respondents conceptualize the dictionary using process (Section A, questions 1.8, 1.9, 1.10) reveals that their grasp of basic principles such as alphabetical ordering is deficient, and would therefore probably impact negatively on the success rate of the look-up procedure. Table 1 shows the results for these questions.

Table 1: Conceptualization of dictionary using process

	Question 1.8			Question 1.9			Question 1.10		
	√	X	Undecided	√	X	Undecided	√	X	Undecided
	61	145	11	124	84	7	136	69	9
%	28	67	5	39	58	3	64	32	4

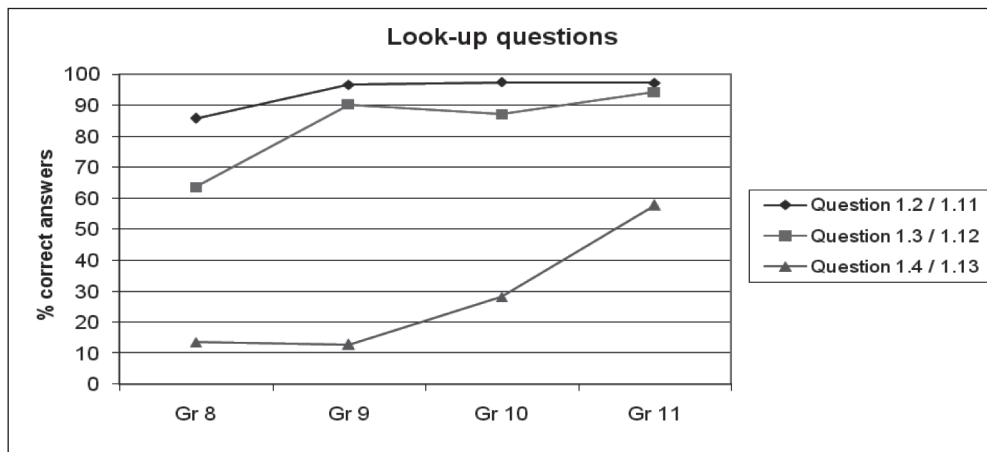
The majority of respondents (67%) indicated that they would expect to find *hydrometer* before *crystal*, and 58% are of the opinion that *moist* would come before *model*. The percentages of the correct answers for these two questions are 28% and 39% respectively. On the ordering of the multiword terms, most respondents provided the correct answer: 64% indicated that *chemical reaction* would be preceded by *chemical equation*. It needs to be taken into account that the respondents had to answer these questions without having access to a dictionary. Since the medium of instruction to which learners are exposed is English, it was assumed that they would have the necessary skills to decode simple instructions (questions) in English.

### Look-up skills

In Section C of the questionnaire, the respondents' actual look-up skills were tested. When asked which of the two words *neutron* and *impulse* they found first when paging through the dictionary from front to back, 82% indicated that they did indeed find *impulse* before *neutron*. Only four percent could find neither of the two words. The next three questions were also put to the Grade 10 and 11 learners who completed the second questionnaire. A total of 94% of the respondents, covering grades 8 to 11, could successfully look up the lemma *immiscible* and provide the correct definition thereof (Questions 1.2 and 1.11 in the two questionnaires respectively), and 84% correctly indicated that the lemma *molar volume* is to be found on page 64 of the dictionary (Questions 1.3 and 1.12), which indicates that they are able to find multiword terms. The respondents therefore do seem to have the basic look-up skills for both single and multiword entries. However, the results for the question dealing with following up on a cross-reference (Questions 1.4 and 1.13) are poor – on average, only 28% of the respondents managed to find the

correct definition for *constructive interference*, even though 60% indicated in Section B, Question 1.1 that they always follow up on cross-references. In the dictionary, no full treatment is given to the term *constructive interference*; only a cross-reference to *interference* is provided. A breakdown of the results as obtained per grade is given in Figure 6:

**Figure 6:** Following up on cross-references



An analysis of the answers provided to Questions 1.4/1.13 clearly reveals that the respondents were unable to interpret the cross-reference marker that was provided at the cross-reference position correctly. In this particular instance, the cross-reference entry consists of two text segments, i.e. the cross-reference marker 'see' and the cross-reference address 'interference'. Respondents incorrectly interpreted the cross-reference entry as a definition, and therefore explained the meaning of the term *constructive interference* as 'seeing an interference' or 'to see an interference'. Two possible reasons could be considered for the low success rate of the look-up procedure:

- It is the kind of mistake one would expect from an inexperienced and possibly untrained dictionary user.
- That the cross-reference entry is given in English could be the root cause for the respondents being unable to correctly decode the instruction contained in the cross-reference entry.

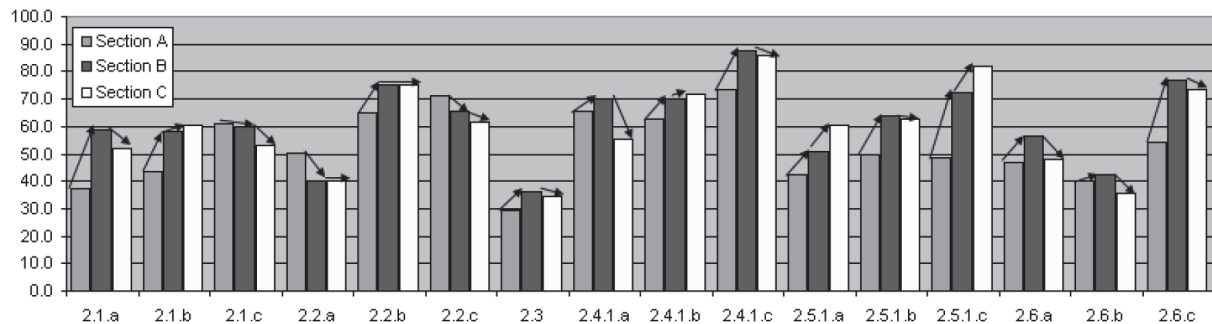
The fact that the success rate of the look-up procedure increases from 14% in Grade 8 to 58% in Grade 11 seems to favour the second possibility. While the successful look-up rate increases as the learners' proficiency in English progresses, the rate of improvement does not fully compensate for the lack of experience in the use of a dictionary and the lack of a culture of dictionary use.

The inability to follow up on cross-references is something that can and should be addressed in a users' guide, which typically appears in the front matter of a dictionary. The users of these particular dictionaries seem to realize their shortcomings with regard to effective look-up strategies. To the question 'If the dictionary had a guide to help you find the information that you are looking for, will you read it?', 63% answered that they would read the guide since they are of the opinion that it would help them; 35% indicated that they will not read it because they know how to use a dictionary, whilst the remaining 2% were not sure. There is thus a good correlation between the users' actual needs as revealed by their performance in actual look-up activities and their own perceived needs. A possible consideration here would be the quality of the Northern Sotho translations. Although we acknowledge that this could impact on the efficacy of the dictionary, an in-depth evaluation of the quality of the translations falls outside the scope of this article.

### Assessment of the value of access to definitions

The data analysis for this section starts on a general level, and the first results are represented in Figure 7. This diagram represents the effect that access to the definitions of terms had on the number of correct responses to the multiple-choice questions. It traces the progression for each question from the benchmark level in Section A through to the final level in Section C where respondents had access to definitions in English, which is the language of teaching and learning, and the home language, i.e. Northern Sotho.

**Figure 7:** The effect of access to definitions

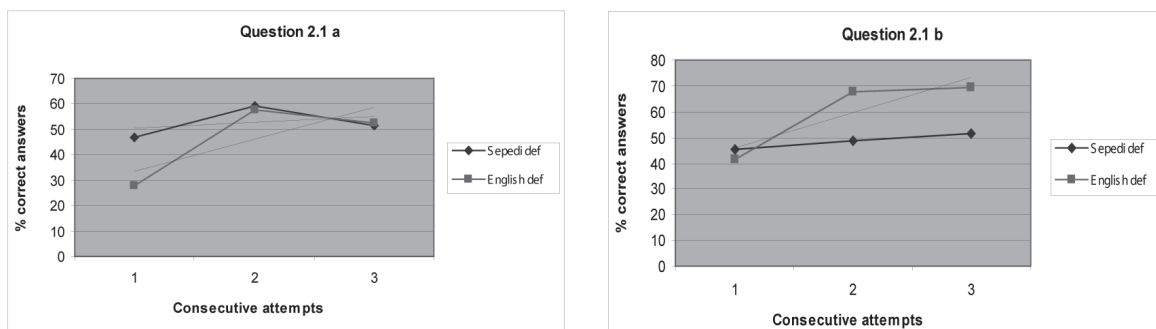


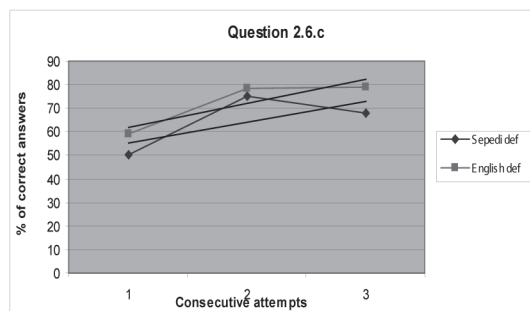
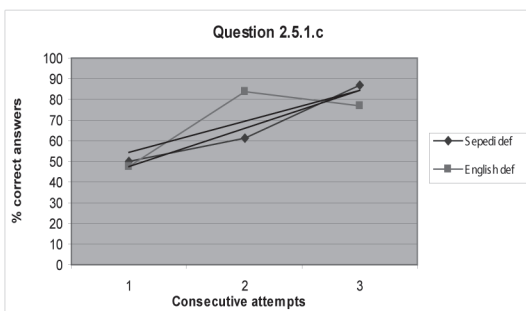
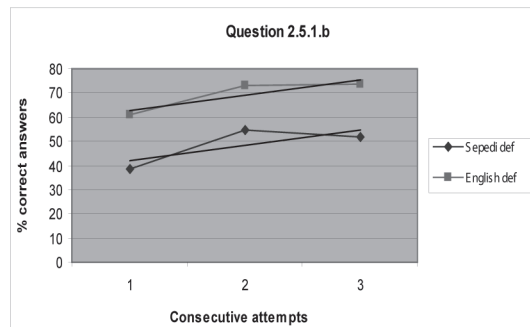
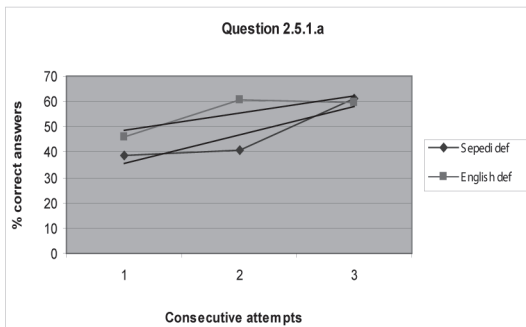
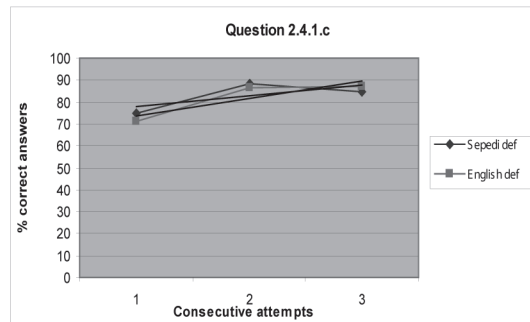
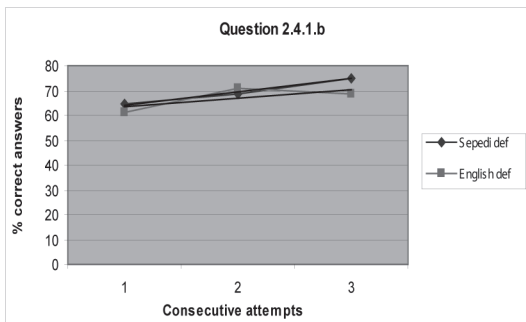
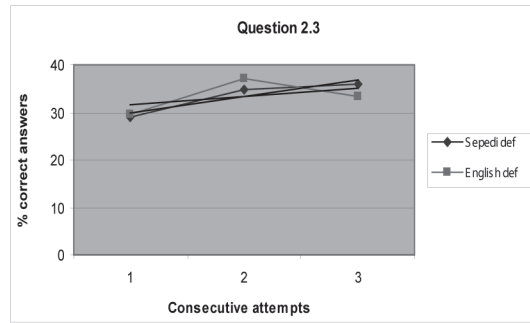
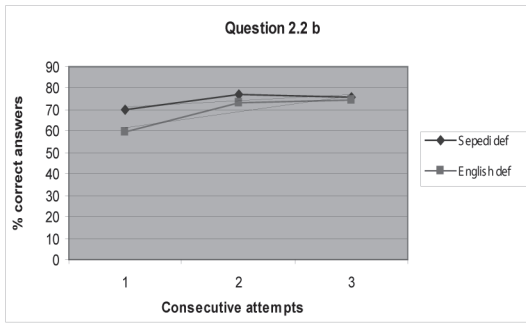
The results for the sections of the questionnaire measuring the impact of the availability of definitions can be classified into two categories.

- Category one: questions where the access to definitions leads to an increase in the number of correct answers across the three phases in which the questionnaire was administered
- Category two: cases in which the availability of definitions causes a decrease in the number of correct answers.

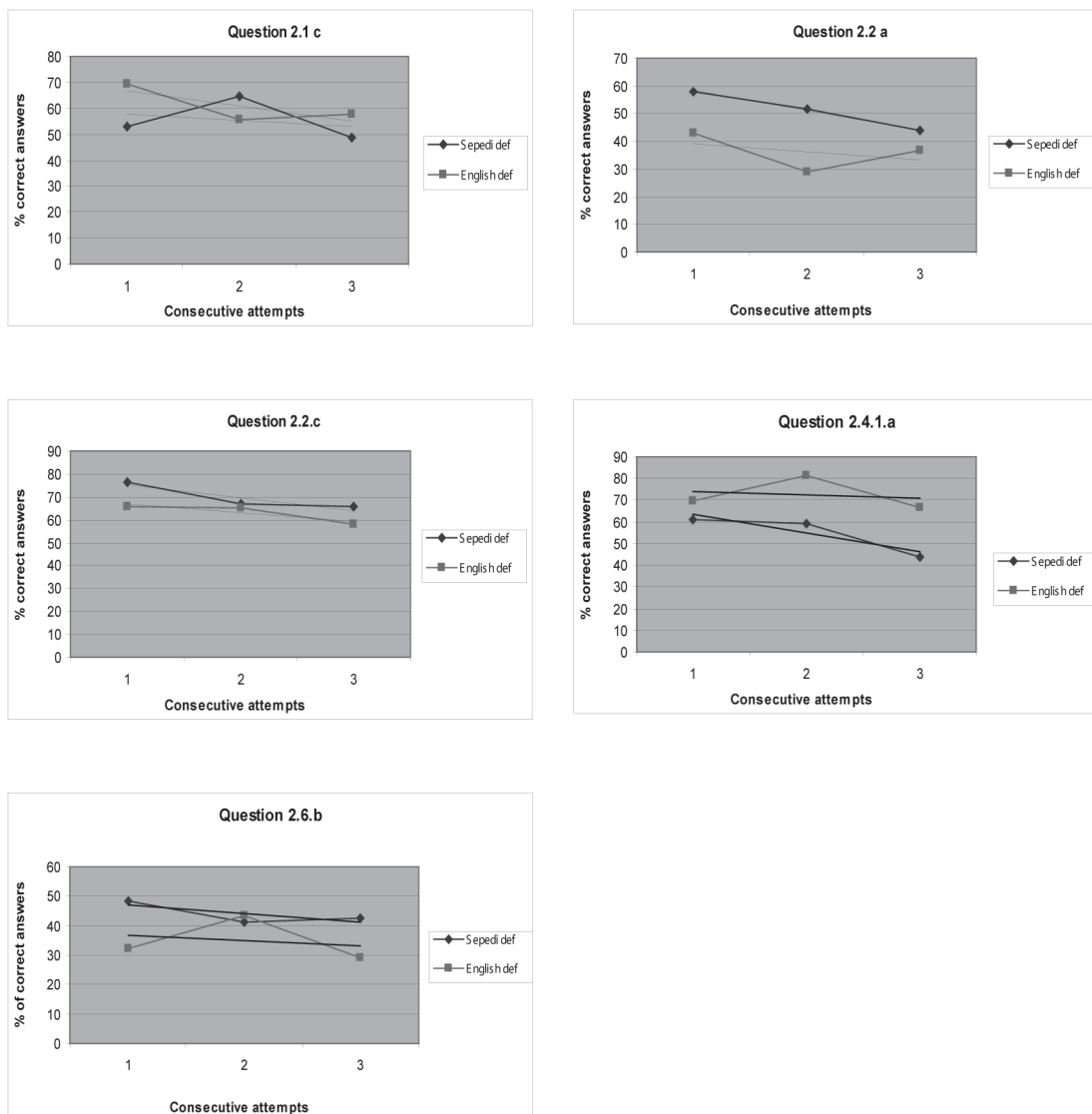
The diagrams in Figure 8 represent the questions belonging to category one. The trend lines in these diagrams indicate a clear line of progression as respondents obtain access to the definitions of the selected terms. The results obtained for these questions are therefore what one can expect logically, i.e. that access to definitions of terms would assist the dictionary user to decode the meaning of the term:

**Figure 8:** Cases reflecting an upward trend in correct responses





The second category of results represents those cases where there is a downtrend in the number of correct responses. Compare Figure 9 in this regard:

**Figure 9:** Cases reflecting a downtrend in correct responses

Although the general trend in all of the cases in Figure 9 above is downward, closer inspection reveals that there are cases where there is a significant difference between the impacts of the definitions, depending on the language in which the definition was first provided.

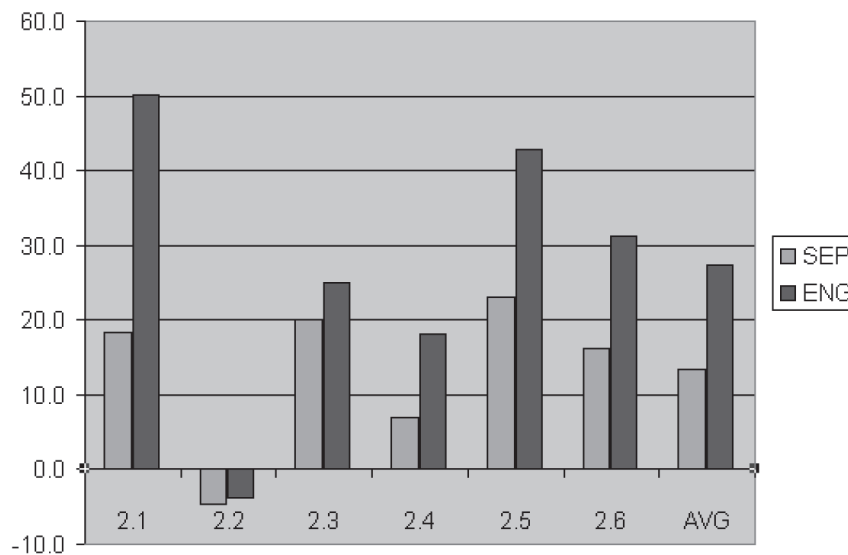
It must be borne in mind that one group of respondents first had access to a Northern Sotho definition, whereas the other group was first presented with an English definition. The results for Questions 2.1.c and 2.6.b are a case in point. In Question 2.1.c, access to the Northern Sotho definition in Section B led to an increase of correct responses from 53.1% to 64.7%, whereas the correct responses for those learners who were first presented with the English definition decreased from an initial 69.4% to 55.6%. The responses to Question 2.6.b present the opposite situation. Those respondents who had been provided with English definitions in Section B increased their correct responses from 32.4% to 43.2%, whereas those of learners who had access to the Northern Sotho definitions decreased from 48.4% to 41.2%.

It was therefore deemed necessary to analyse the results of the two groups of respondents separately to determine whether the language in which the definitions were initially presented had any significant influence in the decoding

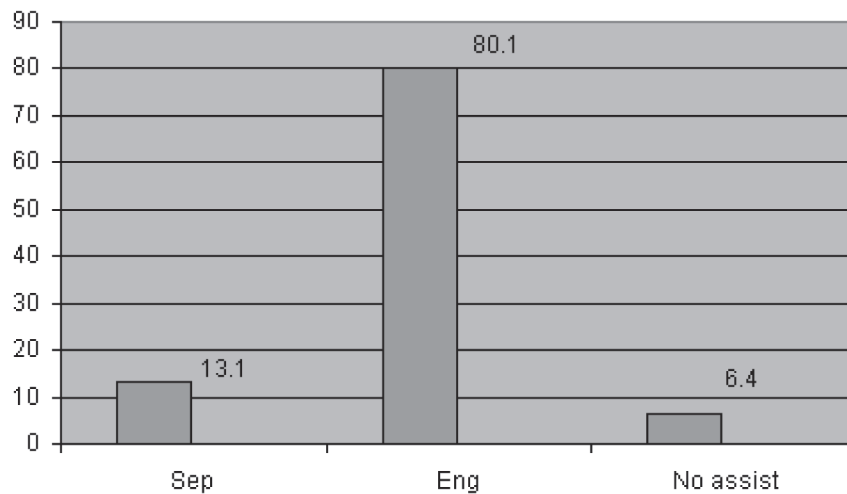
of the relevant term. The focus will be on the progression from Section A, which represents the benchmark level, to Section B, in which respondents had the first opportunity to consult the definition of the relevant term in either English or Northern Sotho. The analysis for the progression from Section B to Section C was also done, but the percentage of increase was found to be negligible. For those respondents who initially had access to the Northern Sotho definitions in Section B and added access to the English definitions in Section C, the increase in correct responses is only 0.1%, whereas those who started off with the English definitions actually managed a decrease of 4.9%, indicating that the Northern Sotho definitions somehow served to mislead the respondents.

The analyses were done on both categories of results, i.e. where access to definitions had a positive effect and those where it had a negative effect. Compare Figure 10:

**Figure 10:** Positive and negative effects of access to definitions



On average, initial availability of the English definitions had a more positive effect than the Northern Sotho definitions: the average percentage increase in correct responses from the initial benchmark to the second phase is 27.3% for the English definitions, whereas access to the Northern Sotho definitions lead to an increase of 13.3%, thus a difference of 14%. The higher percentage increase of the availability of the English definitions is probably because English is the language of learning and teaching. It is therefore probable that learners are not familiar with the Northern Sotho terminology that is used in the definitions. These results pose an interesting contrast to those of Section C, Question 4, in which respondents' perceptions about the usefulness of the English and Northern Sotho definitions are elicited. Here, learners had to indicate which of the English or Northern Sotho definitions they found most helpful, or whether the dictionary provided no assistance at all. In this question, 80.1% of learners indicated that they found the English definitions most helpful, as opposed to 13.1% who found the Northern Sotho definitions valuable, and 6.4% who got no assistance from the dictionary. Compare Figure 11 in this regard:

**Figure 11:** Users' perceptions of the value of definitions

These figures in turn correlate well with the responses to those of Question 1.6 (Questionnaire 1) and 1.14 (Questionnaire 2), in which 75% of learners answered that they read only the English definitions; 21% read the English definition first, then the Northern Sotho definition, and 4% read the Northern Sotho definition first, followed by the English definition. Their perceptions as to the usefulness of the English definitions therefore determine their actual look-up behaviour. Taken together, these results seem to highlight a discrepancy between users' perceptions as to the usefulness of the definitions in English and the home language respectively, and the actual usefulness of the definitions as reflected in the results for the multiple choice questions which are repeated in the different sections of the questionnaire. The learners' perceptions are that they benefit far more from the English definitions, whereas the actual results of Questions 2.1 to 2.6 indicate that there is only a 14% impact difference between the English and Northern Sotho definitions.

The diagram in Figure 10 above reveals that there is only one question in which the access to definitions impacted negatively on the number of correct responses, i.e. Question 2.2, specifically Sections a. and c. With regard to the group of respondents who had access to the Northern Sotho definitions first, the percentage of correct responses to Question 2.2.a dropped from an initial 58.1% at the benchmark level to 51.5% in Section B when respondents were provided with the Northern Sotho definitions.

Access to the English definitions in Section C could not offset this negative trend, and the percentage dropped to a further 43.8%. The same trend presents itself in the group who first had access to the English definitions in Section B, but here the decrease from Section A to Section B was even more marked: from 42.9% to 28.9%. Access to the Northern Sotho definition in Section 3 resulted in a slight improvement to 36.8%. Question 2.2.b posed no problems, but the downward trend observed in 2.2.a resurfaces in 2.2.c.

Exposure to the Northern Sotho definition in Section B led to a decrease in correct responses from an initial 76.7% to 66.7%, and a further slight drop to 65.6% in Section C. The results for those respondents who were first exposed to the English definition declined slightly from 65.7% in Section A to 64.9% in Section B and to 57.9% in Section C. The search for an explanation for this negative trend would logically presume that the definitions that were provided are in some way defective or misleading, but an analysis of both the Northern Sotho and English definitions brings nothing to the fore. It could also be that the distracter itself might be unclear or ambiguous. In Question 2.2.a., the multiword term 'hydrogen gas' is used in the distracter, and it is possible that the learners could not correctly interpret this as a multiword term, which could have led to an incorrect interpretation of the question or even failure to interpret it at all.



## Conclusion

Whenever a dictionary is compiled, it is compiled (or should be compiled) with a specific and well-defined target user in mind, but the question that often remains is to what extent the envisaged target user coincides with the actual target user.

The analyses of the case study as presented above, enable the researcher/lexicographer to draw a clear profile of the actual target user – his/her capabilities and actual needs. The picture that has thus far emerged is one of a user who is inexperienced and untrained, indeed the product of a learning environment where a dictionary culture is absent to a large extent. The dictionary using skills of the respondents are rudimentary; they were able to perform simple look-up procedures, but performed badly in cases where a more sophisticated approach is called for. This highlights the need for the dedicated training of learners and teachers in the use of dictionaries. Although reference is made to dictionary use in the school curricula, this mostly seems to be regarded as a peripheral activity. An understanding of the value of dictionaries as supportive material to any academic activity needs to be instilled into teachers.

As to the second research question, i.e. whether access to definitions of terms assists learners in conceptualizing core terms in science and mathematics, the answer is an unqualified yes. The reason for the higher impact of the English definitions is that it is the language in which science and mathematics are taught; learners would therefore be more familiar with English terminology than with Northern Sotho terminology. The positive impact of having the definitions of technical terms available once more underlines the pressing need for LSP dictionaries in South Africa, where the specific needs of learners who have a Bantu language as home language but who receive their tuition in English, are met. We hope that this study could be used in future work to, in the words of Atkins (1998a:5), ‘provide a launch pad for other investigative experiments from which dictionary makers and dictionary user alike may benefit’.

## Note

1. We wish to thank Phillip Pare for his contribution with regard to the setting of the questionnaires, and Andrea Leipoldt and Daniel Prinsloo for assistance in the processing of the data.

## Appendix

### RELEVANT SECTIONS FROM QUESTIONNAIRE 1: MAY 2006

NOTE: WHERE QUESTIONS IN QUESTIONNAIRE 1 OVERLAP WITH QUESTIONS IN QUESTIONNAIRE 2, THE NUMBER OF THE CORRESPONDING QUESTION IN QUESTIONNAIRE 2 IS GIVEN IN SQUARE BRACKETS

### SECTION A:

#### A.1

- 1.1 Please mark the appropriate block with an “X”:

I am a teacher

*Ke nna morutabana*

I am a learner in Grade 11

*Ke nna moithuti wa go tsena Mphato wa 11*

- 1.2 Do you speak Northern Sotho (Sepedi / Sesotho sa leboa) at home?

*Na o bolela Sepedi / Sesotho sa leboa kua gae?*

Yes  No

- 1.3 Which language do you most often speak to your friends? \_\_\_\_\_  
*Na o bolela sekae ge o boledišana le bagwera?*

Please answer the following questions by ticking the correct box:

*A o arabe dipotšišo tše di latelago ka go swaya lepokisi le le nepagetšego*

- 1.4 [1.4] **Do you ever use a dictionary?** Yes, often  Please go to  
 Sometimes  **1.5**, do not answer 1.6
- Almost never  Please go to  
 Never  **1.6**, do not answer 1.5

**Answer either question 1.5 or question 1.6**

1.5[1.5] **If you sometimes use a dictionary, which one do you use?**

- a. An English dictionary with English words and English explanations such as the Oxford English dictionary
- b. A dictionary that gives words in English and Sepedi
- c. A dictionary that gives words in English and Afrikaans

**OR**

1.6[1.6] **If you almost never use a dictionary, please tell us why not.**

- a. I am not sure how to use a dictionary
- b. I never find the words that I'm looking for
- c. There are no dictionaries in my school
- d. I don't think it is necessary

1.7 **The word that you want to look up in a dictionary is called a head word. Please study the following entry taken from a dictionary, then answer the questions.**

**chemist** a person who does research connected with chemistry or who studies chemistry

1.7.1 Write down the **head word** of this entry

1.7.2 Write down the definition or description of the word **chemist**

1.8[1.7] **If you page through a dictionary from front to back, which of the following words do you think will come first: hydrometer or crystal?**

- a. crystal
- b. hydrometer
- c. I'm not sure

1.9[1.8] **Which of the following words do you think will come first in a dictionary: moist or model?**

- a. moist
- b. model
- c. I'm not sure

1.10[1.9] Which of the following words do you think will come first in a dictionary: chemical reaction or chemical equation?

- a. chemical equation
- b. chemical reaction
- c. I'm not sure

## A.2

2.1 Show whether the following statements about insulators are true or not true. Do this by writing an "X" in the box of your choice.

- a. If I want to transfer heat from one wire to another, I can use an insulator. True  Not true
- b. An insulator increases the flow of electricity between two points. True  Not true
- c. Insulation tape can be used as an insulator between electrical wires True  Not true

2.2 Show whether the following statements about dehydration are true or not true. Do this by writing an "X" in the box of your choice.

- a. During dehydration hydrogen gas is removed from a compound True  Not true
- b. During dehydration water is removed from a compound True  Not true
- c. During dehydration water is added to a compound True  Not true

2.3 What will you use a compass for? Choose only one of the following:

- a. To measure air pressure
- b. To find direction
- c. To show what time it is in England
- d. To draw a circle
- e. I'm not sure

2.4 Acid rain:

2.4.1 Show whether the following statements about acid rain are true or not true. Do this by writing an "X" in the block of your choice:

- a. Acid rain is some form of rain True  Not true
- b. There is acid in acid rain True  Not true
- c. Air pollution causes acid rain True  Not true

2.4.2 Why should the industry be blamed for acid rain?

---

2.5 Crystal:

2.5.1 Show whether the following statements about crystal are true or not true. Do this by writing an "X" in the block of your choice:

- a. A crystal has flat surfaces and round edges True  Not true
- b. A crystal can be a gas or a liquid True  Not true
- c. A crystal has flat surfaces and straight edges True  Not true

2.5.2 How are the particles of a crystal arranged?

---

## 2.6 Energy and entropy:

Show whether the following statements about entropy are true or not true. Do this by writing an “X” in the box of your choice.

- |  |   |
|--|---|
| a. When I tidy my bedroom I increase the entropy of my bedroom.      | True <input type="checkbox"/> Not true <input type="checkbox"/> |
| b. When I tidy my bedroom I do not affect the entropy of my bedroom. | True <input type="checkbox"/> Not true <input type="checkbox"/> |
| c. Energy and entropy mean the same thing.                           | True <input type="checkbox"/> Not true <input type="checkbox"/> |

## SECTION B

### B.1

1.1[1.10] If you look up a word in a dictionary and see that you must look up another word to find the information that you are looking for, what do you do?

- |                                       |                          |
|---------------------------------------|--------------------------|
| a. I always look up the other word    | <input type="checkbox"/> |
| b. I sometimes look up the other word | <input type="checkbox"/> |
| c. I never look up the other word     | <input type="checkbox"/> |

**B.2 Please read the [Sepedi] explanations that are given below, then answer the questions that follow.**

2.1 **Insulator:** a substance that does not conduct electric current or heat easily, a non-conductor. [or for those who received the Sepedi definitions: *Selo seo se sa kopantšhego moelamohlagase goba phišo gabonolo. Seo se sa kopantšhego.*]

[Question A.2: 2.1 repeated here]

2.2 **Dehydration:** a process during which the number of molecules of water of crystallization in a compound is decreased. [or for those who received the Sepedi definitions: *Tiragalo yeo palo ya dimolekhule tša meetse tša kgahlofalo ka khomphaonteng di fokotšegago.*]

[Question A.2: 2.2 repeated here]

2.3 **Compass:** an instrument used to find which way is north. [or for those who received the Sepedi definitions: *Sedirišwa seo se šomišwago go hwetšwa gore ke kae e lego leboa.*]

[Question A.2: 2.3 repeated here]

2.4 **Acid rain:** rain which has become acid because of air pollution from industry. [or for those who received the Sepedi definitions: *Pula yeo e fetogilego esiti ka lebaka tšhilafatšo ya moya go tšwa diintastering.*]

[Question A.2: 2.4 repeated here]

2.5 **Crystal:** a solid substance with flat surfaces and straight edges. The particles of a crystal are arranged in a pattern. [or for those who received the Sepedi definitions: *Selo se sethata sa mahlakore a pepetla le merumo e thwii. Dikarolwana tša khirisetale di beakanywa ka phethene.*]

[Question A.2: 2.5 repeated here]

2.6 **Entropy:** this is a measure of the disorder of a system. [or for those who received the Sepedi definitions: *Ye ke kelo ya go se šome botse ga peakanyo.*]

**Energy:** this is the ability to do work. [or for those who received the Sepedi definitions: *Go kgona go dira mošomo. Enetši e laolwa ke go bala bontši bja mošomo wo o ka dirwago.*]

[Question A.2: 2.6 repeated here]

## SECTION C

Please read the following basic information, especially if you do not know how to use a dictionary:

If you look up a word in a dictionary you look for what is called a **head word** (also called a lemma). These words are normally given in **bold** and are arranged in an alphabetical order. For example, if you would like to know what the term **dictionary** means, you would go to the alphabetical category “**D**” in the dictionary and look for the head word **dictionary**:

**The alphabet: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z**

**dictionary:** A dictionary is a book that should at least have a user's guide and a list of head words (also called lemmas) for which the meaning is mainly given in the form of definitions (descriptions or explanations) of the meaning of the headwords or translations of the headword in another language.

**C.1 Please use the dictionary to answer the following questions**

1.1 **If you page through the dictionary from front to back, which word do you find first: impulse or neutron?**

- a. neutron
- b. impulse
- c. I cannot find any of the two words

1.2[1.11] **Find the word immiscible in the dictionary and write down the English definition / explanation of it** \_\_\_\_\_

1.3[1.12] **On which page in the dictionary can one find molar volume?** \_\_\_\_\_

1.4[1.13] **Find the word constructive interference in the dictionary, then explain in English what it means.**  
\_\_\_\_\_

1.5[1.14] **If the dictionary had a guide to help you find the information that you are looking for, will you read it?**

- a. No, because I know how to use a dictionary
- b. Yes, because I think it will help me
- c. I'm not sure

1.6[1.15] **When you look up a word in the dictionary, do you**

- a. read only the English explanation?
- b. read only the Sepedi explanation?
- c. read the English explanation first, then the Sepedi explanation?
- d. read Sepedi explanation first, then the English explanation?

1.7 **Would you also like to have the following information in the dictionary?**

- a. the periodic table Yes  No
- b. the most important formulas, with an explanation Yes  No
- c. a list of symbols, such as  $N_A$ , with an explanation Yes  No
- d. a list of abbreviations, such as J= joule etc. Yes  No
- e. a list of measuring units, such as *power* is measured in *watt* Yes  No
- f. other (please list) \_\_\_\_\_

**C.2 Look up the following words, then answer the questions that follow.**

[Question A.2: 2.1-2.6 repeated here]

**C.3**

3.1 **Did you enjoy using the dictionary?**

- a. Yes  b. No  c. I'm not sure

**C.4 Which language helped you most to understand the meaning of these words? If you choose the answer in Column C, please give a reason.**

		A	B	C	REASON
4.1	Insulator	Sepedi  __	English  __	Dictionary did not help me  __	
4.2	Dehydration	Sepedi  __	English  __	Dictionary did not help me  __	
4.3	Compass	Sepedi  __	English  __	Dictionary did not help me  __	
4.4	Acid rain	Sepedi  __	English  __	Dictionary did not help me  __	
4.5	Crystal	Sepedi  __	English  __	Dictionary did not help me  __	
4.6	Entropy	Sepedi  __	English  __	Dictionary did not help me  __	
4.7	Prism	Sepedi  __	English  __	Dictionary did not help me  __	
4.8	Pyramid	Sepedi  __	English  __	Dictionary did not help me  __	
4.9	Cylinder	Sepedi  __	English  __	Dictionary did not help me  __	
4.10	Cuboid	Sepedi  __	English  __	Dictionary did not help me  __	
4.11	Sphere	Sepedi  __	English  __	Dictionary did not help me  __	
4.12	Cube	Sepedi  __	English  __	Dictionary did not help me  __	
4.13	Hexagonal	Sepedi  __	English  __	Dictionary did not help me  __	
4.14	Plane	Sepedi  __	English  __	Dictionary did not help me  __	
4.15	Cross-section	Sepedi  __	English  __	Dictionary did not help me  __	
4.16	Parallel	Sepedi  __	English  __	Dictionary did not help me  __	

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