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Development of IsiNdebele–based material to enhance understanding and comprehension in some parts of energy concepts in physics curriculum of Zimbabwe

Amon MAPHOSA, Persuade NYANDORO, Tsepang MATHE and Anselem MADZUDZO

ABSTRACT

English: The problems emanating from the shortage of energy in Zimbabwe requires a heritage-based approach and culture centric solution. Researchers were optimistic that generating Ordinary Level Physics teaching and learning resources in IsiNdebele will bolster the attainment of higher order skills, enhance progress and growth of original scientific ideas and foster problem solving in the indigenous people. A qualitative approach to research under interpretivist paradigm was exploited to gather and contextualise critical information required for advancing vocabulary in IsiNdebele language for the teaching and learning of energy concepts. The paper has developed a Physics vocabulary in IsiNdebele for the teaching of energy to better the teaching and learning of Physics at ordinary level in Zimbabwean Schools. Our elaborate theoretical framework, Culturally Aligning Classroom Science (CACS), justified integration of knowledge from the modern Physics classroom into an indigenised Physics classroom. Now that we have framed the IsiNdebele-Physics vocabulary there requires an overdrive desire to integrate it into the classroom through a teaching text. We recommend that a strong framework for language policy be crafted in order to promote language development beyond the primary school level. Local languages should be employed as media of education instead of only being taught as discrete subjects. It is essential that the grammatical structures of the two languages involved in adoption and adaptation must be braided together, especially the phonemes and morphemes.

IsiNdebele: Inhlupho ezibangelwa yiku swelakala kwezomlilo eZimbabwe zinga xazululwa ngemizamo egxile kwezemvelo lemasikweni ethu. Abachwayisisi balethemba lokuthi ukulungiswa kwe zinsiza zokufundisa lokufunda iPhysics ngesiNdebele kungakhulisa ukutholakala kwamakhono aphezulu, kube lentuthuko lokukhula kwemibono yesayensi njalo kube lula ekuxazululeni izinhlupho ebantwini bendabuko. Indlela yokuchwayisisa yeziqondiso ezichazayo yeCACS yasetshenziswa ekuqoqweni lekuhlelweni kolwazi olubalulekileyo ukuze kuthuthukiswe amagama esiNdebele kwezokufundisa lokufunda izimiso zamandla omlilo. Leli phepha lithuthukise amgama ePhysics ngesiNdebele ukuze ukufundisa lokufundwa kwePhysics ku 'O'level kube lula ezikolo zaseZimbabwe. Isisekelo sethu esicacileyo seziyalezo kwezemfundiso sifakazela ukuhlanganiswa kolwazi olukhona emfundweni yePhysics yesimanje lasemfundweni yePhysics ehlanganiswe lezomdabu. Njengoba sesihlele amagama ePhysics ngesiNdebele, kule ndingeko enkulu yokuhlanganisa lokhu ekilasini ngokusebenzisa umbhalo wokufundisa. Sixwayisa ukuthi kubunjwe isisekelo esilohlonzi ukuze kuthuthukiswe ukukhula kolimi okwedlula lapho okufundwa kuzinga eliphansi. Izindimi zesintu kufanele zisetshenziswe njengemithombo yemfundo ngaphandle kokufundiswa kuphela njengezifundo. Kubalulekile ukuthi nxa kwakhiwa amagama kusetshenziswa indimi ezimbili ku lumbaniswe imisindo yenkulumo ikakhulu amafonemi (phonemes) lamamofimi (morphames).

KEY TERMS: *amagama ephysics, Culturally Aligning Classroom Science (CACS), energy physics, IsiNdebele-physics text, iphysics zamandla, umfanekiso weCACS, Zimbabwe*

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INTRODUCTION

The undercurrent Ordinary Level Physics Zimbabwean curriculum is heritage based and is skewed towards learner centered approaches. It follows that conception of Physics ideas in class is grounded in learner imagination and societal background. Researchers were convinced that developing Ordinary level Physics teaching and learning materials in local languages enhances comprehension and understanding of concepts which will aid the attainment of other higher order skills. This study was determined to develop IsiNdebele-based vocabulary for the teaching and learning of Energy concepts in the Ordinary Level Physics syllabus.

CONTEXTUALISING THE STUDY BACKGROUND

In an earlier work, Mushore, Nyandoro and Madzudzo (2024) have shown that Forces, a concept in the Ordinary level Physics syllabus, can be taught in an Indigenous Zimbabwean language. The Shona-Physics text on Forces has motivated current researchers to develop vocabulary in IsiNdebele for the teaching and learning of Energy concepts. Arguably, the ideal medium of instructing a heritage based curriculum is through the mother tongue (Kamwendo, 1999), since the indigenous language is the primary means by which learners are nurtured by the society (Mutasa, 2004). A similar study conducted by Viriri & Viriri, (2014) on the utilisation of ChiShona as a medium of instruction in the Buhera District in Zimbabwe reported improved comprehension in mathematics and science. As a result, this paper targeted to design IsiNdebele–based vocabulary for the teaching and learning of Energy concepts at Ordinary Level Physics, not as material for code switching when students have trouble in understanding particular concepts but as an IsiNdebele-Physics resource.

Dlodlo (1999) has also argued that Physics can be taught and learnt in the Nguni language by suggesting Nguni-Scientific vocabulary. However, Dhlodlo's contribution was merely a translation without developing a useful text, and in our viewpoint, it was just a linguistic contribution. It is our inherent target to develop IsiNdebele vocabulary for the teaching and learning of Energy in IsiNdebele in a similar way to what Mushore, Nyandoro & Madzudzo (2024) did. Our vision was partly influenced by Bangura (2014) who advocated that STEM subjects be domesticated using the African mother-tongue in order to successfully impart the competences. While suggestions have long been made (Mushore, Nyandoro & Madzudzo, 2024), for teaching science subjects in African languages, there is no place where it is known that this has actually been done in IsiNdebele for Energy concepts.

Besides, all scientific, artistic, economic and cultural transformation envisioned in Education 5.0 cannot be fully realized without extensive use of African languages in the teaching and learning process (Mazrui, 2002). While Zimbabwe is facing intermittent power supplies and energy shortages that require reasoned thinking, there is absolute need to devise localized solutions which are encapsulated in a local language context (Ogutu, 2006). Teaching and Learning Physics in IsiNdebele is rarely mentioned in policy texts on education although the curriculum stipulates that English will be used as the main language of instruction, while resources in the learners' mother tongue may also be used (Ministry of Primary and Secondary Education, 2014, p. 34). Even while the curriculum recognises that IsiNdebele is an official language taught in schools, the challenge is that the emphasis is on teaching it as a distinct subject and not in using it as a medium of instruction of the Physics concepts. It is unclear how the indigenous languages may be used as teaching tools for other disciplines, despite the fact that it is indicated that they can be used as resources. There seems to be a concentration on monolingualism where it is stated that the language of instruction is the language of examination. As a result, English continues to be the official language of teaching Physics in schools, as well as a taught subject, and a requirement for all school certificates in Zimbabwe.

Researchers were also enthused by critiques from fellow workmates who described the undercurrent task as an unrealistic target that has never been suggested or tested elsewhere. To prove an academic point, the researchers opposed the exclusion of the local African languages as media of Instructing Physics by pushing for the use of all languages through strategies such translanguaging. This necessitated the development of Physics Texts in indigenous languages thereby promoting successful communication.

DEFINING THE PROBLEM

Zimbabwe is facing serious power outages and energy shortages which are affecting the envisaged innovation and industrialisation. The rural Zimbabwean community has survived the test of time by using firewood as the primary source of energy because the unreliable power supply is also inadequate when available. Inherent problems, such as, failure to properly preserve nutritious food, medical drugs and the inability to power electrical gadgets are being noticed even in a 21st Century Zimbabwe. The problems emanating from the shortage of energy require a heritage-based approach and culture centric solution. Hence developing a vocabulary in IsiNdebele will enhance understanding and foster problem-solving skills in the indigenous people.

Purpose of the paper

The purpose of this study was to develop vocabulary in IsiNdebele language to be used for teaching and learning of energy concepts in order to improve science literacy and comprehension which enhances development and growth of original scientific ideas in Zimbabwe.

Research objectives

In light of the problem stated above, this study sought to address the following objectives:

- Develop a Physics vocabulary in IsiNdebele for the teaching of energy concepts,
- Explore possible strategies for creating science terms in local African languages.

THEORETICAL FRAMEWORK

While constructivism (Vygostky, 1978) was the overarching framework informing this study, we focussed on the Culturally Aligning Classroom Science (CACS) framework propounded by Mpofu, Otulaja & Mushaikwa (2013). The original CACS framework constitutes concepts of knowledge, classroom science, traditional plant healing, indigenous knowledge, world views and integration (Mpofu, Otulaja & Mushaikwa, 2013) as indicated in the illustrative Fig. 1.

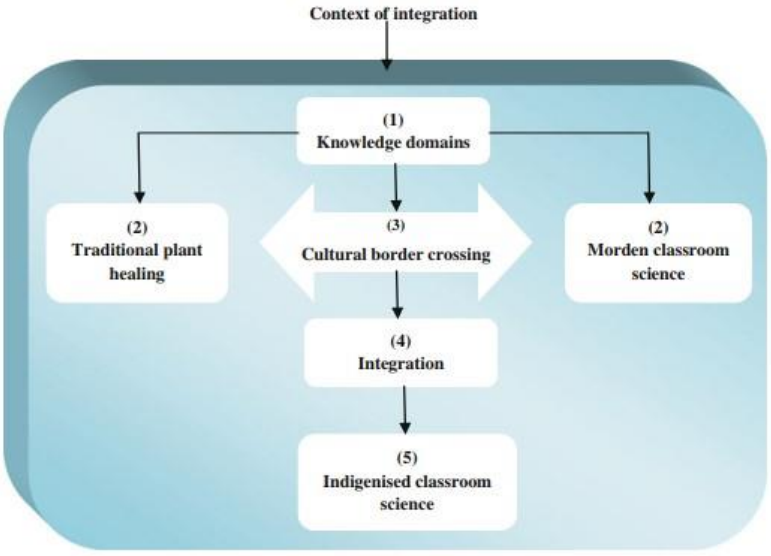

Fig. 1 CACS theoretical model (**source**: Mpofu, Otulaja, & Mushayikwa, 2013)

The descriptive Fig. 1 reveals that CACS is a multifocal lens for integrating Indigenous Knowledge Systems (IKS) in modern Physics classrooms through the tetrahedral model of knowledge, situating classroom Physics within worldviews, cultural border crossing, concepts of integration, and indigenous classroom science as an outcome of integration.

Although we appreciate that knowledge is unique (Shizha, 2007), with localised knowledge held by community elders of a particular origin, we found it important to advance CACS within the IsiNdebele context. It is our considered view that a language is a repository of a particular culture. Hence developing an IsiNdebele-Physics text is an appropriate way of aligning Ordinary level Physics with the Ndebele culture. In this paper, we have theorised a CACS model that integrates indigenous knowledge with modern classroom Physics through the IsiNdebele language. In our theorisation of CACS, we subsume that the dearth of energy in Zimbabwe compels a heritage-based approach and culture centric solution that can only be harnessed from the indigenous knowledge systems in the indigenous people. A similar thought was echoed by Dei (2010) among other scholars who propose that privilege and dominance of western solutions on energy need to be deconstructed entirely. In fact, we regard this view as extreme only in that we perceive knowledge forms as plural and our logical assumption in this paper is based on substituting western knowledge by integrating indigenous knowledge with the modern classroom Physics to resolve energy crises.

Whereas researchers didn't find the immediate applicability and transferability of traditional plant healing, in Fig. 1, to the teaching and learning of Energy concepts, we decided to constrict CACS framework to knowledge domains and modern classroom science only. As indicated in CACS framework, Fig. 1 illuminates that cultural border crossing (aspect 3) is a double-edged arrow that supports plural integration of knowledge forms into an

indigenised Physics classroom. Our understanding of integration (aspect 4) is a subsequent event to a multi-pathway convergence of knowledge forms. And aspect 5 reveals that convergent integration of knowledge culminates into a peculiar ilk of an indigenous Physics classroom that breeds culture centric solutions to the energy glitches confronting Zimbabwe.

Nature of the research

This study used a qualitative approach to research under the interpretivist paradigm to gather and contextualise critical information required for developing vocabulary in the IsiNdebele language for the teaching and learning of energy concepts. A qualitative approach was appropriate for the small sample (Bell, 2005) used in the present research and its effectiveness mostly depends on the knowledge and experience of the researchers (Spyros, 2014). Whilst Mushore, Nyandoro & Madzudzo (2024) used focus group interviews in their study, the current researchers adopted a similar but different approach by using semi structured interviews. The interview guide was deliberately left open-ended to give the researchers an opportunity to learn about the occurrence from the informant's own perspective.

Researchers used the clustered sampling technique to select 7 out of 18 secondary schools in Beitbridge whose identity was going to be kept anonymous. Out of the seven, two participated in the pilot test only while the other five participated in the main study. A purposive sampling technique was then employed to identify a community of elders who are native IsiNdebele speakers, accessible and willing to partake in the study. Physics teachers, who were based at the sampled schools, are IsiNdebele speakers, who held at least a Diploma in Education and were willing to participate in the study were selected as a purposive sample. Only teachers and community elders who fitted the profile outlined were asked to fill informed consent forms before inclusion in the study. A total of 8 teachers and 6 community elders were chosen for the study.

Ethical issues

Researchers sought permission to conduct the research from the Ministry of Primary & Secondary Education (MOPSE) through the Provincial office as per the recommendations of Kristjansson, Sigfusson, Sigfusdottir, & Allegrante, (2013). Participants were asked to fill in the informed consent form before which the research objectives were explained and any questions answered. The respondents were informed of their rights to voluntarily decline involvement and to discontinue participation at any time without repercussions. To achieve dependability of the study, researchers documented the research findings (Tobin & Begley, 2004) in a file which will be disposed after five years. As already mentioned, non-probability sampling techniques were used to choose the respondents for the study to increase transferability of the findings. Researchers used voluntary informants in an effort to assure the correctness and dependability of the data. Participants in the study were given the option to decline taking part in the experiment, ensuring that only those who were genuinely willing to participate and prepared to provide data were used in the analysis. Confidentiality and anonymity of participants and schools was assured by using pseudo name codes. In order to ensure that the privacy of participants was respected, the primary researcher asked the respondents if there was any information that they did not want to be publicized. Further, during the process of data collection, all the data was kept in a safe place and all recordings were stored digitally in a password protected drive, with the password only known to the primary researcher.

Data analysis

Data was analysed following a model prescribed by Boaduo (2010), who suggested six (6) steps for effective data analysis. The steps are as follows: -

Step 1: Verbatim transcription of the data with notations and additional margin notes and comments.
Step 2: Analysing the data, creating field notes from the interviews, adding codes, and adding reflections or other remarks in the margins.
Step 3: Sorting and filtering through the data to look for common themes, patterns, related terms, correlations between variables and frequent sequences.
Step 4: Identifying trends and processes, as well as their similarities and differences, uniting the data, and producing meaningful meaning-making units.
Step 5: Creating sets of generalisations that cover the consistencies in the data in step four, which involves creating preliminary categories and subcategories.
Step 6: Making a list of crucial terms, expressions, and things (basic concepts) and contrasting them with a body of codified information in the form of constructs, theories, or related research

Results

The researchers found it necessary to establish the level of academic and professional qualifications of the elders of the community and teachers who participated in the study.

Table 1 shows the said qualifications.

Participant	Academic Qualification	Professional Qualification
PE01	O level	Certificate in Electrical Engineering
PE02	O level	Builder
PE03	O level	Diploma in Nursing
PE04	O level	None (shop owner)
PE05	Degree (Not specified)	
PE06	Degree (Not specified)	

The illustrative Table 1 shows that there is adequate comprehension of the academic issues involved in this research by the participants.

IsiNdebele terms that can be used to teach energy concepts

It was crucial to determine the attitude of participants towards the use of IsiNdebele in the teaching and learning of energy concepts. Our study findings unearthed that the perceived lack of appropriate vocabulary in the language was the main obstacle to using IsiNdebele in the teaching and learning of Energy concepts in Physics. One of the facilitators, Participant PF08 remarked:

> *The use of Ndebele in physics instruction remains a brilliant innovation. However, I am worried about the terminology to be used. Finding terms in IsiNdebele to describe these concepts may take hundreds of years, in my opinion.*

Similar sentiments were echoed by PF03 that:

> *Because these languages lack the necessary vocabulary, it can be challenging to teach Energy concepts in IsiNdebele, Shona, or other local languages. Imagine all the technical terms; how would you translate them into everyday language? Who will be in charge of coming up with the terminology that will be utilised in fields like physics, chemistry, and biology?*

The community elders also agreed that developing meaningful energy terms in IsiNdebele could bring more confusion to learners. One community elder participant PE02 had this to say:

> *The learners will probably be even more confused than they already are if we employ the mother tongue. The learners will be confused by scientific terms that can be employed in local languages. Just try to translate all the scientific terms we use now into Ndebele. There will be excessive confusion.*

Another elder participant PE04 said:

> *It is always best to communicate in the mother tongue, and employing African languages to convey scientific ideas is nothing new. There is no need to translate texts or coin new words because teaching and learning can be done using the same language that we use every day to discuss ideas like computers, tablets, cell phones, and other similar concepts. However, when it comes to education, we like to make things more complicated.*

Defensibly, our findings reveal that the lack of IsiNdebele terminology is one of the main obstacles hampering the teaching and learning of Energy concepts. Also, in the present study researchers considered standardised IsiNdebele vocabulary as a repository of knowledge that is a functional tool for communication and the transmission of Energy concepts. Although Kageura (2002) opposes standardising scientific terminology in education because it stifles students' imagination and inventiveness, researchers were convinced that developing IsiNdebele text is a mammoth task.

Our findings also unearthed apprehension, among research participants, about the language for assessing learners, when IsiNdebele is now being used as a language of instruction. Participants were worried whether or not IsiNdebele was going to be used for summative evaluation although they acknowledged that learners were facing challenges in expressing themselves in English. One participant teacher, PF05 had this to say:

> *Are exercises and examinations going to be written in IsiNdebele that the students are being taught in, or will they be written in English? When it comes to assessment, the employment of IsiNdebele is certain to confound both teachers and students.*

Another participant facilitator, PF 02 believed that:

> *If students are permitted to use their native tongue when studying, they also should be permitted to use the same language when completing assignments and examinations. Examination marking is likely to be difficult as very few teachers may be comfortable in the variety of languages used in this country.*

The incorporation of African languages, which the researchers support, is not intended to isolate the languages but to employ them in translanguaging, with the goal of improving learners' cognitive abilities. If translanguaging was used to combine their native language and English, the students would comprehend concepts more easily. The incorporation of African languages in science education does not mandate that assessments be conducted in those languages. It has been demonstrated that bilingual students who receive instruction through translanguaging become fluent in both their mother tongue and English (Childs 2016; Karlsson et al. 2018; Vogel and Garcia 2017). Because learning through translanguaging does not prevent students from becoming fluent in any of the concerned languages, the learners can therefore be evaluated in any language that the examining body requires.

Adoption of English to IsiNdebele terms

It was imperative to gather IsiNdebele terms that could be used in the teaching and learning of energy concepts in Physics. Table 1 shows the English–Ndebele terms as proposed by the teachers and elders of the community through adoption. The column of consolidated terms was developed by considering submissions from the teachers and elders of the community.

Table 1 English Ndebele terms

English terms in the syllabus	**IsiNdebele terms proposed by**		**Consolidated**
	Teachers	**Elders of Community**	
Petrol	ipetrol	iphetroli	iphetroli
Diesel	idizili	idizili	idizili
Stroke	istroke	*Istirokhu*	*istroku*
Engine	injini	*Injini*	*injini*
Spark plug	Isiphaki plagi	*Ispakhi-pulagi*	*Ispakhi-pulagi*
Chemical	Ikemikhali/umuthi	*Ikhemikhali*	*Ikhemikhali*
Kinetic	ikinetic	*Ikhayinethiki*	*Ikhayinethiki*
Filter	ifiltha	*Ifilitha*	*isefa*
Throttle	ithrottle	*Ithrottle*	*Ithrottle*
Piston	iphistoni	iphistoni	iphistoni
Cylinder	isilinda	*Isilinda*	*Isilinda*

The illustrative Table 1 indicates that elders of the community and Physics facilitators used adaptation and adoption to develop an IsiNdebele term, particularly in cases when the English term was unfamiliar. Adaptation and adoption were used to convert English terms from the source script into those IsiNdebele terms that are pronounced in the destination script (Yuming, 2015). For instance, *i-khemikhali* for chemical, *i-phistini* for piston, and *i-silinda* for the word cylinder in isiNdebele were developed. As illustrated in Table 1, the English terms were

adopted and changed to suit the IsiNdebele phonology by both teachers and community elders. The descriptive Table 1 also indicates that there was a shared vision between teachers and community elders as they concurred on several terms including petrol, diesel, throttle, kinetic, stroke, engine, spark plug among other terms. As a result it was easier to consolidate the findings although researchers found several other terms that are used in the society that could be most appropriate, for example *ifiltha*/*ifilitha* was raised in the findings but *isefa* was found to be a better term. Again, researchers viewed *istroku* to be most appropriate than *istroke* because the *-ke* in *istroke* would sound *khe* not *khu*. While similar research carried out by DACRSA (2005) yielded similar results with minor variations that include but not limited to *idizila* for diesel, *Ivelufu* for valve, *Iphistini* for piston, our findings show that adoption can be used to familiarise English terms.

Research findings disclosed that there were English terms to which teachers and community elders could not separately propose an IsiNdebele term applicable to the English term. Table 2 reveals the terms that teachers and community elders could not suggest a term.

Table 2 English-IsiNdebele terms

English terms in the syllabus	**IsiNdebele terms proposed by**		**Consolidated**
	Teachers	**Elders of Community**	
Energy	Amandla	--	*ieneji*
Fuel	amafutha	--	ifuel
Inlet	--	*Ingeniso*	*inlet*
Intake	ngenisa	--	ngenisa
Power	Amandla	*Iphawa*	*Iphawa*

The illustrative Table 2 indicates that community elders could not agree that *Amandla* was the best term for Energy and at the same time they could not suggest their own term for energy. From our deduction, community elders were convinced that *Amandla* is most suitable for power than energy whereas teachers declared that *Amandla* is appropriate for both Energy and Power. Although *iphawa* has been added as a synonym, the term *Amandla* for power has always been used. In order to resolve the differences and improve specificity of physics concepts researchers resorted to the term *ieneji* which could be universally accepted for energy only. Whereas the term *amafutha* could mean fuel in general terms, it is most appropriate for liquid fuels. There are also solid fuels which may not be explicitly implied by *amafutha*. As a result, researchers agreed that *ifuel* is most appropriate term for fuel because it universally includes all solid, liquid and gaseous fuels. In their wisdom as well, teachers and community elders could not agree on the terms inlet and intake. Teachers were satisfied that inlet valve could have been used in the syllabus than inlet only to refer to *ivalufu yokufaka* while elders were convinced that *ingeniso* is appropriate for inlet. Consequently, teachers were confident that *ngenisa* was most apposite for intake than inlet.

As raised in the background to the study, it was essential to develop IsiNdebele- Physics terms for the teaching and learning of Energy concepts in Ordinary Level ZIMSEC Physics. Table 3 presents consolidated findings of IsiNdebele terms specifically for combustion engine related concepts as outlined in the ZIMSEC Ordinary Level Physics syllabus.

Table 3 English-IsiNdebele terms for Combustion Engine

English terms in the syllabus	IsiNdebele terms proposed by		Consolidated
	Teachers	Elders of Community	
Inject	puntshezela	java	puntshuzela
Heat	ukutshisa	Khudumeza/khudumala	tshisa
Compression	ukupantshaza	*Ukubandezela*	*ukufithizela/ukubandezela*
Exhaust	i-ekzosti	*i-ekzosti*	*ekizosti*
Pressure	iphresha	*Incindezelo*	*ipresha*
Mixture	inhlanganiswa	*Inhlanganisela*	*imixture*
Ignite	lamatha	*Lumathisa*	*lumatha*
Motion	ukhuhamba	*Umhambo*	*ukuhamba*
Pump	impompi	*Pompa*	impompi
Combustion	Ukubhebha/ukutshisa	*Khombasishini*	ukutshisa
Chamber	uhlangothi	*Isigaba*	*Isigaba*

Our findings, in Table 3, indicate that the community elders use *umhambo* for motion while teachers are satisfied that *ukhuhamba* is the most appropriate term. In our own analysis, researchers adopted *ukuhamba* for motion. Experience gained from interacting with the teachers has shown that a pump as an instrument is referred to as impompi in IsiNdebele while pompa is the process. Interactions with community elders unearthed that pressure has been uniquely recognised as an IsiNdebele term and has emerged as *ipresha* although *Incindezelo* is also a localised term. While our findings are consistent with other findings Dlodlo (1999) and DACRSA (2005) among other scholars, the isiNdebele terms for grades 4 to 6 sciences and technology developed by the DACRSA (2005) for teaching diesel and petrol engines unearthed several IsiNdebele words distinct from our study. For example, the terms *Isisbaseli* for Fuel, *Isigandelelo* for pressure, *Umvango* for mixture, *Umnyakazo* for motion, *Gandelela* for compression, and *Sefa* for filter were proposed to get rid of direct translations.

Interaction with teacher participants unearthed that they used *ukutshisa*, a process of heating something instead of *tshisa* for heat as a form of energy while community elders used Khudumeza/khudumala for thermal energy. Also, interface with community elder participants has taught us that *ukupantshaza* that has been raised by teacher participants is more appropriate for destroying than the concept of compression being referred in the syllabus. As a result we have adopted *ukufithizela/ukubandezela* as the most appropriate term for compression. Whereas suggestions to use exhaust valve instead of exhaust was made to explicitly emphasise the syllabus concept being developed, both teachers and community elders agreed that *ekzosti* was the most suitable IsiNdebele term for exhaust. The recommendation was made with the argument that the term exhaust is used only with reference to exhaust valve translated to *Ivalufu yokulahla* or *ivalufu yokukhupha* which is a different impression to exhaust only.

Interaction with community elders and teachers has uncovered that they wanted to retain the purity of the language by recommending the term *Inhlanganisela* and *inhlanganiswa* respectively while the general populace uses mixture in the everyday life. A similar study was carried out by Dlodlo (1999) to develop Physics terms in the Nguni language and IsiNdebele in South Africa. Dlodlo's (1999) proposal was determined not to adopt or adapt English terms or use phonetic transcriptions. Dlodlo wanted to develop scientific terminology that is exclusively Nguni or IsiNdebele by term development or creation. Although, the findings in Dhodlo (1999) were limited to few terms of Energy concepts in Physics, Dhlodlo managed to coin the term *isidlakela* for energy, *isvimbonduku* for Piston and *unyakazo* for motion.

Unlike Dlodlo's attempt to get rid of existing terms and replacing them with new ones, our findings included several isiNdebele terminologies that are already in use in the society which are likely to increase learner comprehension. The idea by Dlodlo (1999) to create entirely new terminologies that bear no resemblance to English would complicate the already convoluted English scientific vocabulary. By advocating a purist stance and prescribing terminologies that are likely to confound language users, Dlodlo (1999) is departing from reality. In

our pragmatic approach of adopting or adapting concepts in English, where appropriate, we are taking cognisance of the fact that some of these scientific terms were translated into English after being adopted from other languages in order to fit to the phonological and morphological patterns of the English language.

IMPLICATIONS AND CONCLUSION

In this paper we have developed IsiNdebele-Physics vocabulary on Energy to better the teaching and learning of Physics at ordinary level. Our elaborate theoretical framework, Culturally Aligning Classroom Science, justified integration of knowledge from the modern Physics classroom into an indigenised Physics classroom. Now that we have framed the IsiNdebele-Physics vocabulary there requires an overdrive desire to integrate it into the classroom through a teaching text. We recommend that a strong framework for language policy be crafted in order to promote language development beyond the primary school level. Local languages should be employed as media of education instead of only being taught as discrete subjects. It is essential that the grammatical structures of the two languages involved in adoption and adaptation must be braided together, especially the phonemes and morphemes.

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