NATURAL SCIENCES TEACHERS' PERCEIVED COGNITIVE ACADEMIC LANGUAGE PROFICIENCY (CALP) NEEDS

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Abstract

Teachers Cognitive Academic Language Proficiency (CALP) has been found to be important for meaningful teaching and learning of any subject. Over the years research has focused more on English second language learners' CALP needs and less on the teachers. Because teachers are the cornerstones who drive the process of teaching and learning in the classrooms, their proficiency in the language of teaching and learning are vital. In the South African context, English is regarded as the official language of teaching and learning from grade 4 onwards despite that both teachers and learners come from diverse linguistic backgrounds where English is a second or third language. Underpinned by the socio-cultural theory as the theoretical framework, the paper reports on a study that determined both in-service and pre-service teachers' perceived CALP needs when teaching Natural Sciences in multicultural township schools. In a qualitative research approach 12 teachers were randomly selected who comprised of six in-service teachers and six final year pre-service teachers enrolled for a Natural Sciences course at a University in South Africa. Each teacher was interviewed once using a semi-structured interview schedule which allowed them to freely express their perceived CALP needs. The data was analysed using a constant comparative method. Findings from the analysis of data showed that teachers experienced many challenges when teaching Natural Sciences using English, a language different from their home languages and those of their learners. They indicated that because science is a unique language on its own they struggle to spell, pronounce, understand and most importantly to explain to the learners using English. The teachers indicated their little to non-exposure to English other than in the classrooms compared to their home languages. Whilst some of the teachers perceived English as an important language due to its universality, they however indicated that code switching to own home language and those of the learners was inevitable when it comes to meaningfully explain some scientific concepts and processes in a way that learners would comprehend. However, others acknowledged the challenges of using code switching in the linguistic diverse classroom environments. Most teachers suggested training workshops intended to develop them with skills to identify appropriate terms and expressions, and explain complex scientific concepts in English. These findings have implications on both pre-service and in-service teacher professional development programmes.

Keywords: Cognitive academic language proficiency, natural sciences, teacher's perceptions, English second language.

1. Introduction

Language is the most powerful tool used during communication, particularly in teaching and learning. In South Africa, English is regarded as the language of teaching and learning from grade 4 onward (Department of Basic Education, 2010), which is a second or third language to most teachers and learners in schools, especially township schools. Teachers are required to be proficient in the English as the medium of instruction. This requires teachers to possess a well- developed Cognitive Academic Language Proficiency (CALP). CALP refers to the level at which a person has excess to the academic language used for schooling and education (Van der Merwe, 2018). Furthermore, Razak and Yunus (2017) indicated that the concept CALP consists of two components which are the academic language and the academic content. The academic language is defined as a language which consists of a complex and specific grammar, academic vocabulary and a complex discourse style while the academic content is the specific subject matter (Krashen & Brown, 2007). In this study, we are referring to the Natural Sciences content.

As early as 2001, Willington and Osborne noted that science is a language on its own, and thus learning science is equivalent to learning a new language. In this regard teachers are tasked with teaching learners who are not only challenged with learning the science content in English but also have to cope

with language comprehension (Ferreira, 2011). It is with this reason that teachers are expected to possess a well-developed CALP. Van der Merwe (2018) mentioned that in order for learners to be proficient in the academic language which will allow them to successfully complete tasks, they require teachers who are competent in using the academic language. Otherwise, the teachers would fail to develop and engage the learners in the science content meaningfully. Merwe (2018) mentioned that language cannot be separated from one's context and thus language is learnt through social interactions. This accounts to the reasons that most teachers may not be proficient in the language of learning and teaching. Similar to the learners, teachers are also exposed to the English language in the classrooms only and speak their respective home languages during social interactions (Motloung, Mavuru & McNaught, 2021). Due to their comfortability and fluency in their home language, teachers unintentionally code-switch to their home languages to explain science concepts better. However, Ferreira (2011) mentioned that because of the language diversity within the South African context code-switching becomes a challenge because a teacher needs to be fluent in all the learners' home languages in order to use code switching successfully.

2. Literature review

Teacher's language proficiency is regarded as one of the important factors which has an effect on the learners' acquisition of concepts. Cahn and Renandya (2017) stated that teachers with an extended level of the target language proficiency are believed to be more capable of providing learners with meaningful explanation of concepts, which is one of the imperative aspects for effective and successful teaching and learning. In contrast, failure to distinguish and correct learners' mistakes is evident of teachers with less proficiency in the language (Farrell & Richards, 2007). An intense level of cognitive processes occurs in the classroom context where teachers and learners interact with one another (Kellerman & Evans, 2021). Poor interaction is exacerbated by the complex scientific processes, concepts and terms which require effective communication between the teachers and learners. Considering that English is a second language to most teachers especially in township and rural school contexts (Mavuru & Ramnarain, 2020; Nomlomo 2010 proficiency in the language of teaching and learning may be an inevitable challenge. This is because teachers are extensively exposed to their respective home languages as compared to the English language, which they merely speak in the classroom context. Consequently, teachers find themselves code switching due to their lack of proficiency in the language of teaching and learning (Kellerman & Evans, 2021)

In a study conducted by McCoy (2017) which assessed the impact of the teachers' limited language proficiency, it was found that teachers had hindrances when explaining scientific concepts in the English language because of their narrowed vocabulary and lack of communication abilities. Furthermore, McCoy's study revealed that even though the teachers were confident in their language proficiency, lack in language proficiency and language mistakes were evident in their conversations with the learners during the teaching and learning process. It could therefore be concluded from the study that teachers at times fail to recognize their own errors in the use of the English language. As early as 2007, Brock-Urine conducted a comparative research where a teacher was observed teaching science in English in one class and another in a home language. It was observed that in the class where the teacher used English to teach science, little explanations were given on the subject matter and errors were evident in the language whereas in a class where a home language was used explanations were explicit and comprehensible. This indicates how teachers' poor CALP may unintentionally have a negative effect on the teaching and learning process.

The teachers' deficiency in CALP necessitate a development which should begin within the teacher education programmes. Van der Merwe (2018) argued for the need to develop pre-service teachers by teaching them the academic language and give them opportunities to develop in academic language prior to becoming qualified teachers. Van der Merwe's study highlighted the language aspects which pre-service teachers must be developed in for them to become competent teachers. These aspects include academic language conventions, convention of language necessary for discipline specific areas and cognitive exhausting tasks. On that note Tsang (2017) mentioned that even though teaching qualification is approved to determine the competency level of the qualification holder, it is not clear how the pre-service teachers' language proficiency is measured. Hence, many pre-service teachers continue to battle with language use after obtaining their teaching qualifications.

Kellerman and Evans (2021) noted aspects which may determine academic language proficiency such as oral fluency, vocabulary, pronunciation, grammatical accuracy, reading and writing. The mentioned aspects including intonation were confirmed as challenging areas in a study conducted by Gan (2012). Based on the arguments put forward in terms of the need for science teachers to be proficient in the language of teaching and learning, the current study sought to determine both in-service and pre-service teachers' perceived CALP needs when teaching Natural Sciences in multicultural township schools in context of South Africa.

3. Conceptual framework

This study was underpinned by the socio-cultural theory (1978) which emphasizes the role of language in learning and social interactions. This theory outlines that individuals acquire language through social interactions. Consequently, more exposure to a language influences the language proficiency. In this regard, English-second language teachers are more exposed to and communicate using their home languages socially, which makes them proficient in their home languages. In contrast, teachers are exposed to the English language only in the classrooms during teaching and learning hence they may lack proficiency in the language, also considering the fact that English is a second language to them. The theory also recognizes the responsibility of the teacher as a knowledgeable individual with the duty to ensure that learners understand the content taught. Therefore, this will require the teacher to be proficient in the language of teaching and learning. Semeon and Mutekwe (2021) posit that mediation is the essential part of the socio-cultural theory because the science concepts should be mediated to assist learners with comprehension. The teacher is the mediator and thus, language proficiency is required to provide explicit explanations and instructions to Natural Sciences learners.

4. Research methodology

The current study adopted a qualitative case study research design (Merriam, 2009). Qualitative research allows the researchers to determine the interpretation of individuals' experiences. Thus, the approach allowed for the establishment of the English second language pre-service and in-service teachers' CALP needs.

4.1. Selection of the participants

Using random sampling technique (Patton, 2002) six in-service Natural Sciences teachers teaching in six different township schools and six pre-service teachers enrolled at a South African University for a Natural Sciences methodology course were selected to take part in the study. The pre-service teachers were in their final year of study and had been involved in work-integrated learning at different school contexts throughout their four years of teacher development. All the selected teachers were English second language speakers.

4.2. Data collection and analysis

Data was collected by means of semi-structured interviews. Each of the teachers (both in-service and pre-service Natural Sciences teachers were interviewed individually to determine their perceived CALP needs. Each interview took approximately 30-45 minutes long. Interviews were audio recorded with permission from the teachers and then transcribed verbatim. Using constant comparative method (Merriam, 2009), each data set was coded for the challenges and then categorised into language challenges teachers and developmental needs.

5. Findings

The teachers pointed out that they experienced challenges when they have to explain scientific concepts using English, which is their second language. Some of the teachers answered some of the interview questions in both their home language and English when trying to elaborate their answers. This is evident that teachers lacked English language proficiency because they speak English minimally outside the classroom context. Hence their home languages become the central part of their cognitive processes. Pre-service teachers were more comfortable in expressing their challenges as compared to in-service teachers who were a little reluctant to express their challenges. This could be because of the fear of appearing incompetent.

Teachers mentioned the complexity of the science subject matter which they have to teach using English in a manner that learners can easily comprehend as one of the challenges. They bemoaned that some of the learners they teach could not easily comprehend the Natural Sciences concepts because of they struggle with both the language of instruction (English) and the scientific language, which demand that teachers put extra effort. The other challenge teachers mentioned was the nature of the scientific content which is composed of Latin and Greek words, which both teachers and learners struggle to spell, pronounce, understand and even explain some of the terms and processes using English. Some of the examples of teachers' responses are captured as follows:

In-service teacher: *I find it difficult to pronounce scientific terms not only in Natural sciences but also in other subjects and explaining some scientific terms.*

Pre-service teacher: *Atoms and compounds and all those things, I could not really understand fully what they were so I tried to explain as best as I could but deep down I felt that I was not really understanding what I was teaching even though I was teaching it.*

The responses indicate that even though this particular study focused on Natural Sciences, teachers acknowledged the use of English language as a challenge for English second language teachers in other disciplines. The findings also found that teachers' subject matter knowledge is compromised since they were taught in English which is their second language. Some of the teachers pointed out that they provide superficial explanations to science concepts as a result of their own lack of understanding and inability to express oneself in English. As such, learners' acquisition of scientific concepts is compromised as their teachers fail to provide explicit explanations.

Some teachers indicated that sometimes they resorted to code switching during the teaching and learning process. Code switching as a strategy to mitigate language challenges in the science classroom drew mixed views from teachers. The following responses are testimony to this:

In-service teacher: *Code switching is okay because sometimes, you as a teacher you will be blank. You want to explain something in English but then English is gone, but you know what you to say.*

Due to the teachers' flexible and comfortable use of their home languages, some teachers view code switching as an escape when they struggle to explain concepts in English. In addition, they mentioned that code-switching is effective in enhancing meaningful explanation of scientific concepts. From the other teachers' responses, it shows that code switching may not be feasible in a linguistically diverse classroom context. This is evident in the following teacher's response:

Pre-service teacher: *There is diversity amongst learners with their home language so especially in schools in Gauteng where you could be sitting with learners that speak all eleven official languages. For me to code switch in a classroom like that would further create communication barriers because I am a Zulu speaker. I do not speak any other language. I would not be able to explain anything else in another language besides Zulu.*

It is with this reason that some of the teachers are not in favour of the use of code switching. In some instances, teachers and learners have different home languages and it is less likely that a teacher will be proficient in all the home languages of the learners in their Natural Sciences classrooms. Some of the teachers clearly indicated that they could only speak one indigenous language. What it means is that when such a teacher code switches to one home language other learners who speak a different home language would be excluded in the learning process. The teachers pointed out that code switching becomes effective when all the learners in the classroom have a common home language, which is almost impossible in township schools where Black people from various provinces were forced to relocate to during Apartheid era in South Africa.

Because of these challenges, teachers indicated that they needed professional development in the effective use of code switching in situations where teachers can speak learners' home languages. Some teachers recognized and acknowledged the importance of using English as the language of teaching and learning despite their lack of proficiency in the language. They perceived English as a universal language. As such, these teachers made requests that they be developed in other alternative strategies that mitigate language challenges which do not discriminate other learners. Some were vehement by pointing out the need for them to be developed continuously to improve their CALP and that of their learners. They indicated that developmental workshops should develop them with skills to identify common terminologies and expressions they can use in the classroom in place of some of the complex terminologies and the academic explanations used in science textbooks. These teachers pointed that they needed to be trained to assist and expose their township learners who are English second language to effectively perform cognitive demanding tasks and comprehend concepts in language. To this, one of the teachers said:

Pre-service teacher: *I think it is important that we get the basic understanding of how English works and how to write, how to speak it because if we cannot do it, then our learners will also not be able to do it.*

6. Discussions

Both in-service and pre-service teachers indicated that they were challenged to teach Natural Sciences in English, a language which is different from their home languages and those of their learners. These findings are consistent with findings from previous studies (e.g. Ferreira, 2011, Motloung, Mavuru & McNaught, 2021) though in the context of Life Sciences. Based of Vygotsky (1978)'s constructivist theory it means that some of the teachers failed to create learning environments where learners and themselves could communicate, interact and mediate or scaffold learning. The teachers' perceived needs

are consistent with those obtained in previous studies for example Van der Merwe (2018) and Brock-Urine (2007). Because their limited CALP, teachers intentionally and at times unintentionally code-switched to their home languages during the teaching and learning process. Whilst previous researchers (e.g. Mavuru & Ramnarain, 2020; Nomlomo, 2010) have showed how code switching can be useful when explaining science concepts in the classroom, it only becomes a powerful strategy when teachers are proficient not only in the language of teaching and learning, but also learners' home languages.

7. Conclusion

This study focused on establishing the Natural sciences teachers' perceived needs regarding their Cognitive Academic Language Proficiency. The findings showed that both pre-service and in-service teachers who are English second language speakers, lack in cognitive academic language proficiency. As a result, they struggle to spell, pronounce, understand and articulate themselves clearly without grammatical errors when using English. This is exacerbated by the complexity of the Natural sciences subject matter whose language is complex due to its academic nature and the use of scientific terms borrowed from unfamiliar languages other than English. Based on the teachers' perceived needs, it shows that both pre-service and in-service professional development programmes are failing to meet the teachers' needs in this respect. These findings have implications for professional development providers to equip teachers with the knowledge and skills to teach science in English. Focus should not only be on development of subject content knowledge and contemporary teaching strategies or use of technology but rather embed language development in any of the developmental workshops.

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