UTILISING ICT TO ADDRESS LANGUAGE CHALLENGES IN LIFE SCIENCES CLASSROOMS

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Abstract

Language is not everything in the teaching and learning process, but without language education becomes worthless. A normal classroom in South Africa consists of learners of different cultures thus having different home languages. Previous studies showed that teaching has become a complex task for Life Sciences teachers who are responsible for meaningfully teaching linguistically diverse learners in public schools using English, a second or third language for learners. With the advent of the Fourth industrial revolution (4IR) and the technology use in science education, the current study sought to determine how teachers utilise ICT tools to address language challenges in Life Sciences classrooms. The use of ICT provides multiple representations which are pertinent in the teaching and learning of Life Sciences - a subject with many languages (e.g. Greek, Latin and English). In an explanatory mixed method research design, 42 Life Sciences teachers were purposefully selected from public schools in Johannesburg to take part in the study. Data was collected first through administration of questionnaires to the 42 teachers to establish their beliefs about the role of technology in mitigating language challenges and also their ICT competencies. Secondly, three teachers who had shown to be more digitally literate based on the analysis of questionnaire data, were selected for lesson observations. Nine lesson observations were made in total to investigate how teachers use ICT tools to mitigate language challenges. The observed teachers were interviewed once to provide them with an opportunity to explain and elaborate on some of the episodes observed in their lessons. Data analysis involved computation of descriptive statistics from quantitative data and thematic analysis of qualitative data. Findings of the study indicated that 97.62% of the teachers believed that technology can be useful in solving language problems in the Life Sciences classrooms and 95.24% indicated that they were confident in using technology when teaching Life Sciences. Teachers used PowerPoint presentations, YouTube videos and tutorials amongst others when teaching. However, in the interviews two of the teachers failed to explain how these tools helped in mitigating the language challenges learners encounter during the teaching and learning process. Another important aspect that came out is that the lack of access to appropriate technological devices thwarted teachers' efforts to use ICT tools. These findings have implications on resource distribution in schools to ensure quality teaching and learning occurs within the disadvantaged communities where the language of teaching and learning is problematic and also development of teachers' technological pedagogical content knowledge.

Keywords: Life sciences, language challenges, ICT tools, technological pedagogical content knowledge.

1. Introduction

Language has a huge influence on how effective the teaching and learning of Life Sciences can occur in a classroom where learners are not proficient in the language of learning and teaching (LoLT). A normal classroom in South Africa consists of learners of different cultures thus coming from diverse linguistic backgrounds. The teaching of Life Sciences does not accommodate learners whose home languages are different from LoLT (Owen-Smith, n.d.). In most township schools in South Africa teachers are also English second language speakers hence they struggle to explain and engage learners meaningfully in their classrooms. These challenges include difficulty in understanding the concepts, spelling and pronouncing Life Sciences terminologies (Smith-Walters, Mangione & Bass, 2016), which may include terms from Greek and Latin.

A point to note is that a child taught in a 'foreign language' is least likely to swiftly progress to upper grades because "language is not everything in education, but without language, everything is nothing in education" (Alidou, Boly, Brock-Utne, Diallo, Heugh & Wolff, 2006, p. 6). To this Moore (2007) bemoaned that whether oral or written, language remains a gatekeeper to learning. Teaching

becomes an even complex task for teachers who are responsible for classrooms of linguistically diverse learners. Teaching becomes an even complex task for teachers who are responsible for classrooms of linguistically diverse learners. A recent study by White-Clark, Robertson and Lovett (2017) has shown that ICT can be useful in a classroom to bridge the language gap provided it is used appropriately. The current paper reports on a study which determined how teachers utilise ICT tools to address language challenges in Life Sciences classrooms. The study sought to address the following research objectives: 1. To identify the ICT tools teachers can use to address language challenges in a Life Sciences classrooms. 2. To investigate how teachers use ICT tools to address language problems in a Life Sciences classrooms. 3. To assess whether Life Sciences teachers' have the capacity to utilise technology meaningfully in their teaching.

2. Literature review

The language challenges in science classrooms are widely considered as gate keepers to learning (Moore, 2007), which means that language can either give learners access to education or may hinder them from attaining their full potential in terms of performance in science assessments. One of the objectives as stipulated in the Life Sciences Curriculum and Assessment Policy Statement (CAPS) document is to ensure that learning is accessible and attainable by all learners from different backgrounds (Department of Basic Education, 2011). However, the language challenge in classrooms makes it almost impossible for the objective to be met. Because South Africa has 11 official languages, most South Africans are multilingual (they are able to speak more than one local language), which makes English a third or fourth language to most teachers and learners speak (Msimanga, Denley, & Gumede, 2017). Science subjects are well-saturated with science jargon, some which are neither easily spelt nor pronounced, which makes teaching a challenging task for most recently graduated teachers who are not native speakers of the LoLT (Smith-Walters, Mangione, & Bass, 2016). On the other hand learners stuggle to understand to the science content as learning science is synonymous with learning a new language (Brown & Ryoo, 2008).

Researchers have highlighted the following as solutions to mitigate the language challenges in a Life Sciences classroom which include: (a) using practical work and investigations to clarify concepts that may not be easily understood by the learners, (b) using analogies to further explain the biological concepts, and (c) code switching to ensure that the content is understood by the learners (Motloung, Mavuru & McNaught, 2021). Research has shown that the usage of ICT in a classroom makes teaching a less complex task as it improves the learning environment by making it more conducive to learning, thus improving the quality of education that the learners receive (Zehra & Bilwani, 2016). The use of technology attracts the attention of the learners which motivates them to engage with the learning materials and activities. Recently, studies have shown that the integration of ICT in teaching and learning bridges the language gap in the classrooms (White-Clark, Robertson, & Lovett, 2017).

The issue however is whether Life Sciences teachers have the capacity to integrate ICT tools that allow meaningful teaching and learning, and at the same time whether they can identify appropriate ICT tools to teach specific concepts and specific learners. In the US, Kajder (2005) found that 66% of teachers in the US felt very ill prepared to incorporate ICT in their lessons and by 2010, Hutchison and Reinking still found that 82% of teachers believed that they lacked proper training that would enable them to integrate ICT with the curriculum. A point to consider is that ICT integration should take into cognisance the school, its setting and environment because the integration should be context-based since these factors have implications for implementation (Rabah, 2015). This applies to the South African context where availability of ICT facilities, especially in disadvantaged communities matter (Denoon-Stevens & Ramaila, 2018). When ICT is integrated in this way, it has the capacity to develop social capital in learners and empower them in their communities (Ismail, Jogezai, & Baloch, 2020).

The current study is underpinned by technological pedagogical content knowledge (TPACK) (Koehler & Mishra, 2009) as the conceptual framework. Such a framework is pertinent in the current study considering that the ability of teachers to select the right ICT tools to teach particular content and also how they integrate ICT when teaching that content can be analysed through TPACK lens.

3. Methodology

This study employed an explanatory mixed methods research design (Creswell, 2013). Each of these methods of researching (qualitative and quantitative), could not answer the research questions independently, hence there was a need for mixed methods research. Using purposeful sampling technique (Patton, 2002) 42 Life Sciences teachers were selected from schools that had embraced the use of technology in their classrooms and had English as their LoLT. Data was collected first through

administration of a 4-point Likert scale questionnaire to the 42 teachers to establish their beliefs about the role of technology in mitigating language challenges and also their ICT competencies. Secondly, three teachers who had shown to be more digitally literate based on the analysis of questionnaire data, were selected for lesson observations. Nine lesson observations were made in total to investigate how teachers used ICT tools to mitigate language challenges. The observed teachers were each interviewed once to provide them with an opportunity to explain and elaborate on some of the episodes observed in their lessons. Data analysis involved computation of descriptive statistics from quantitative data collected through questionnaires. Interviews and lesson observations were audio- and video recorded respectively with permission from the participants. After transcription, qualitative data from lesson observations and interviews were subjected to thematic analysis (Bowen, 2009) and emerging patterns obtained.

4. Research findings

Table 1 shows the participant teachers' beliefs and competencies in using technology in their Life Sciences lessons. The 42 teachers who responded to the questionnaire items indicated that they were competent and they were motivated to integrate technology in their teaching.

Table 1. Teacher beliefs and competencies in using technology in their lessons.

Description of item	Strongly Agree/Agree (%)	Disagree/ Strongly Disagree (%)
I am very confident in using technology in my lessons.	95.24	4.76
I believe technology integration is useful.	97.62	2.38
I think technology fits my beliefs about teaching and learning.	92.85	7.15
I have no problems managing the classroom when learners are working on computers/devices.	21.43	78.57
I know how to use technology in my lessons.	92.86	7.14
I think technology is reliable.	90.48	9.52
I understand how to integrate technology into my literacy instruction.	90.47	9.53
I think internet text is easy for learners to read.	66.67	33.33
I know how to incorporate technology and teach content meaningfully.	83.33	16.67
I know how skilled my learners are at using technology.	57.14	42.87
I am motivated to use technology in my lessons.	76.19	23.81
I can control what information my learners access online.	45.24	54.76
I know how to evaluate or assess learners when they work online.	73.81	26.19
I think I have time to integrate technology for preparing learners in high stakes assessments.	76.19	23.81
I have time to teach learners the basic computer skills needed for them to learn more complex tasks.	59.52	40.48
I think I have enough time to prepare for teaching using technology.	14.28	85.72
There is enough technical support at my school.	35.72	64.28
I have received professional development on how to integrate technology.	83.33	16.67
There are adequate technological tools and equipment at my school.	30.95	69.05
I select appropriate technological tools for teaching and learning.	52.38	47.62
Average	57.00	42.00

From table 1 it shows that in as much as the teachers indicated that they were competent to utilise technology in their teaching (95.24%) since they had received professional development on how they can integrate technology (83.33%), they however indicated that time was a limiting factor. The majority pointed out that they were pressed with time as 85.72% indicated that they hardly have adequate time to prepare for their teaching using technology. Whilst teachers were technologically equipped, a worrisome proportion of teachers (40.48%) clearly indicated their lack of capacity to equip their learners with the necessary technological skills for effective learning. Only 21.43% of the teachers indicated that they could easily manage what happens in their classrooms when learners are using technology during their lessons, which relates to more than half of the participants (54.76%) who indicated that they had no control over the information their learners could access during the teaching and learning process. An important aspect to note is that the teachers indicated that their schools were well equipped in terms of the appropriate technologies for teaching, a success attributed to the efforts of the Gauteng Department of Education in providing technological resources in township schools.

Although English is deemed an international language and the language of learning and teaching, the observed Life Sciences teachers sometimes struggled to teach in English strictly, as per the policy and

also to engage their learners in meaningful discussions. When asked why they had such challenges, the participant teachers regarded Life Sciences as a language on its own which meant that teaching Life Sciences in English was like teaching two foreign languages to learners. When observed teaching, the three teachers used their laptops and projectors. Their teaching was aided by the use of PowerPoint slides displaying of notes and visuals, YouTube videos, animations, and voice over notes. The learners' attention was captured by the colourful diagrammatic representations typical of the Life Sciences diagrams and illustrations. Teachers unfortunately took this as an opportunity not to explain the concepts further. When asked how technology aided in making concepts accessible to the learners, the teachers mentioned the ability to offer multiple representations as an advantage of using technology. They considered the use of technology as replacing their voices, a weakness which rendered the use of technology ineffective in mitigating the language challenges learners had.

Teachers identified WhatsApp messenger as a useful tool in dealing with language problems between the teacher and the learner as the learners could type messages to their teacher in their preferred language as long as the teacher could understand the language. They indicated that they also used WhatsApp messenger to share the slides and notes that were displayed during the lesson hoping that learners would understand the content. The teachers attributed learners' lack of understanding of the content to the poor foundation that may have been laid down by teachers who taught the learners at lower grades. In the three schools that were visited for lesson observations, the majority of the learners spoke English as their second language. This was evident in the teachers' and the learners' usage of code switching during the lessons.

An important observation was when learners answered teachers' questions in their home languages, which showed that they had an understanding of the content taught or displayed on the board. They however failed to converse fluently in English though it could be inferred that there was some level of understanding learners had attained from the short videos or illustrations teachers used in the lessons. Unlike situations where teachers explain concepts without displaying the slides with visuals afforded by technology, in these observed lessons, learners could see the spellings of the Life Sciences terminologies, which are problemmatic to them when not displayed. In a way videos also helped them in terms of pronunciation, which teachers also struggled in considering that the terminologies may be Greek or Latin. The teachers showed appreciation of the use of technology in reducing language problems in their classrooms though they failed to identify the intricate affordances of the technologies they used in that respect.

5. Discussion

The findings of the research showed that language challenges indeed existed amongst the teachers and learners in Life Sciences classrooms. With English being an additional language for most learners in public schools, it is challenging for teachers to strictly teach in English. The participant teachers regarded science as a language which corresponds with the suggestion Brown and Ryoo (2008) made that teaching of science should be regarded as teaching a language. The teachers supported the use of code-switching as a teaching strategy which they all referred to as 'translation to a local language' in the interviews. This practice has also been found in previous studies as an effective method of making concepts accessible to the learners who are English second language speakers.

An important feature that was noticed in the observed lessons was the use of notes in the form of PowerPoint slides and elaborate diagrammatic representations typical of Life Sciences as a subject, which captured learners' attention. Though teachers lacked the TPACK (Koehler & Mishra, 2009) to meaningfully utilise this affordance to advance the reduction of language challenges in their classrooms, learners could engage with the content, which normally is not possible if teachers use explanations only. Technology has been found to be important in ridding some of the language challenges in the classroom as it has the power to represent real-life objects in a virtual space, thus making learning authentic (Hollenbeck & Hollenbeck, 2009). The teachers however showed inadequacy in TPACK development as evident in the interviews where they failed to explain different ways in which technology helped them and the learners in mitigating language challenges. As such the teachers failed to explain what they consider when selecting the technology tools to use for teaching and learning of specific Life Sciences concepts, a weakness which defeats the purpose of utilising technology in the classrooms.

6. Conclusion and implications

Though the findings from analysis of questionnaire data showed that teachers understood how to use technology and were confident to integrate it in their classrooms, they however failed to meaningfully utilise it in the classrooms when observed. This shows that there can be a mismatch between teachers'

beliefs and what they practise in the actual teaching and learning process. Whilst teachers indicated that they were knowledge and skilled to teach using technology, it should be noted that teachers still required professional development when it comes to selection of appropriate ICT tools for use in teaching specific concepts and in alleviating specific challenges for example language challenges. The findings have implications for both pre-service and in-service teacher professional development on the effective integration of ICT tools in science classrooms.

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