Natural Sciences Teachers' Experiences using Blended Teaching in Township Smart Schools: Perceived Benefits and Challenges

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Abstract

This study explored the perceived benefits and challenges that Natural Sciences teachers experience when using blended teaching in Smart Schools. This qualitative research focused on public township schools with challenging socio-economic contexts in the Gauteng Province, South Africa. A non-probability purposive sampling method was followed. The data collection technique used involved individual, face-to-face, semi-structured interviews. Interviews conducted with 10 Natural Sciences teachers were analysed through inductive analysis. The key findings of this study portrayed that teachers perceived that the incorporation of blended teaching and learning presented major pedagogical benefits, such as increased learner enjoyment and improved engagement as visual enhancements of the scientific processes and concepts aid learning, save teaching and reduce learning time since complex scientific concepts are simplified and use virtual experiments instead of traditional hands-on practicals. Efficiency in long-term running costs was seen as another benefit. According to these Natural Science teachers, one disadvantage in particular was an increased workload owing to double lesson planning for classroom activities and particularly for science practicals with and without the use of smart equipment, where there were external challenges such as load shedding, inoperable devices, connectivity challenges and/or smart equipment thefts. It is recommended that Smart School teachers are encouraged to form communities of practice to share strategies to minimise the perceived or experienced challenges in blended teaching.

Keywords: Blended teaching and learning; Natural Sciences teachers; Smart Schools; Perceived benefits; Perceived challenges

Introduction

In the twenty-first century, people around the world utilise technology in their daily lives. Therefore, technological competency is crucial for coping in a digital-driven society and especially in the Fourth Industrial Revolution (4IR). Butler-Adam (2018) highlight that science education should prepare individuals to utilise science for improving their own lives and for coping with an increasingly technological world. Fonseca and Picoto (2020) emphasise that it is important for members of society to become more digitally literate, hence the need for the education system to upskill in digital competence to address the ever-changing requirements of the labour market.

The Department of Basic Education (DBE) in South Africa recognises that blended teaching and learning and the use of ICT in schools are imperative. In 2004 a White Paper on E-

Education was published, and part of the E-Education initiative was to equip schools with technological equipment (Mukuna & Aloka, 2020). A Smart School is included in one of these government-designed initiatives where identified public schools in the townships have been converted and equipped with technological smart devices for teaching and learning purposes (Department of Basic Education, 2018). These smart devices include tablets with an e-curriculum and games, smart boards, Wi-Fi school connectivity, teacher laptops and class-size computer centres. In a Smart School, the teacher is a co-participant in the learning process. It is therefore important to encapsulate the teachers' experiences from their perspective to gain a better understanding of the perceived benefits and challenges of teaching Natural Sciences at junior secondary school level in a Smart School. The DBE in South Africa designed Smart Schools in collaboration with external stakeholders (large international companies) funding of technological smart devices and facilities (Graham et al., 2020) in order to address the need for technological advancements in schools to cope with continuous dynamic changes in technology (Butler-Adam, 2018). Ong and Ruthven's (2010) study in Malaysia confirms that Smart Schools have the adaptive ability to advance and evolve according to the changing educational learning environment. Unfortunately, there are few Smart Schools in South Africa, and the majority of the teacher and learner population have not yet experienced the benefits and opportunities of Smart Schools.

There is a substantial number of studies available regarding online, hybrid and blended teaching and learning, but there is a dearth of literature on blended teaching and learning in South African Smart Schools with a specific focus on Natural Sciences. Furthermore, research on the perceived benefits and challenges based on the teachers' experiences in a Smart School setting in various educational socio-economic contexts is limited. The aspect of the study taking place in formerly disadvantaged township schools (schools in areas that have challenging socio-economic circumstances; technologically underdeveloped schools) also underlines the uniqueness and importance of the study. These schools have been historically disadvantaged and are often inclined to be ignored as end-users of technology (Tigere & Netshitangani, 2022).

The purpose of the study was to specifically explore Natural Sciences teachers' experiences at Smart Schools within socio-economic disadvantaged communities. The study was guided by the following research question: what are the Natural Sciences teachers' blended teaching experiences at Smart Schools in townships, in terms of perceived benefits and challenges?

Blended Teaching and Learning

Although blended teaching and learning is a major global educational model, Africa still has a great need to address digital inequalities in supporting learning for work readiness in 4IR. The contributors to these inequalities are inadequate information communication technology (ICT) infrastructure and limited adjustment of the curriculum and pedagogical approaches to assist learners to cope with the demands from the 4IR world of work (Oke & Fernandes, 2020).

In South African Smart Schools, a hybrid blended learning model, i.e. the Flex Model (Hrastinski, 2019), is used rather than fully online learning blended models. The Flex model consists of a combination of face-to-face teaching and offline activities; however, homework activities are online. Some research findings support the idea that online learning enhances learning as well as higher order thinking skills (Heflin et al., 2017). However, not all topics in science can be transacted completely online because science as a discipline demands other

modes of teaching and learning such as hands-on experimentation, demonstration and discussion (Hrastinski, 2019).

Blended teaching and learning utilise a combination of face-to-face and online learning through an online learning management system, as well as traditional classroom practices. This learning practice focuses on the teachers' and learners' collaboration through various modes of delivery. This is not restricted to the classroom itself, and can exist, or be expanded, outside the classroom environment, and in turn learners' learning time and opportunities are expanded (Lawrence & Tar, 2018). The online component of blended learning can be done in a synchronous and/or asynchronous mode of delivery, which allows for the inclusion of a variety of learning styles and approaches depending on the course content and outcomes to be achieved, resource availability, internet efficiency, the availability of electricity during the lessons and apparatus for hands-on learning. The method used should be that which best suits the achievement of outcomes taking into consideration all learning styles. Teachers also need to be sensitive to the pedagogical challenges and enhancements that can be created when using technological tools (Jita & Sintema, 2022).

Teachers' and learners' perceptions of blended learning platforms and technology, and the inherent challenges, could affect the use of blended learning tools in the educational environment (Lawrence & Tar, 2018). Therefore, there is a need to ensure a greater adoption of the tools and technology available, with appropriate orientation that focuses on access and navigation, troubleshooting and helpdesk support, and on the teacher/facilitator as an active participant. Chisango et al. (2020) assert that teachers' low confidence and/or negative attitude towards the use of ICT in teaching result in lower satisfaction from learners using the blended teaching platforms. They further argued that some teachers have a positive attitude but lack the required skills in ICT. Makama et al. (2022) also emphasise that negative user experiences lead to limited participation and low attainment of the expected pedagogical gains, resulting in the abandonment of the use of technologies.

Geng et al. (2019) argue that highly self-directed learners engage more with online activities, both in class and outside, and that they are able to apply critical thinking skills in different scenarios. In South African Smart Schools, the self-directed learning activities are often homework activities or in-class activities conducted on the learners' tablets which were issued to most township school learners as part of the initiative for blended teaching and learning (Graham et al., 2020). In Natural Sciences teaching and learning, consistent integration of ICT in science classes improves the teachers' Technological Pedagogical Content Knowledge (TPACK) and simultaneously captures the interest in science of the millennials using virtual simulations, virtual labs and citizen science projects (Habibi et al., 2022).

Conceptual Framework

This study was guided by the conceptual framework which was designed by the researchers after an in-depth review of literature. The overall conceptual framework presented in Figure 1 is part of a much broader study, which depicts the Natural Sciences teachers' experiences within a Smart School setting in South Africa, which included potential benefits and challenges of blended teaching, support by external stakeholders and the nature of incorporating blended teaching. However, the latter two aspects within the framework were not considered in this study since the aim was to explore and identify the perceived benefits and challenges of blended in Natural Sciences teaching as aligned with the research question.

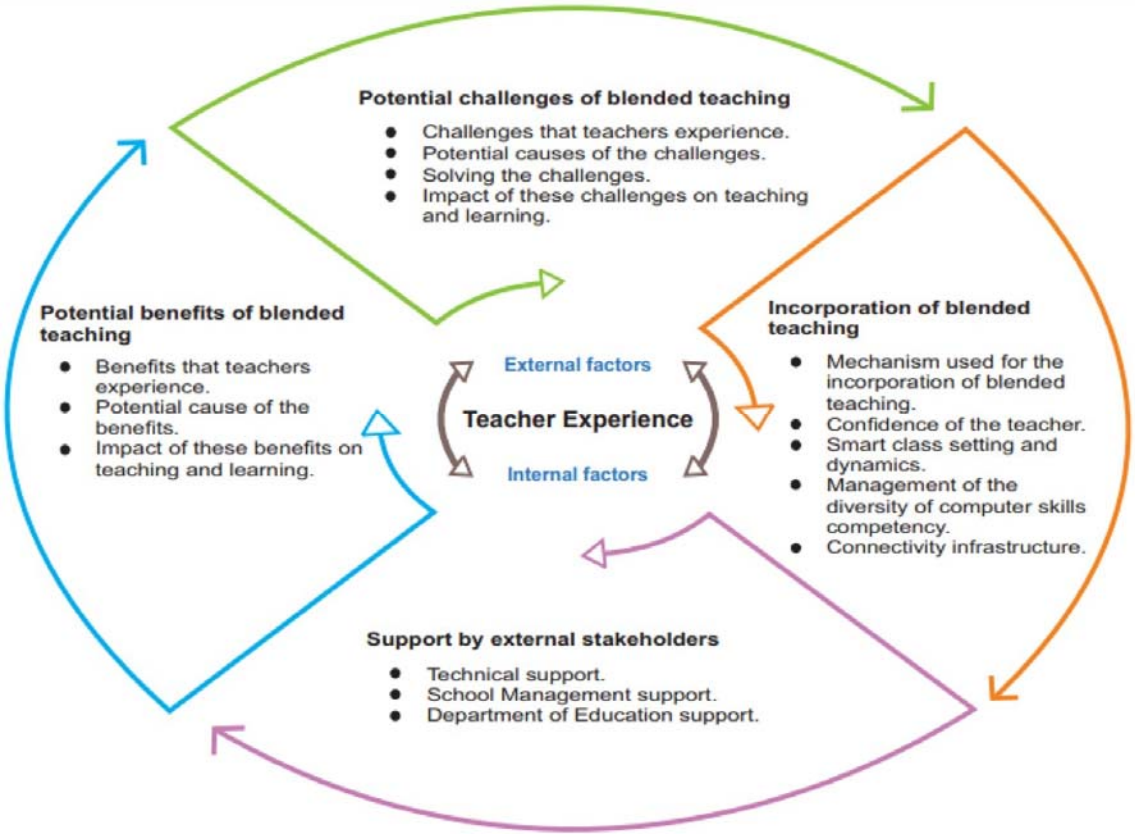

Figure 1. A diagrammatic representation of a proposed conceptual framework of this study: a teacher experience model

There are external and internal factors that may influence the teachers' perceptions in terms of the benefits and challenges of using blended teaching of Natural Sciences in Smart Schools. The internal factors include teachers' confidence in the utilisation of blended teaching tools; their ability to utilise ICT equipment for teaching and learning purposes; the ability to teach and support learners in the use of smart equipment (like tablets), educational games, virtual experiments and e-books; and teachers' pedagogical perceptions of the value of blended teaching and learning, which influence their viewpoints on both the benefits and challenges experienced (Maharaj-Sharma et al., 2017). Martin et al. (2020) confirm that incorporating technology into the classroom is affected by teacher and learner attributes, such as time management, communication and technical competence. The external factors that may also influence the teachers' perceptions of their experience include load shedding, functionality, connectivity and the safety of the equipment. Lawrence and Tar (2018) highlighted that external factors that are barriers to ICT integration have an impact on the adoption and integration of ICT in education for teachers.

According to Rogers and Twidle (2013), integrating technology in Science Education has enhanced interaction during practical work done in the science classroom. They further emphasise that professional development in terms of integrating ICT in the classroom activities and an improvement in a teacher's pedagogy to enhance learner independent learning are major benefits that stem from ICT integration in science education. Many researchers indicate that effective use of ICT in science education has the ability to improve pedagogical and subject

matter proficiency in the teachers' practice including novice teachers' practices (Jita & Sintema, 2022).

Research Design and Methodology

A qualitative research approach within an interpretive paradigm and a multiple case study design were used to address the research question posed. Flick (2022) describes the use of interpretivism as a way to understand a particular context and social relations; this was important in this study so that the perceived benefits and challenges could be explored.

Participants

The study followed a non-probability, purposive sampling method. Purposive sampling comprises pinpointing participants that are well-informed or experienced with the research topic (Palinkas et al., 2015). Purposive criteria were applied to identify five research sites (Smart Schools) and 10 participants (teachers). The school selection criteria were that the school must be a public Smart School offering Natural Sciences for the Intermediate (Grades 4–6) and/or Senior phase (Grades 7–9) within the Gauteng Province. The reason for this selection criterion was because these Smart Schools were the only ones that existed and were fully equipped at the time of this study. Ten Natural Sciences teachers at the five selected Smart Schools (two teachers from each school) were interviewed (see Table 1). The teachers' selection criterion was that they had to be teaching Natural Sciences in the Intermediate and/or Senior phase at the selected schools.

Table 1. Biographical information of the participants

Pseudonyms	Gender	Number of years teaching Natural Sciences	Number of years in a Smart School
Mpho	Female	8	2
Karabo	Female	1	1
Jeffrey	Male	3	3
Maria	Female	2.5	2.5
Janet	Female	5	3
Thabang	Male	4	2
John	Male	10	5
Alfred	Male	14	3
Joseph	Male	5	5

Research Instruments

The research complied with the ethical guidelines laid down by the researchers' university for educational research, including informed consent, voluntary participation, anonymity, trust and safety in participation, and confidentiality. Pseudonyms were used for the participants. Semi-structured interviews (duration 45 minutes) were used as a research instrument. Semi-structured interviews gave participants an opportunity to express their experiences and perceptions of their social context. Some key interview questions were: 'Explain the kind of benefits and challenges you as a Smart School Natural Sciences teacher experience in your classroom'; 'Please elaborate on what you believe is the cause and impact of the benefits and challenges that you experience in your NS classroom'; 'Do you require additional support or training to maintain or enhance your Smart school within your subject Natural Sciences? If so, please specify?'; and 'Do you as a Smart School Natural Sciences teacher find the Smart School environment beneficial to learning? Why/why not?'

Data Analysis Procedures

All of the interviews were audio-recorded and transcribed. The external transcribing was done purposefully to increase the reliability of this research. An inductive analysis of the data was conducted. This data analysis strategy assisted in grouping the data by creating commonalities, which were coded by making use of AtlasTi. The coded data were then grouped into two themes, five sub-themes and 13 categories that were in line with the research question (see Figure 2).

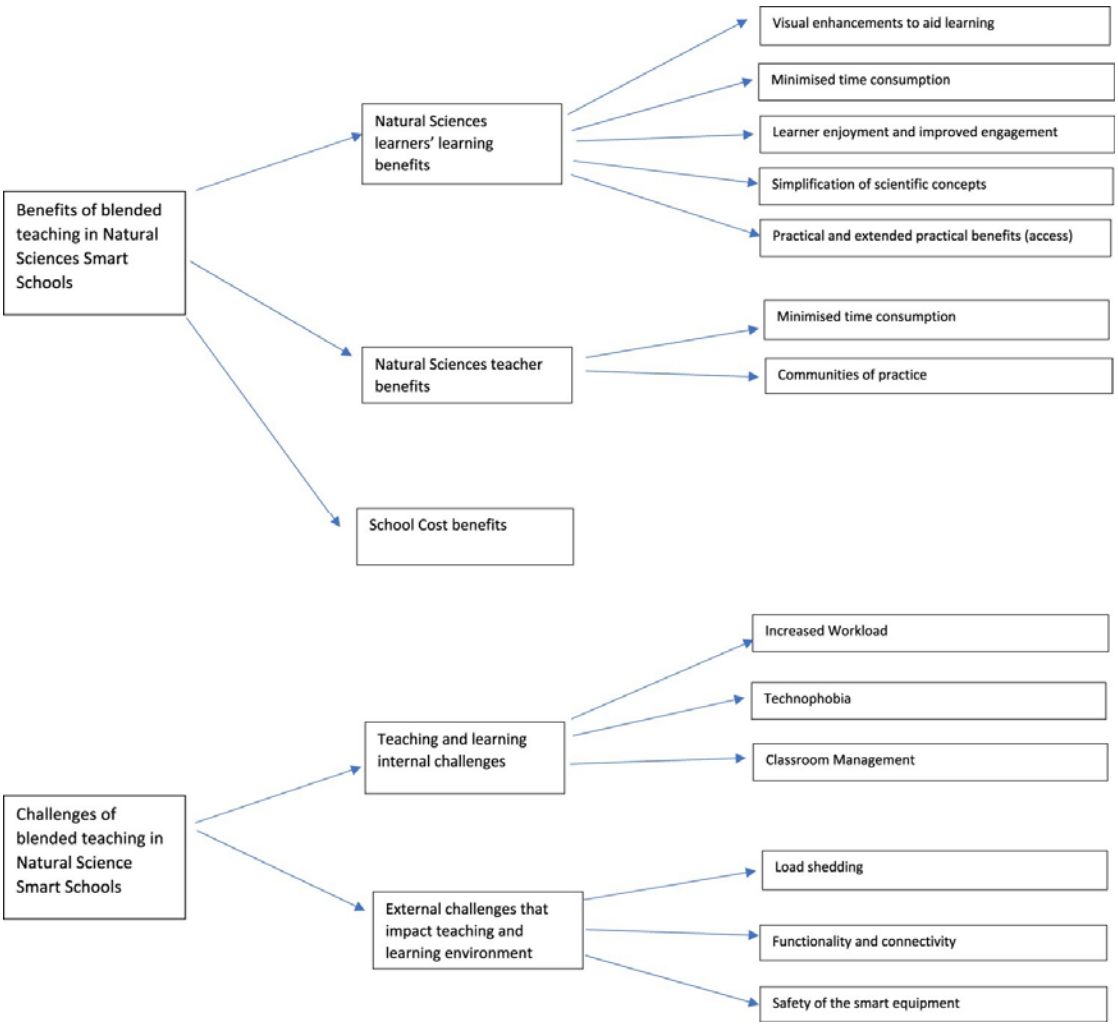

Figure 2. Graphical representation of themes with its sub-themes and categories

The trustworthiness of this research was assessed by focusing on credibility, dependability, conformability and transferability (Cohen et al., 2018). The interview schedule was piloted. Ten participants from five schools were interviewed to gain different perspectives and views about the research topic to avoid potential bias. Cross verification was completed by comparing the data received from the transcriber and the recordings. Member checking with the interviewed teachers was necessary to ensure that the interpretation of the responses was in accordance with the teachers' intentions. Dependability was ascertained by keeping an audit trail that provided comprehensive details of the research process. Coding of the interview transcripts was done by three researchers and compared. Confirmability was achieved by

including the participants' verbatim quotes from their responses to support their answers to the research question.

Findings and Discussion

Perceived Benefits of Blended Teaching in Natural Sciences Classrooms

The findings showed that the perceived benefits included learners' learning benefits, teacher benefits and school cost benefits.

Natural Sciences Learners' Learning Benefits

The Natural Sciences teachers highlighted numerous benefits for their learners, which were grouped into five categories: visual enhancements to aid understanding; saving time in learning; learner enjoyment and improved engagement; the simplification of scientific concepts which aided teacher explanations; and practical/experiments simulations and extended access benefits.

Visual enhancements to aid learning

All the Natural Sciences teachers indicated that visual enhancement to support the learning process was a key benefit of the Smart School setting. They further explained that the utilisation of visual components in the learning process helped learners to visualise learning content. The teachers further extolled the use of videos, models, virtual reality, games and virtual experiments in providing learners with visual stimuli for learning. In support of this, Rogers and Twidle (2013) highlight the necessity of visualisation to enhance learner engagement and motivation in learning about concepts and aiding abstract thinking, which in turn assists learners in remembering and making better cognitive connections. This was also mentioned by Karabo:

> You can open the pictures like for fertilization, human anatomy, phases of the moon, different compounds so the learner will understand more because when you teach the learners without visualising it's very difficult because the learners are not at the same level of understanding, others they are struggling. So, if you visualise, they see the pictures, it's easier for them to understand what you are talking about or what are you teaching.

Minimised time consumption

Smart Schools are more time effective for learners as they can access information in real time and they do not need to spend excessive amounts of time making notes. John provided the following account:

It's useful when it comes to saving time so instead of writing notes on Life and Living or Planet Earth and Beyond. I can send them notes but in class we write the other themes, so they don't spend more time writing notes they can just write summaries and then compare them with already sent notes and textbooks.

Learner enjoyment and improved engagement

Another learning benefit was enjoyment and improved learner engagement through making use of the smart equipment in the Natural Sciences classroom. The majority of Natural Sciences teachers indicated that the learners enjoyed using the smart equipment and this led to learners being more self-directed and engaged with the content. The teachers emphasised that learning through a blended mode of delivery improves learners' self-enrichment and self-discovery skills, therefore learners are more actively involved in their own learning, resulting in independent learning. In a comprehensive literature review Shan-Fu (2013) also found that learners are more self-directed whilst using ICT for learning. It was further found that the Smart School learning environment improves learner engagement and keeps the learners interested in the Science subject. The use of ICT aids them to manage digital information more effectively. Karabo explained:

> Okay it is enjoyable for the learners because when you use the old textbook, they get bored, but when you use a smartboard, they saw pictures that you are talking about … it's very interesting and it's easier to address maybe when we Google and you find some different ways, I can use the Google so that we can get answers of the definition for the words that I'm using in the Natural Sciences topics.

Simplification of scientific concepts

As reported by all the Natural Sciences teachers, another benefit was that blended learning makes it easy to explain intricate and abstract scientific concepts in a more simplistic way, which enhances learner understanding. Habibi et al. (2022) have found that blended learning promotes learners' understanding of scientific concepts and increases learners' ability to apply higher order thinking. The teachers in the current study indicated that the smart equipment helped learners to grasp intricate and abstract scientific concepts as the equipment displayed and demonstrated the learning content more visually, and virtual reality could be used to demonstrate complex scientific learning content. Using games and applications, learners became more active in their learning, which assisted them in learning science content more effectively. Markauskaite and Goodyear (2020) explain that teaching with technology assists learners to be involved in hands-on learning, which maximises the impact of their learning process. This was emphasised by Thabang:

> When I teach photosynthesis, factors that affect it, and its by-products, they [learners] never wonder how it happens that sunlight becomes part of food making. Now I give them a more technological interactive option which gives them kind of the knowledge to see what actually happens and this also starts to release a hunger and a curiosity for further learning.

Practical and extended practical benefits (access)

Beyond the learning benefits, a Smart School setting provides practical and extended access benefits to Natural Sciences learners. In this study virtual laboratories were found to support learning practically, and Maharaj-Sharma et al. (2017) identified that virtual laboratories allow learners to repeat activities, which is not possible in traditional classrooms. Further practical benefits were that learners did not need to carry excessive amounts of textbooks as all their textbooks and learning resources were electronically available on their tablets. Some of the Natural Sciences teachers indicated that this supported learners who needed to travel long

distances to school. In terms of the extended access benefit, several teachers indicated that the learners' exposure to ICT at the Smart School may be their only ICT exposure as they might not have ICT equipment at home. From this perspective, Smart Schools in South Africa have been deliberately positioned to redress socio-economic differences by placing these Smart Schools in townships where there are more financially disadvantaged people. This particular strategy forms part of the underpinnings of the Broadband Policy of 2013 (Department of Communications, 2013). Janet outlined different ways in which learners could access complex scientific explanations and how she assessed them.

> I teach some Natural Sciences concepts through science channels which have alternatives to practicals, like cyber schools, Sciences roulette and assess them through Biology quizzes, match and learn science, the periodic table quiz, elements of the periodic table, acids and bases, energy and power.

Natural Sciences Teacher Benefits

Teacher benefits are categorised into time saving and communities of practice.

Minimised time consumption

Most of the Natural Sciences teachers indicated that teaching in blended learning environments saved them time as they did not need to write on the chalkboard repeatedly for each new class that they saw. They could simply type their work and save it to be accessed again for each parallel Natural Sciences class.

Communities of practice

A few Natural Sciences teachers supported one another with the functionalities of the smart equipment and shared best practices on how to teach using the smart technology. These Communities of Practice were sometimes formal, but it was clear in this study that some of the teachers paired themselves with a peer who had good ICT skills. Shand and Farelly (2018) recognise that in blended teaching and learning environments, peer relationships and communities were formulated to support one another.

School Cost Benefits

The initial costs to set up a Smart School are high, but the long-term running costs are more financially feasible. According to Talebian et al. (2014), e-learning saves costs and time as learners can learn anywhere where they have access to the internet. The Natural Sciences teachers in the current study added that smart equipment does not need to be replaced often and that they can utilise their tablet over and over and merely get new e-books loaded onto their tablet. Some schools mentioned that they no longer needed to buy chemicals since the practicals could be done online.

Perceived Challenges of Blended Teaching in Natural Sciences Smart Schools

Teaching and Learning Internal Challenges

The Natural Sciences teachers highlighted numerous internal challenges in blended teaching in Smart Schools, which were grouped into three categories: increased workload; technophobia; and classroom management.

Increased workload

One of the challenges that Smart School teachers experience is an increased workload. Unreliable and inoperable equipment have a momentous effect on the teachers' workload in the Smart School settings, as teachers need to plan for teaching using the smart equipment and using traditional teaching methods, owing to potential problems that could occur with the smart equipment. A few Natural Sciences teachers indicated that they must create two lesson plans for every lesson and even if the teachers intended to do online experiments, they still prepared demonstration apparatus in case there was internet or power failure. The time that teachers spent planning for the utilisation of smart equipment in their classroom was more than for teaching in a traditional classroom. According to Lin et al. (2013), incorporating ICT in the classroom is more time consuming as it increases the teachers' lesson preparation time and the creation of teaching activities.

Technophobia

Some of the Natural Sciences teachers' technophobia is a challenge that impacted their confidence in using the smart equipment. Teachers who were not as confident in the use of technology admitted to minimal use of the smart equipment or if they used the smart equipment, they merely used the functionalities that they knew and did not explore further functionalities by themselves. Moodley et al. (2020) equally observed that if teachers suffer from technology anxiety, they are reluctant to use technology as they fear losing classroom control and being perceived as incompetent in front of learners. Although their perceived skill set varied in terms of ICT competence, all teachers in the current study indicated that they would like further training in functionalities and how these can be used for teaching and learning.

Classroom management

Teachers in a Smart School experience an increased classroom management responsibility. Many Natural Sciences teachers indicated that learners are more engaged in the learning content and therefore the classroom management was improved by using smart equipment. Contrastingly some teachers indicated that the use of smart equipment could lead to an additional layer of classroom management as learners would get distracted and not use the smart equipment for learning purposes. Alfred provided the following narration:

> Learners might want to play with the instrument … you know, instead of learning. So, we need to constantly conscientise them so that they don't get distracted from the outcomes of the lesson and have strict classroom rules. As you can see, classroom rules around challenging them to concentrate and focus only on the academic and not on any other things.

These teachers specified that their classroom management load increased as they needed to monitor what the learners were doing on their tablets. Peck et al. (2015) reiterate this, noting that learners use their ICT devices for social media and personal use instead of using them as a learning support tool.

External Challenges that Impact the Teaching and Learning Environment

The Natural Sciences teachers highlighted three external challenges that impact the teaching and learning environment, i.e. load shedding, functionality and connectivity challenges, and safety of the equipment.

Load shedding

Load shedding is when electricity is turned off across one or several power grids to manage the amount of power used, and to avoid a nationwide power collapse in the electricity supply system. Load shedding in Smart Schools causes major problems as the smart equipment requires a power supply. Generators can be used to supply electricity during load shedding; however, not every Smart School has a generator. Tigere and Netshitangani (2022) also emphasised the negative impact of load shedding on the use of technology for teaching and learning and they further indicated that less affluent schools cannot afford power alternatives. Some teachers in the current study indicated that they had hard-copy textbooks as well as tablets. These hard-copy textbooks were used when the smart equipment could not be used or was inoperable. This caused an increase in expenditure for schools as they needed to buy hard-copy textbooks alongside e-books to try to mitigate circumstances where smart equipment was inoperable. Karabo explained:

> you must always be having plan B so that if ever load shedding happens, you have got another lesson that you've prepared which will not require the use of what, smartboard and projector.

Functionality and connectivity

Functionality and connectivity were also found to be a challenge for the majority of Natural Sciences teachers. The teachers raised the concern that the smart equipment needs stable connectivity, appropriate ICT infrastructure and ample bandwidth to allow teaching and learning to take place smoothly. Some of the teachers indicated that if there were connectivity issues, the smart equipment would lag, buffer or become inoperable. Naturally, this is disruptive to teaching, especially when teachers want to carry out alternatives to practicals or virtual laboratories. Herselman et al. (2020) also experienced the same challenges of tablets malfunctioning or freezing in their study of training teachers in rural schools to integrate ICT in classroom activities.

Safety of the smart equipment

Smart Schools are known to have high-tech equipment on the premises, making these schools vulnerable to criminals. These schools are in townships that are less affluent and have challenging socio-economic contexts. Smart Schools have safety precautions such as gates, alarms, safes, and security guards to prevent burglaries, as urged by Selwyn et al. (2017). However, according to a few of the Natural Sciences teachers in the current study, where learners were allowed to take smart equipment home, they were at risk of being mugged owing

to socio-economic issues within the surrounding location of their Smart Schools. Joseph described that:

> The tablets are given to them from school, they sell them and then come and say the tablets have been stolen or taken from them. Another challenge with the usage of these tools in classes is that people get to target the schools to come and rob the schools of these smart boards and computers.

Recommendations

It is recommended that Smart School Natural Sciences teachers vocalise their training needs and use the Quality Management System and/or subject meetings within the school, as well as facilitator meetings with the DBE for addressing those needs. Smart School teachers should practise lifelong learning to keep abreast of innovations in teaching Natural Sciences using educational technologies to improve their practice. The South African Council for Educators, which is the professional body of teachers in South Africa, recognises teacher development as a means to enhance the teachers' level of competence to be relevant in the educational domain (South African Council for Educators, 2020). Teachers can also form Communities of Practice, where they can learn from each other regarding best practices in teaching Natural Sciences in blended environments.

This study shows that teachers report that Smart Schools in South Africa have multiple pedagogical and learning benefits that assist Natural Sciences learners in grasping complex scientific concepts so as to improve the performance in sciences, especially in township schools. Therefore, an increase in the number of Smart Schools is needed to redress the socio-economic development issues of learners who may not have access to smart equipment at home, and who need technological development to enable them to sufficiently contribute to the workplace in this digital era.

The development of a tailor-made policy or guideline is recommended for Smart Schools and their educational setting. The existing DBE ICT Policy is broad and does not clearly provide details to guide these teachers in navigating the functionality and pedagogy of teaching in a Smart School and the Policy is not subject specific. The DBE's teacher development department should create continuous teacher development to improve the teachers' TPACK so that they can use relevant technology, pedagogy for the appropriate scientific concepts or content in the Natural Sciences classroom to optimise the teaching and learning benefits.

Concluding Remarks

From the findings, it is evident that the teachers acknowledge both the benefits and challenges brought about by blended teaching of Natural Sciences in Smart Schools. However, taking into consideration both the internal and external factors reflected in the conceptual framework as well as the teachers' narratives, it is clear that the benefits seem to outweigh the challenges. The teachers concur on the overall benefits of blended Natural Sciences teaching in Smart Schools especially in simplifying complex scientific concepts through virtual simulations, experiments and showing processes. The findings of this study should inform policymakers, the DBE and the Gauteng Member of the Executive Council (MEC) on issues to take into consideration to improve the effectiveness of Smart Schools by minimising the challenges mentioned by the teachers. Finally, the results of this study may serve as a guide to further work in other areas of research, such as exploring the effectiveness of support of teachers by

external stakeholders and the incorporation of blended teaching as depicted in the conceptual framework model as well as the influence of blended teaching and learning on learner proficiency in Smart Schools.

Disclosure Statement

No potential conflict of interest was reported by the authors.

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