Jurnal Pendidikan Teknologi dan Kejuruan
Vol. 30, No. 1, May 2024, pp. 145-156
https://journal.uny.ac.id/index.php/jptk/issue/view/2602
DOI: https://doi.org/10.21831/jptk.v30i1.72289

Smartboard enhanced creativity in the technology classroom: lessons on mechanical systems and control

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ABSTRACT

Smartboards are generally known for enhancing interaction between teachers and learners because of their capacity to communicate and interact with devices such as smartphones, tablets, and computer screens. These are technologies that exist in our schools, and both teachers and learners have warmed up to them as educational assistive technologies. However, what are their benefits in teaching technology concepts in our classrooms? The purpose of this study was to explore how smart boards enhance creativity in Technology classrooms. The theory of creativity was used as a lens to view the study. The study used a qualitative research approach and a case study design to gather and analyze data. Semi-structured interviews and observations were used as data sources from four schools, which were purposively sampled because they had smart boards. Four Technology teachers and eight learners were the participants in the study. Thematic analysis was used to analyze the data. This study found that smartboards acted as a savior for teachers in explaining the mostly confused mechanical systems concepts of gears, pneumatic, and hydraulic systems. These smartboards displayed animation and real-life videos that augmented the conception of mechanical concepts in Grade six. Teachers and learners found that smartboards were able to make lessons interesting and exciting as they were reflecting real-life context examples. Thus, this study calls upon subject experts to design activities and lessons that can solely be done through smartboards to increase the number of educators that use them. Learners are not always sharp in concentration, thus having animation and other videos boosts their focus on what is being studied.

Keywords: Effectiveness; Smart Board; Creativity; Creative teaching; Creative thinking

Article history

Received:	*Revised:*	*Accepted:*	*Published:*
29 March 2024	*06 May 2024*	*10 May 2024*	*31 May 2024*

Citation (APA Style): Ndwandwe, K. P., Ramalingela, S. M., Mtshali, T. I. (2024) Smartboard enhanced creativity in the technology classroom: lessons on mechanical systems and control. *Jurnal Pendidikan Teknologi dan Kejuruan*, 30(1), 145-156. https://doi.org/10.21831/jptk.v30i1.72289

INTRODUCTION

Today, educators around the world are very much interested in learning how to keep creativity in the classroom Al Hashimi (2020). This helps their learners look forward to their lessons, particularly when there are technologies that enable interaction between the social world and classroom practice. Henriksen et al. (2017) brought to light the difficulty teachers face in coming up with original ideas for instructive practice issues. These include "self-identifying as "creative" or being uncomfortable with intellectual risk-taking and open-endedness" (pg. 1).

Furthermore, Nikolopoulou (2019) suggests that novel teaching instruments and existing frameworks are insufficient; as a result, it is critical that educators obtain the necessary training to welcome innovations and foster creativity in educational settings.

There is extensive global research on Technology Education, covering various aspects such as creativity, critical thinking, and pedagogical methodologies. For instance, Neo and Neo (2013) investigated learners' creativity and design skills in a Malaysian classroom using multimedia projects, while Shubina & Kulakli (2019) explored pervasive learning for creativity development. In South Africa, studies by Makgato (2012) and Kola (2015) focused on constructivist methodologies and critical thinking skills, respectively. While most recently, Nkosi, Kola and Mtshali (2024) looked into the paradox of creative thinking skills among Technology teachers, they discovered that their conception of creativity is impaired making it difficult to employ various strategies to enhance it in their classrooms. However, research on the effectiveness of smart board usage in enhancing Technology teachers' creativity, particularly in South Africa, is lacking. Therefore, this study aims to fill this gap by examining the effectiveness of smart board integration in enhancing Technology teachers' creativity in the classroom.

In the past years, the Department of Basic Education (DBE) provided smart boards to most of the Mathematics, Science and Technology (MST) schools and their feeder schools in Mpumalanga Province. The smart boards were installed in Grade 6 classrooms for teaching Mathematics, Science and Technology subjects. The purpose was to enhance effective teaching and learning in Grade 6, while preparing the learners for high school. However, Khoza, Kekana, and Dlamini (2019) who were later supported by Ndwandwe, Ramaligela and Mtshali (2024) report that, the smart boards that are available in these feeder schools are rarely used by the teachers, partly because they are not sure of their benefits in teaching and learning. Some teachers think that the smart board is there to replace them as the authoritative sources of information and ultimately, they will take their jobs (Oriji & Amadi, 2016). The shortage of teacher training in creativity can be the motive why most teachers do not employ creative activities through the use of smart boards in the classrooms (Mróz & Ocetkiewicz, 2021). The smart boards are, however, used by the School Management Team (SMT) to review and analyze the school results (van Niekerk, 2015). Actually, Technology teachers rarely use smart boards for teaching and learning (Ndwandwe et al., 2024). If technology can be used adequately in schools, it would be a great tool for creativity (Kekana et al., 2024). In the school where the researcher is working, the observation is that some teachers are not using smart boards to teach, and this was further confirmed by teachers in the other schools. This experience was also identified by Oigara and Keengwe (2013) who found that most of the teachers did not use smart boards. In addition, there are very few teachers in schools who completely welcome the use of technologies and are prepared to learn how to use them in

their classrooms (Oriji & Amadi, 2016). However, according to the researcher's experience as a teacher, the teachers' hesitancy to use technologies such as the smart boards, especially during the Covid-19 pandemic period, where online learning was encouraged, delayed an alternative way to assist most of the learners to understand various concepts much easier (Sari & Hamdi, 2021). Researchers such as Ghavifekr (2006) argue that the lack of teachers who engage using Information Communication and Technology (ICT) tools in their classroom practice may further result in the lack of opportunities for greater creativity in the classrooms. Hence, this study sought to explore the effectiveness of the smart board in enhancing Technology teachers' creativity in the classroom.

Literature review

Teachers' perceptions and beliefs play a crucial role in the effectiveness of Information and Communication Technology (ICT) implementation (Albugami & Ahmed, 2015). The success of ICT classrooms hinges on teachers' attitudes and convictions towards technology (Clement, 2012). However, Beghetto (2007) notes that teachers often view creativity as an additional burden rather than an integral aspect of teaching. Integrating smart boards into teaching practices may represent an effort by teachers to address the diverse needs of their students (Bdiwi et al., 2019). Additionally, Yangın Ekşi and Yeşilyurt (2018) suggest that smart boards can enhance creativity by enabling teachers to present visually engaging material accompanied by audio and animations. Mustapha (2019) finds that teachers with computer skills generally exhibit a more positive attitude towards smart board usage. However, despite some teachers' positive inclinations, many lack the necessary skills to effectively integrate smart

Learners' perceptions towards the use of the smart board in the classrooms

Min and Siegel (2011) report that learners' perceptions only marginally favor the use of the smart boards. Not a single learner in the study preferred learning without technology, and only half of the learners found the smart boards more appealing. In addition, Chau, Zainuddin, Ling, Ng and Yang (2020) found that the use of smart boards brings fun and variety to learning, as the learners adopt positive perceptions. Since the learners do not only learn but they enjoy the lessons, they always look forward to class.

Smart board technology has an opportunity to give a positive impact in the learners' creativity since the learners will develop their own idea after going through the online resources that the smart board offers (Aldalalah, 2020). Learners are using the smart board for entertainment purposes, while some use it for their own presentations (Mihai, 2020). Teaching using smart boards is more fun, exciting, engaging, and enjoyable. In addition, it provides so many opportunities for the learners as it allows them to access a number of resources in a short space

of time (Singh & Mohamed, 2012). Hence the study sought to explore the effectiveness of the smart board in enhancing teachers' creativity in the Technology classroom.

Theory of creativity

To explore the effectiveness of the smart board in enhancing Technology teachers' creativity in the classroom, this study used the theory of creativity which was developed by the National Advisory Committee on Creative and Cultural Education (NACCCE) in 1999. Creativity is characterized as a form of imaginative engagement that strives to generate outcomes that are both unique and valuable (NACCCE, 1999). The theory further says that creativity is viewed in two angles, which are creative teaching and teaching for creativity. By teaching creatively, the teachers employ creative approaches to make learning more interesting, exciting and effective, and teaching for creativity means developing the learners' creative thinking (Yazgan-Sag & Emre-Akdogan, 2016).

The theory of creativity was used as a lens to view how the smart board could enhance Technology teachers' creativity in the classroom. This study considered both teaching creatively and teaching for creativity. While utilising the smart board for creativity, the teachers need to think about two parts of creativity. Firstly, how the smart board may provide the teachers with opportunities to teach creatively, and secondly, how the smart board may encourage and support the learners to develop creativity skills.

METHOD

Research approach

In this study, a qualitative research approach was employed. The purpose of using this qualitative approach was to gather comprehensive descriptive data concerning the specific phenomena to gain a deeper understanding of the subject being investigated (Merriam & Grenier, 2019). In addition, qualitative research enables researchers to explore diverse perspectives within a community regarding a specific research topic (Choy, 2014).

Research Design

A case study design was used in this study to explore the teachers and learners' perceptions towards the use of smart boards in enhancing Technology teachers' creativity in the classroom. Using case studies, the researchers can explore the motives behind the specific actions of the participants thus providing proof and findings (Rauch et al., 2014). In addition, the study used a multiple case study design. Using a multiple case study design allows the collection of complete data from multiple sources in a variety of locations (Unluer, 2012). The research design therefore drew together various case studies from four primary schools that were already using the smart boards for teaching in Nkomazi East Circuit.

Population

According to Omona (2013), the term population refers to a group of individuals, objects or events which the researchers can generalize and make them the focus of the study for their research findings. The target population for this study was the Technology teachers and the learners from primary schools around Nkomazi East Circuit, in Mpumalanga Province. There are 15 primary schools in Nkomazi East Circuit.

Sampling

To explore Technology teachers' perceptions of the effectiveness of the smart board in enhancing their creativity, the study purposively selected four Technology teachers who were using smart boards in their classrooms from four primary schools within Nkomazi East Circuit in Mpumalanga Province. Four teachers were purposively sampled in order to understand their views on the effectiveness of the smart board in enhancing the teachers' creativity. Even though this was an ungeneralizable sample, this study's inclusion criteria was that the teachers should be habitual users of smartboards which took us to four teachers in the whole circiut.

Data Collection Techniques

As this was a qualitative study, the researcher conducted semi-structured interviews within the schools attended by the participants.

Semi-Structured Interview

The theoretical framework was used to develop the semi-structured interview schedule. The semi-structured interview schedule consisted of nine semi-structured questions, and it was used to on the Technology teachers' perceptions of the effectiveness of using the smart board in enhancing the teachers' creativity. The interviews were conducted with the teachers. Observations were used to supplement a single aspect of this data collection which was concerned with proofing the claims made by the teachers on developing critical thinking skill.

Data Analysis

According to Stake (1995) there is no specific point during the qualitative research process at which data analysis must start. Data analysis can occur simultaneously with data collection. According to Harding (2013) in the data analysis process, the researcher should become familiar with the data through reading, providing detailed descriptions, classifying data into themes and then interpreting the data. Hence, this study used thematic analysis to review the information available to the researchers to deepen their understanding and meaning so that they are able to draw conclusions from the data (Noble & Smith, 2014). To analyze the qualitative data, the researcher used the data analysis steps as outlined by Mabuza, Govender, Ogunbanjo and Mash (2014) which involve familiarization, the development of a thematic index, charting, interpretation, and confirmation.

So, to analyze the semi-structured interviews, information was obtained from the semi-structured interviews and transcribed from the voice recorder into a word document, and it was stored in a computer file for analysis (Mayring, 2014). The researcher was quoting exactly what the participants said. The data was coded into themes and categories and analyzed based on the purpose of the study.

RESULTS AND DISCUSSION

To reiterate, the purpose of this study was to explore the effectiveness of smart boards in enhancing Technology teachers' creativity in the classroom. Through data analysis, this study determined that smartboards in Technology classrooms made teachers to:

- Present interesting lessons,
- Become excited in teaching technology concepts effectively, and
- Develop learners' creative thinking skills.

The themes are unpacked below:

Presenting lessons interestingly

When analyzing the collected data from the semi-structured interviews the study found that both teachers and learners perceive smart boards as a good tool in enhancing Technology teachers' creativity, see the extract below:

"I was struggling to teach about pneumatic and hydraulic systems, I always used syrenges for demonstration and it was not always interesting, now I get to use videos showing real examples of pneumatic systems." – Teacher B interview.

With smart boards, teachers can create more dynamic lessons by writing or sharing multimedia content such as videos and images (Sukadari et al., 2023). Indeed, this resonated with teacher B's view that vidoes can be played on smartboard to give learners an experience of the real world. Also, a group of learners from Teacher B expressed their views about learning through smartboards, see the except below:

"The teachers showed us a truct with a load and how they stop. Trucks takes a bit longer to stop because the use air unlike cars that use liquid." – Learners interviews

Indeed, based on their inputs, it showed that learners could understand the concept of pneumatic and hydraulic systems much better through the video which was played on a smartboard. Interestingly, Tsayang, Batane, and Majuta (2020) conccurs that the capabilities of the smart boards to present information visually, greatly assist learners in understanding concepts better. It is worth mentioning that based on the other three teachers, they used diagrams and power point presentations to draw learners' prior knowledge about mechanical systems and control. It was also reported by Khosa (2020) that, a smart board makes teaching and learning interesting as it

provides new ways for teachers to teach, and learners to learn because the touch screen capabilities allow learners to touch and interact with the board. Teachers could also elaborate on the concepts easily as learners were seeking clarity based on the diagrams, pictures and You Tube videos shown to them.

Exciting lessons in teaching technology concepts effectively

It is common course that creative teaching involves making a lesson more interesting and assisting teachers to deliver difficult concepts effectively (Jimoh et al., 2020). In this case, Teacher A, B, C and D seemed to have similar examples of how they made their lessons exciting. This included the use of similar animation vidoes and diagramsm, to clarify and describe forces, flcrum and equilibrium concepts. When asked what the reasons could be, they all use similar animations to make vidoes they responded as follows:

"We are in the same circuit, and we receive similar sources from our cluster leaders. Last year we were visited by a company which delivered a lot of resources like USB, CDs, charts and toys". Teacher C interview

"In my school they told us that we can start with coding and robotics from grade 4-6 with those toys". Teacher A interview

It seems that teachers used all the donated resources in their schools to make their lessons exciting. The fact that the donors had thought about coding and robotics when they donated, teachers took the opportunity to maximise the use of those resources to deliver technology lessons instead. This speaks volumes about teachers' creative capabilities. According to Bereczki and Kárpáti (2021)it is in the nature of a creative teacher to use any technology-based resource to foster creativity in their planning, teaching and assessment practices.

Development of creative thinking skills

To develop learners' creative thinking skills, teachers used smart board to design practical tasks that relates to learners' social context, see extract below

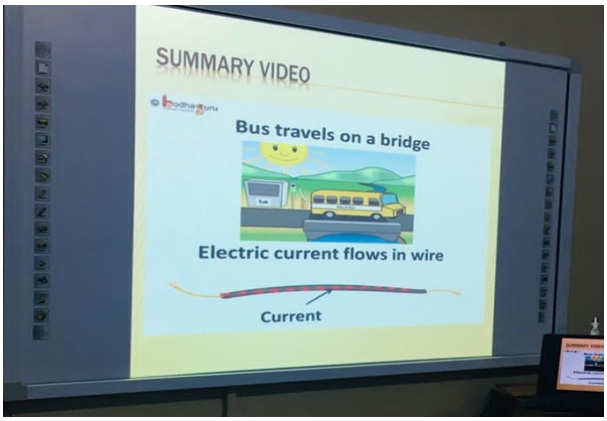

Figure 1: Teacher D's class

During Teacher D's lesson, he finalized his lesson by showing how mechanics ultimately affect their daily lives. He posted a school bus so that learners can start to think why learning about gears, belts, hydraulic and pneumatic systems. This was one way of developing learners' creative sphere. According to Mtshali (2020) one of the greatest determinants of creativity and critical thinking, it is the ability to think and associate information given with many possible scenarios of where it can be used. This reflects Teacher D's lesson that although he was not really talking about school bus, it was given that the gears and pneumatic systems cocnpets could be associated with a scenario that closely links to learners in a school, which is a school bus.

Significance of the study

This study was very important as it contributed to the literature on how to utilize the smart board to enhance the teacher's creativity. The analyzed results of this study served as a secondary source for the identified gap and provided solutions to the issues that other researchers in this area needed to address. This meant that other researchers were able to find information based on the use of the smart board for creativity. The study guided the Department of Basic Education officials on how the smart board could effectively enhance the teachers' creativity. It provided a good understanding of how a smart board could stimulate learners' creative thinking skills in the Technology classroom. The study introduced the teachers to a new teaching approach that encouraged creativity during the teaching and learning process. Additionally, the study assisted other researchers who wanted to investigate the positive or negative impact of using the smart board on teachers' creativity and engagement in the Technology classroom.

Limitations

The research was based in some schools in Nkomazi East Circuit, Mpumalanga Province of South Africa. Sample size had a great effect on the interpretation of this study. However, this study in on the view that schools with similar context may resonate with it and thus increase reliability and generalizability. Smartboard is a global phenomenon educational technology, and it is used by a lot of people who experience similar challenges and successes stipulated in this study. Future research should consider including teachers of other subjects as participants in studies related to creativity through the use of smart boards. While this study employed qualitative research methods, future investigations could benefit from employing both qualitative and quantitative approaches.

CONCLUSION

In conclusion, the study revealed that the smart board assist the teachers to successfully make their lessons more interesting, exciting, effective, and developed the learners' creative thinking skills. It is not only beneficial to Technology classroom, science, geography and

mathematical subjects could benefit more on the use of smartboards. We thus call upon subject experts to design activities and lessons that can solely be done through smartboard. This is with a view to increase the number of educators that uses it. Learners are not always sharp in concentration, thus having animation and other videos boots their focus on what is being studied.

ACKNOWLEDGMENT

- I would like to thank God for His strength, guidance, grace, and wisdom in making this research project a great success.
- I also wish to show gratitude to my family and friends for their continuous support and assistance.
- I would like to appreciate my supervisor Prof. Ramaligela S.M. for her direction, assistance, advice and support throughout the course of the study. As well as my co-supervisor Dr. T. I. Mtshali for organising writing retreats and meetings during the study.
- Special thanks to all the participants who participated during the data collection process.

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