



www.ijres.net

Constraints and Performance Gap Analysis (CPGA) of Lecturers in Utilizing Smart Boards for Improving Students' Engagement, Motivation and Learning Outcomes (SEMLOs)

Jimoh Bakare 
University of Nigeria, Nsukka, Nigeria

Samson O. Ariyo 
University of Nigeria, Nsukka, Nigeria

Samson A. Ojo 
University of Nigeria, Nsukka, Nigeria

To cite this article:

Bakare, J., Ariyo, S. O. & Ojo, S. A. (2021). Constraints and Performance Gap Analysis (CPGA) of lecturers in utilizing smart boards for improving Students' Engagement, Motivation and Learning Outcomes (SEMLOs). *International Journal of Research in Education and Science (IJRES)*, 7(3), 681-714. <https://doi.org/10.46328/ijres.1765>

The International Journal of Research in Education and Science (IJRES) is a peer-reviewed scholarly online journal. This article may be used for research, teaching, and private study purposes. Authors alone are responsible for the contents of their articles. The journal owns the copyright of the articles. The publisher shall not be liable for any loss, actions, claims, proceedings, demand, or costs or damages whatsoever or howsoever caused arising directly or indirectly in connection with or arising out of the use of the research material. All authors are requested to disclose any actual or potential conflict of interest including any financial, personal or other relationships with other people or organizations regarding the submitted work.



This work is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License.



International Journal of Research in Education and Science (IJRES) is affiliated with the **[International Society for Technology, Education, and Science \(ISTES\): www.istes.org](http://www.istes.org)**

Constraints and Performance Gap Analysis (CPGA) of Lecturers in Utilizing Smart Boards for Improving Students' Engagement, Motivation and Learning Outcomes (SEMLOs)

Jimoh Bakare, Samson O. Ariyo, Samson A. Ojo

Article Info

Article History

Received:

20 October 2020

Accepted:

29 April 2021

Keywords

Constraints

Smart board

Technical education

Motivation

Students' engagement

Abstract

The study investigated the constraints and performance gap analysis of lecturers in Utilizing smart boards for improving students' engagement, motivation and learning outcomes in technical education courses of Nigerian universities. Five research questions guided the study while the hypotheses formulated were tested at 0.05 level of significance. Population for the study was 135 experienced and less experienced lecturers in the universities that offered vocational and technical education programs. There was no sampling because of the manageable size. The instruments for data collection were structured and non-structured questionnaire. All the researchers partook in the data collection while weighted mean and improvement need index were used to answer research questions and t-test was used to test the hypotheses formulated. The study found that lecturers lack skills and competencies in setting up, operating and solving technical problems arising from Utilizing smart boards for teaching technical education courses. The study also revealed that lecturers need improvement in Utilizing smart boards for improving students' engagement, motivation and learning outcomes in technical education courses. Recommendations include: that all the skills and competencies identified should be packaged into training program to retrain these lecturers through workshops, seminars and short term training in the tertiary institutions.

Introduction

Teaching becomes interesting when classroom environment is conducive and one of those things that makes environment more conducive for teaching and learning is the use of relevant technology. Teaching and catching the attention of students during instruction sound simple; but very demanding, but this can be achieved with ease when relevant technology such as smart board (SB) is being used. According to Pearson (2009), technology can be a new machine, equipment and way of doing things that are based on modern knowledge about science and computer for selling online. Smart board is the product of electrical and electronic engineering. The smart board is an electronic gadget that depends on electricity for its operation; teachers used it for teaching contents of a curriculum. It improves students learning and in most cases improves skills acquisition among students. It is a technology that combines the functionality of a whiteboard, computer, and projector into a single system

(Giles & Shaw, 2011). Both students and experienced and less experienced lecturers feel at ease when using smart board for instruction and learning. Lecturers are academic staff within the program with minimum qualification of first degree not below second class honors lower division (Bakare, 2014). Experienced lecturers in this study are individuals who have been teaching technical education courses for the past ten years while less experienced lecturers are university teachers who have less than ten years in teaching technical education courses. Both groups are found in using smart boards for teaching; they may have different views on utilization of SBs and constraints against the use of smart boards for teaching technical education courses. Using smart board technology in the classroom could motivate and engage students throughout a lesson. According to Parameter (2012), it is most beneficial to students when technologies are incorporated into the curriculum to help them become more accustomed to new technologies. Technology such as SB is interesting and appealing; when it is integrated into ones learning it engages students and serves as a motivation for understanding. Giles & Shaw (2011) in addition declared that, the interactive nature of the smart board offers many practical uses for providing an introduction or review of material and its can improve social interaction and students' engagement. Gast, Krupa, and Mechling (2007) also reported that when images are made larger and visible on smart board, it increases attention to the task and students also pay more attentions.

There are many ways the smart boards (SBs) can benefit teachers and mainly students: it helps teachers to introduce their lessons in a modern way, teachers can use it to record students' results, and build up instruction for practical tasks (Mowbray & Preston, 2008). Researchers and relevant authors have made it clear that smart board is effective in the classroom instruction. Tu`rel and Johnson (2012) had emphasized positive effects of SBs when appropriately integrated in teaching and learning such as enriching teachers' instructions, increasing students' attention, engagement, and motivation. There is no doubt therefore that SB is a wonderful tool capable of motivating and engaging students in active learning and improving their learning outcomes, but there are some challenges in using the board for effective teaching in developing nation like Nigeria. Some of these challenges may include: irregular power supply, unwillingness of teachers and students to make use of smart board, unavailability of smart boards, lack of technicians to support the teacher using the technology, lack of technical or operational skills or competencies to make use of SBs, lack of strong policies to compulsorily utilize SB for instruction. Lecturers lack time to learn and prepare their lessons using SBs (Yusuf, 2007; Schuck & Kearney 2007; Preston et al. 2000; Schoepp 2005; Al-Senaidi et al. 2009; Chen et al. 2012; Khan et al. 2012). Some teachers are not familiar with the smart board and tend to shy away from it (Gast, Krupa, & Mechling, 2007; Olelewe & Okwor, 2017; Ogunbodede, 2019). There is need to pay attention to how SBs are being used by teachers in the classrooms, what are the challenges facing its usage and assessment of the performance of lecturers or teachers using it; because the essence of using smart boards for teaching is to make teaching and learning easy and productive. These activities if properly carried out in this study will provide everlasting solutions to ineffective use of smart boards in the classrooms for improving students' engagement, motivation and their learning outcomes (SEMLO). Multimedia such as smart boards have made their ways into schools and colleges in Nigeria although strong policies are yet to be formulated for their use. Different multimedia tools have been found very relevant in today's classrooms to achieve acquisition of 21st century skills and experience. Turel (2010) noted that interactive whiteboards or SBs have become popular over the last few years particularly in higher education. The use of multimedia tools like SBs for teaching and learning has been seen to play not

only a definitive role in instruction modeling but also a vital tool for concretization of abstract knowledge (Olelewe & Okwor, 2017). There is need to fish out constraints and carry out performance gap analysis of lecturers for effective use of SBs for improving students' engagement, motivation and learning outcomes.

Teachers make use of diverse of strategies during teaching to engage and motivate their students in order to have better learning outcomes. It is also a known fact that students' engagement and motivation given during instruction determine learning outcome of students. It is really worthy to carry out this study in Nigerian tertiary institutions because experience reveals that lecturers have not been able to improve students' motivation, engagement and learning outcomes through smart boards and this could deprive students of 21st century skills. Motivation according to Silva (2020) is the state that can maintain students' attention and behavior as well as provides with more energy to needed to lead tasks to completion. Motivation in education leads to increased effort and energy to pursue educational or learning goals. Motivation most of the time determines the outcome and interest of students in learning difficult contents or tasks (Hurst, 2020). When a student is motivated, there is every tendency for such student to perform better in his/her study. Motivation urges to students to perform actions such as reading, writing, listening attentively, engaging in learning activities, performing academic assignments and practical tasks. Without it, completing these actions can be hard or even impossible. Motivation given to students improves their quality of engagement while quality of students' engagement dictates the learning outcomes. Great School Partnership (2016) therefore reported that student engagement is the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught. Various pieces of information on students' motivations, engagement and performance of lecturers in Utilizing SBs could be ascertained through need assessment study. A need as stated by Gall, Gall and Borg (2007) is a discrepancy between an existing set of conditions and a desired set of conditions. Needs assessment is a systematic approach to assessing the knowledge, abilities, interests, actual needs, gaps or early behavior of learners or groups of learners before they are enrolled in a learning program (Nugraha, Suwandi, Nurkamto and Saddhono, 2017). Ascertaining the discrepancy or performance gap of lecturers in Utilizing SB for improving students' engagement, motivation and learning outcomes through need assessment is a critical activity that requires serious attention.

Overview of Smart Boards/Interactive Whiteboards

Smart board or Interactive White Board is a 21st century technology-based device that can be used for teaching and learning among other purposes. According to the National Centre for Technology in Education (NCTE) (2009), SB is a large touch-sensitive board that is used with a computer and digital projector to facilitate interactive engagement in the classroom. Balta and Duran (2015) defined an SB as an instructional tool that is connected to a computer and a projector to enable the transfer of images from computer to the board as well as enhancing the control of the contents directly on the screen with a pen or finger. Karsenti (2016) stated that the SB combines touch (pen-and-finger) control of the screen with computerized input from a variety of devices operated by the teacher. Researchers described SB as an electronic device that is connected to a projector, whiteboard and other related tools that detect and presents instructional contents using its multimedia features to the students in an interactive way (Le Lant & Lawson, 2016; Ahmet & Halit, 2015; Al-Faki & Khamis, 2014;

De Vita, Verschaffel, & Elen, 2014; Ersoy & Bozkurt, 2015; Rajabi & Khodabakhshzadeh, 2015; Lamberth 2012; Turel & Johnson, 2012). Nhete, Sithole and Solomon (2016) stated that the IWB has the capacity to manipulate, store and retrieve data, project audio-visual contents, utilize software such as word processing, spreadsheets and desktop publishing, thus, transforming the teaching and learning process into a more successful venture.

There are many forms of SBs or interactive whiteboards that range in size and capabilities. Lamberth (2012) stated that some IWBs may be wall-mounted or placed on a stand to perform either synchronous (enabling two-way interaction between the teacher and the students) or asynchronous (allowing captured material to be shared on paper or electronically later) function. There are several types of IWBs versions because of the development of software and manufacturers. According to design, there are two kinds of SBs; front projection board and rear projection board (Alfaki & Khamis, 2014). IWB has various interactive features that enable it to be used for presentation of images, videos, audios, animations and performing other functions that will make lessons more appealing and engaging for the learners in the classrooms. Marzano (2010) stated that when teachers are using SBs they can use the elements of text, graphics, sound, animation, and video to create lessons that interest and engage students during the learning process. This implies that the SB is a unique instructional tool in the classroom. Although, the IWB shares some features with the traditional whiteboard, it is however superior. Yanez and Coyle (2011) stated that the IWB combine all pre-existing instructional aids such as chalkboard, whiteboard, television, video, overhead projector, CD player and computer. According to Hockly (2013), the features of SB characterize its ability to change the classroom into a stimulating and encouraging learning environment. Blau (2011) stated that the characteristics that transform the IWB/smart board into an efficient pedagogical tool include: ability to skip from pages on the screen to the internet in a structured and fluid manner, ability to simulates the associative organization of the student's brain, serving as a cognitive tool that expand students' mind and facilitate supported joint thinking and enabling interactions between study contents and the students themselves, both face-to-face and online. The above accounts for why SB becomes one of the most viable instructional facilities in the school system and is gradually replacing the use of the ordinary white board for teaching. According to Ahmad, Ali, Sipra, and Hassan and Taj (2017), IWB makes learning more fun because it motivates students to learn.

Researchers acclaimed that the introduction and provision of SB in classrooms is perhaps one of the giant stride in ensuring that teaching-learning takes place with ease (Farooq & Javid, 2012; Nhete, Sithole & Solomon, 2016; Teck, 2013). The introduction of SB into the classroom is as a result of the various ways that SB can be utilized in the classroom for delivering of all kinds of course contents and presentations. The National Center for Technology in Education (NCTE) (2009) stated that IWB can be used to: allow presentation of students' work in a more interactive and collaborative way, show video clips that present and explain difficult concepts in any curricular area, demonstrate how an educational software program works, cater more effectively for students with special needs, display internet resources in a teacher-directed manner, allow students to work creatively through learning activities in whole-class mode or in small groups and to present their work in multi-media form for class viewing and discussion, provide new opportunities for individualized learning experiences, create handwritten drawings, notes and concept maps during class time, all of which can be saved for future reference.

IWB is great for: demonstrating lessons, accommodating different learning styles and age groups in the classroom, enabling distance learning, maximizing computer use, providing interface with other peripherals, saving and presenting lessons in which students need printed copies (Bell, 2002; Lamberth, 2012). According to Karsenti (2016), SB is used for creating multimedia presentations with programs like notebook or power point, search internet, make video presentations, present class notes as word documents, make demonstrations, correct group written work, present digital books and textbooks, engage in interactive activities and record students' oral presentations and display charts and figures. According to Emeagwali and Naghdipour (2013), SB increases student motivation and sense of responsibility, increase participation or engagement, increase effectiveness and frequency of student-teacher and student-student interactions, provide the opportunity to prepare for the lesson effectively, support teacher's development and provide the opportunity to re-produce instructional materials into the digital environment. Lamberth (2012) stated that IWB enhance effective interaction between teachers and students with subject matter displayed. This implies that SB is a very useful tool and thus, offers wide range of importance to everyone at the heart of the teaching-learning transaction.

SB as reported by researchers has varying importance to both teachers and students as it can be applied in different areas to aid effective teaching-learning transaction. The British Educational Communications and Technology Agency (BECTA) (2004) and NCTE (2009) stated that SB increase students' motivation enables greater opportunities for students' participation and collaboration, decreased need for note-taking and cater for students' different learning styles. Karsenti (2016) reported that students stated that they found IWB amazing as they could have internet access through the whiteboard, enjoy visual support during teaching, being able to watch videos which gives greater motivation to learn, exploiting varied teaching strategies, enhancement of better learning, efficient management of time, having a more organized teacher, creating opportunity to communicating with classmates, and doing interactive activities. The author also stated that teachers also benefit from the use of SB as it gives them the opportunity to assess the internet, aid visual support for teaching and particularly multimedia presentations such as PowerPoint, fostering diversification of teaching approach and proper organization of teaching including planning lessons, managing documents, aiding of students' concentration. Nhete, Sithole and Solomon (2016) stated that benefits from the use of SB/IWB as it gives them the ability to save and print materials generated during the lesson, give more effective explanations during lessons and helps in maintaining classroom control and management. According to NCTE (2009), SB enables teachers to save and print what is on the board, including any notes made during the lesson as well as presents the opportunity to share and reuse materials. Balta and Duran (2015) stated that teachers can perform various actions with interactive whiteboards such as dragging, clicking, pasting and copying items; taking handwrite notes, transforming them into texts and highlighting those texts; adding annotations, animations, notes and drawings and saving them to be printed out and shared; showing picture animations and educational videos to the whole class; saving and recalling current and previous screens, revisiting, reviewing and amending when required and use contents available on a website. This implies that the teacher can lean on the strength of SB to facilitate effective transmission of knowledge and also benefit greatly. According to Ahmad et al (2017), teachers who use smart boards in class report a rise in the quality of teaching. This rise is facilitated by the ability of teachers to present lessons that combine multimedia, which attract the students' attention and imagination in creative ways.

Constraints of Lecturers in Utilizing Smart Board for Teaching Technical Education Courses

The classroom environment has evolved a lot in the past two decades, and the use of educational technology materials such as the smart Board has helped transform the teaching and learning environment from a closed and rigid environment to a fluid and borderless environment. The IWB is a dynamic tool which combines computer technology with the indispensability of traditional blackboards (Korkmaz and Cakil, 2013). Even though the SB has been around for a while it was mainly used in business organizations for business presentations, it was only recently integrated into the teaching and learning environment of Nigerian Universities. Different researches have shown the IWB to be of great benefit to both the teachers and learners, according to (Lewin, Somekh and Steadman, 2008; Wood and Ashfield 2008; Sunkur, Arabaci & Sanli, 2012) they stated that SB contributes to the academic achievement, motivation and engagement of students.

A study carried out by the British Educational communication and Technology Agency (2003), was of the opinion that interactive whiteboard could have positive effects on teaching; could also improve students' learning outcome and engagement. Higgins, Beauchamp, and Miller (2007) stated that the use of IWBs could possibly be the most significant change in the classroom learning environment in the past decade. However, despite the positive belief in the use of IWB for teaching and learning some educators still has some reservations about its impact in the classroom environment. Higgins, Beauchamp & Miller (2007) noted that although teachers and students may be motivated as result of using IWBs, this does not necessarily lead to an increase in student achievement. It can however been concluded from literature that the use of SB generally has a positive impact on the teaching and learning process, especially in the teaching of technical education courses. It was observed by Ariyo and Bamgboye (2016) that smart board is very useful for teaching students computer Aided Manufacturing (CAM); Computer Aided Design (CAD) and AUTOCAD thereby making it an invaluable tool for lecturers in teaching technical education courses, but it should be noted that with the advent of new technology comes new problems, since the IWB has been introduced into the teaching environment of Universities in Nigeria, including the teaching of technical education courses there are constraints that are been faced currently in the utilization of IWB by lecturers.

The current undergraduate students in Nigerian Universities are technologically savvy, they are more familiar with technologies than their lecturers are, and they are citizens of a world that has become more reliant on technology than ever, they depend on technology for every aspect of their lives. They have become preoccupied with these high-tech inventions for entertainment to spend their time, so they learn how to use these technologies unconsciously. However, this is not the situation for their lecturers, many lecturers including those teaching technical education courses had neither used ICT- based learning strategies as learners themselves, nor as trainees. They have no previous experiences in teaching with high technology such as interactive whiteboards and this situation has led to them facing constraints with the utilization of this educational tool. These constraints noted from observations include; lack of adequate computer skills, lecturers have been observed to possess inadequate computer skills in utilizing IWBs. Lack of professional training in the use of IWBs, for IWBs to be successful in promoting learning and enhancing achievement, lecturers need to be trained to both

understand the potential that SBs have for learning, and to provide effective instruction using this new technology. Without such training, it is unlikely that lecturers will either be aware of or be able to exploit the potential benefits of IWBs (Armstrong, Barnes, Sutherland, Curran, Mills & Thompson, 2005). Insufficient support, lecturers must also receive ongoing support to maximize their potential. Korkmaz and Cakil (2013) stated that Teachers lack knowledge on how to use these SBs, Lack of suitable presentation and instructional materials and teachers' inability to solve the technical failures by themselves during class hours are major constraints in using smart boards. They will need help to find appropriate software and to match it to different types of learning tasks. This requires an investment of both time and money and is often difficult to provide as a result of the rapid pace of technological change (Goodison, 2002). Insufficient technical support is also a constraint, ongoing technical support must be provided for lecturers, because it has been shown to be a vital component in any information and communication technologies network

Concepts of Students' Engagement, Motivation and Learning Outcomes

Student engagement has currently become one of the latest focuses of consideration among those striving to improve the teaching and learning environment. It has recently taken a prominent role especially in tertiary education. The task faced by tertiary institutions in attracting, training, equipping students with relevant skills and graduating them to become effective members of the society has made the concept of students' engagement hard to ignore in the Nigeria University system. Student engagement is the curiosity of students in actively involved or knowing or learning new academic concepts inside and outside the classroom, which may retention of learning (Kuh, Kinzie, Buckley, Bridges & Hayek, 2007), and as the extent to which students are engaging in activities that higher education research has shown to be linked with high-quality learning outcomes (Krause and Coates, 2008). Similarly, Kuh (2003) defined student engagement as the quality of attention students pay to education or learning in order to achieve better educational outcomes.

It has been observed that students in Nigerian Universities usually view the academic exercise they experience in the University as stressful challenging and not fulfilling and this can lead them to not be engaged in the studies, therefore it becomes important for higher institutions to active improve their students engagement. However student engagement involves more than just participation, according to Harper and Quaye, (2009) it requires feelings and sense-making as well as activity. Students participating in activities without feeling engaged are just involvement or even compliance and feeling engaged without involvement in the activity is dissociation. Fredricks, Blumenfeld, and Paris (2004) identified three types of engagement to include behavioral Engagement which is concerned about students who are behaviorally engaged would typically comply with behavioral norms, such as attendance and involvement, and would demonstrate the absence of disruptive or negative behavior; emotional engagement is concerned with students who engage emotionally would experience affective reactions such as interest, enjoyment, or a sense of belonging while cognitive engagement which is concerned with cognitively engaged students would be invested in their learning, would seek to go beyond the requirements, and would relish challenge. Possession of these dimensions of engagement will enable the Nigerian students to navigate the possible academic challenges they might face, equally achieving adequate engagement in the University by students can lead to better motivation for their academic studies.

Motivation is one of the most vital factors behind achievement. It is also the most vital factor behind students' academic performance and learning outcomes. Motivation is the process that gives students the drive to achieve the aims and objectives set for them by their parents, the society and institutions. It also provides the urge for students to attain self-actualization and self-fulfillment. Students can be motivated in different ways. It can be positive or negative, progressive or destructive motivation. Motivation according to Kostelecky and Hoskinson (2005) is defined as an internal state or condition that activates, guides, and maintains or direct behavior. Motivation is one of the most important factors in education especially when we are talking about the learning abilities, performance and achievement of students in their respective studies. Motivation is one of the most important factor that engages, stimulates the learning ability and interest of students, if a student is properly motivated then it is expected that the learning ability and student engagement of the student will increase, and it can thus lead to an improvement in the students learning outcomes.

Many studies have been carried out to predict the relationship between student's motivation and its impact on their learning outcomes. According to Valarmathie, Juliana, Abdul Nasir, Alwi and Ruzinoor (2017), the level of students' motivation in a particular subject, study or class is reflected in the extent of the students' participation and engagement in that subject or class. A student that is perceived to have high motivation will be more actively engaged in the study or class without expecting any external reward. Meanwhile to encourage a student with low motivation external rewards will be needed to improve their engagement. Student's motivation is divided into two main types. They are intrinsic motivation and extrinsic motivation. When a student enjoys a work or activity, and see it as an opportunity to learn and participate without thinking of any external reward, we say it is intrinsic motivation or the student is motivated intrinsically (Coon & Mitterer, 2010).

Intrinsic motivation in relation to education is a type of motivation in which the student is motivated internally by himself to achieve a set of goals or objectives irrespective of external factors. Students who are intrinsically motivated are keenly focused to attain their goals and objectives without taking into account the rewards that can be gained. Dev (1997) stated that student who does not need any kind of awards for accomplishing their tasks are intrinsically motivated. Students who are motivated intrinsically are very energetic, self-directed and find themselves enjoying their studies, they derive contentment from achieving their set goals without any anticipation of external reinforcement (Asigigan and Samur, 2021). According to Pérez-López and Contero (2013), Lepper, Corpus, and Iyengar (2005) there is a direct correlation and positive bonding between intrinsic motivation and learning outcomes. This implies that students who are motivated intrinsically will perform better and have higher academic achievement because they have a genuine interest and urge to acquire knowledge and succeed in their study. Condry and Chambers (1997) discovered that, when students are faced with multifaceted cerebral project, students who are intrinsically motivated use more coherent data collecting and decision making tactics than students who are extrinsically motivated. Projects or tasks that are more challenging are usually preferred by students who are intrinsically motivated. Hence we can say that students who are intrinsically motivated perform well in academic activities and achieve better and higher learning outcome.

Extrinsic motivation refers to a behavior that is driven by external rewards such as money, popularity, grades, and attention. Extrinsic motivation occurs when someone is motivated to perform an activity to be given a

reward or to avoid punishment. Students who are extrinsically motivated depend solely on external rewards and desirable reinforcement for their motivation. Students that are extrinsically motivated engage in an activities only when they believe that working on the task will result in desirable outcomes (e.g. rewards, good grade, parents' and teachers' approval, avoidance of punishment). Extrinsic motivation in education can also be as a result of avoidance, a student might be extrinsically motivated in a subject or class so as to avoid poor grades or the teacher's disapproval. It might also be to avoid been perceived by the society or peer group to be academically weak. It was observed by Eskja and Edi (2017) that students who are motivated extrinsically will most likely perform lower academically than students who are intrinsically motivated. The importance of motivation in relation to learning outcomes and student engagement in Nigeria Universities cannot be overemphasized, because one of the major problems facing Nigeria Universities is how to continue to improve the learning outcomes and performance of students in their various examinations.

Government spends huge amount of money to build, renovate, equip Universities and train lecturers. They also employ educational planners to plan program s and policies which lecturers and University administrators are expected to implement. This effort is made to improve students' learning outcomes. Students' learning outcomes are categorized into positive or negative learning outcomes. Njoku (1993) defined students learning outcomes as knowledge, skills and abilities students should possess and can demonstrate upon completion of a learning experience. Njoku (1993) further referred to it as educational, societal, and life effects that result from students being educated. Students' achievement is the result of student over a stipulated period of time. To achieve these learning outcomes different variables such as motivation and students engagement can play a part in positively influencing students learning outcomes.

Utilization of IWB/Smart Boards for Improving Students' Engagement, Motivation and Learning Outcomes in Technical Education Courses

The role of technology enhanced classroom in fostering all round academic development of students in the 21st century cannot be over-emphasized. One of such technology is the IWB/smart board which is an electronic instructional device that can be used to facilitate effective transmission of knowledge from the teacher to the learner in a classroom environment. From the literature, SBs can benefit students by improving their motivation, engagement, interest and their learning outcomes (Akkoyunlu & Erkan, 2013; Balta & Duran, 2015; Nhete, Sithole & Solomon, 2016; Sushma, 2014; Turel & Johnson, 2012). According to Blau (2012), the use IWB leads to a pedagogical change and improve students' achievements. This implies that the teacher can utilize d IWB to improve students' engagement, motivation and learning outcomes in Technical education courses.

The use of IWB in the classroom has a lot of key advantages. The drive by the learner to participate in the use of IWB and his or her interaction with it can impact the students learning outcomes. Interactive white board from literature has a lot of effect on different aspects of teaching and learning process, a study carried out by Turel and Johnson (2012) revealed that teachers found IWB to be motivating and engaging for students. According to Tufan (2013) IWBs are classroom enrichment tools that lead to more interactive teaching processes, the use of IWBs stimulates students' attention and interest and this can lead to higher motivation and better classroom

engagement by the student. Most students state that the use of IWB is motivating, engaging and interesting (Aydınlı and Elaziz, 2010; BECTA, 2007; Yanez and Coyle, 2011). It has been observed that students are motivated in classes taught with IWB and the motivation can raise the students' classroom and learning engagement (Lan and Hsiao, 2011).

Students' engagement (SE) is the act of allowing students' active participation in the classroom. Studies shows that that students engage more in discussions, ask more questions for clarifications when IWBs are used in classroom, thus making learning more active and interactive between the teacher and the students. According to Winzenried, Dalgarno and Tinkler (2010), teachers can use IWBs to encourage dialogue in the classroom, thereby fostering students' engagement. The use of IWB as an instructional tool has a beneficial effect on student engagement in classroom lessons and lead to improved student behavior (Alfaki & Khamis, 2014). This implies that the use of IWB inspire students to learn because the more students are inspired to learn, the more likely they will be successful in their academics. Aytaç (2013) stated that using IWBs lead to increased student engagement, primarily because of the visual aspects of the interactive whiteboards. IWB manufacturers have documented the positive themes of student engagement, motivation, and appeal to students with different learning styles (European Schoolnet, 2006; Marzano & Haystead, 2009; Winzenried, Dalgarno & Tinkler, 2010).

Active engagement of students in the teaching-learning process is a key to arousing their motivation. Lamberth (2012) stated that students' engagement is central to student motivation during the learning process. Motivation (M) is the drive that arouses interest in participating actively in a given assignment. Lamberth (2012) stated that effective use of technology is one of the numerous factors that can influence students' motivation. According to Alfaki and Khamis(2014), SB contributes to motivation in many ways, this includes: increasing enjoyment and motivation for learning, increasing enjoyment of classes for both learners and teachers through more varied use of resources, fostering high level of interaction as learners enjoy interacting physically with IWB, manipulating text, image, matching and dragging as well as dropping objects, the capacity to present and discuss learners' work in other to raise their self-esteem and customizing marking use the pen and in the highlighter features to display a number of different colors. There is therefore no doubt that students' rate of motivation in the classroom can lead to an improved learning outcome.

Interactive whiteboard affects learning outcome in several ways. It can be used to support different learning styles and is used in a variety of learning environments (Alfaki & Khamis, 2014). Research evidence shows that the use of IWB can increase students' learning outcome (Dhindsa & Emran, 2006; Zittle, 2006). According to Cuthell (2005), a technology enhanced environment is a boost for an improved learning although it does not displace effort (Nhete, Sithole & Solomon, 2016). Smith, Hardman and Higgins (2006) noted that students who are taught with IWB were observed to exhibit positive behavioral engagement. Studies have shown that use of IWB leads to better classroom collaboration between the teacher and learner and there was an improvement in the participation of students in the classroom (Morgan, 2008), the improvement of students' motivation and engagement can also lead to better student learning outcomes.

Assessment Models and Performance Gap Analysis of Lecturers in Utilizing SBs for Teaching Technical Education Courses

Technical education courses are series of subjects designed to be offered by students who specialized in various programs of technical education. Various technical education programs in Nigerian universities include: automobile/ metalwork technology, electrical/electronic technology and building/woodwork technology. Lecturers teach the courses under these programs with different strategies and technologies and one of such technologies is SB. There are constraints in Utilizing SBs for teaching by lecturers and their performance is in doubt as this is reflected in the learning outcome of their students. In general sense, the essence of Utilizing technology like SB is to improve students' engagement, motivation and learning outcomes. Students' engagement and motivation can influence or determine the quality of learning outcome of students if the teaching and learning are well taken care of. The essence of using various strategies and technology such as SB for teaching or learning is to achieve good or quality learning outcome and lecturers are seen as a major player in this process. In the view of Suryaman (2019), learning is a process of behavior change as a result of the experience, which includes knowledge, attitudes and skills; and to know the level of quality or experience gained by students, the performance gap of their lecturers in using SBs need to be assessed and also find out kinds of constraints working against the utilization of SBs for improving engagement, motivation and learning outcomes.

Performance can mean an action someone takes to get work done. Performance in the statement of Quirk (1995) is the process of carrying out a piece of work or function. In the context of this study, performance is the level of skill possessed by the lecturers in the utilization of smart boards for improving students engagement, motivation and learning outcomes while assessment is the determination of the difference that exists between skill possessed by the lecturers which is their performance and skills needed to be effective in the utilization of SBs. This difference is called performance gap (Bakare & Owodunni, 2011) which when identified or analyzed provides direction for improving the lecturers to meet the level of skills required for improving SEMLO using SBs.

A performance gap can be the difference between how lecturers can make use of SBs for teaching and standard way of using for teaching. In most cases, weighted mean (WM) and improvement need index (INI) could help in determining performance gap or in analyzing performance gap. The performance gap simply means a need. A need as stated by Gall, Gall and Borg (2007) is a discrepancy between an existing set of conditions and a desired set of conditions. Determining the performance gaps or training need of someone requires rigorous analysis based on data collected, not speculation (Association for Talent Development, 2007). In this study, performance gap (PG) analysis is the computation of the mean values (X_n) of the perceived performance of the lecturers subtracting from the computation of the mean values (X_p) of their expected performance in using smart boards for improving SEMLOs in technical education courses. Generally, a model is known as the representation of reality (Bakare, Omeje, Ariyo, Nwaodo, Ogunmilade, & Olaoye, 2020). Bakare, Ifeanyieze, and Olaitan (2019) therefore described need assessment model as the one used in carrying out a research work probably for individuals and companies that made up their minds to begin a project but they do not know how to be set about

it. The need assessment study is generally used to ascertain what is currently in place and what is needed in the future (Bakare, 2014; Teare, Atkinson, & Westwood, 1996).

Function of industry (FoI) model could be involved to conduct research in two directions: a) for improving the operations of an industry b) for establishing an industry through zero-base (Bakare, Ifeanyieze and Olaitan, 2019). This model could be used to identify competence or skills for improving a training program that supplies manpower for such industry or its allies. According to Ugwoke, Babalulu, Anorue, and Amusa (2020), FoI can be used to train relevant individuals for employment in a particular occupation or industry. The model helps the identification of skills or function of the industry that could be used in retraining lecturers of industrial technical education when their need gaps have been determined for effective utilization of smart boards for improving students engagement, motivation and learning outcomes. This model is relevant to this study because it serves as a source of identification of essential basic skills in Utilizing smart board systems from experts who are familiar using and maintaining smart boards for teaching and training. All these models provide anchorage for activity concept in research work; an activity concept involves various research activities that are to be carried out towards finding a solution to an identified research problem (see Figure 1 and 2).

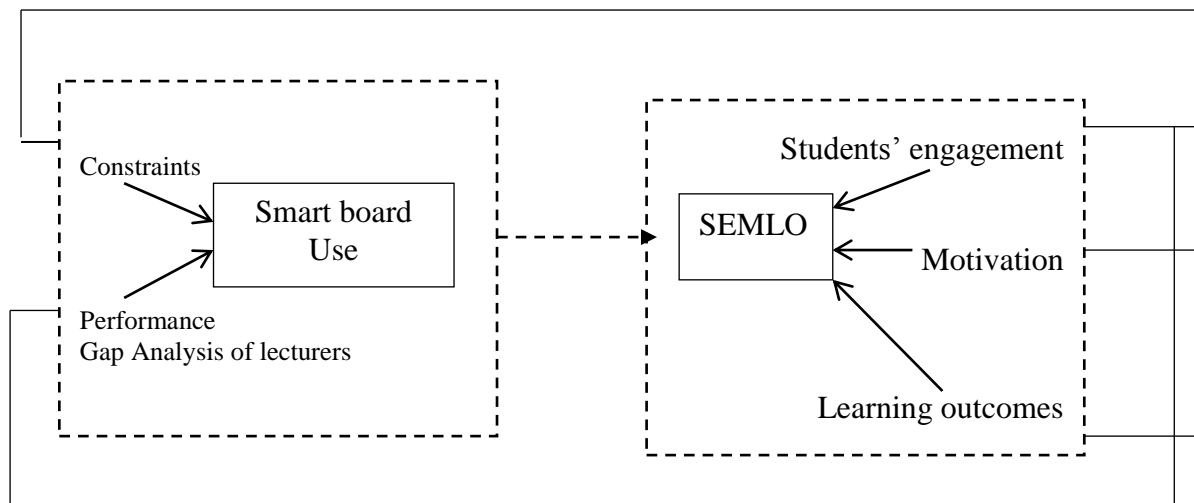


Figure 1. Relationship between Constraints and Performance Gap Analysis of Lecturers in Utilizing Smart Board and SEMLO

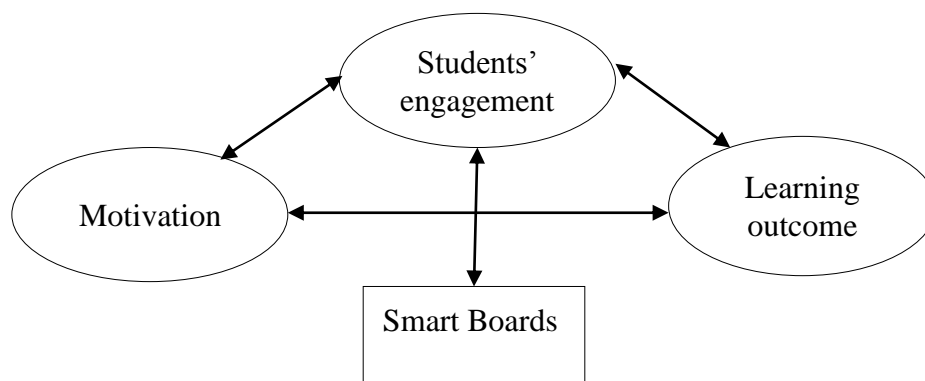


Figure 2. Model of Performance Gap Analysis of Lecturers in Utilizing SBs for Improving SEMLO

Statement of the Problem

Teaching with information and communication technology related gadgets such as smart boards assist teachers to have full control of their classes; it help improve engagement, motivation, interest and learning outcome of learners. Smart board is a flexible teaching tool that creates wide range of learning opportunities to students in all rounds of teachable courses. It is a 21st century electronic equipment or technology introduces into educational system to solidify classroom teaching and learning so that relevant knowledge, skills and attitudes or competencies in a particular course or classroom can be acquired to ease job search, reduce unemployment and social exclusion of learners. However, it appears that twenty percent of lecturers found in the teaching of technical and vocational education courses deprive themselves of using modern instructional tools such as smart boards. The reasons for this according to authors such as Olelewe and Okwor (2017), Momani, Alshaikhi, and Al-Inizi (2016), Korkmaz and Cakil (2013), and Gast, Mechling, and Thompson, (2008) are that lecturers lack smart board skills and experience in Utilizing smart boards or IWB, shortage of IWB/SB in schools, irregular capacity development of lecturers on ICT utilization for course delivery among others. These experiences over the years have resulted to production of half-baked graduates who cannot secure themselves employment in relevant industries or create jobs for themselves and employ others.

This paper was therefore aimed at determining the constraints and performance gap analysis of lecturers in Utilizing smart board for improving students' engagement, motivation and learning outcomes in technical education courses in Nigerian Universities. The will throw more lights on level of skills of lecturers in setting up, operating and Utilizing smart boards for improving students engagement, motivation and learning outcomes. Specifically the study achieved the following objectives:

1. determine performance gaps of lecturers in setting up SBs for improving SEMLOs in technical education courses
2. ascertain performance gaps of lecturers in operating SBs for improving SEMLOs in technical education courses
3. determine performance gaps of lecturers in solving problems arising from using SBs when teaching technical education courses
4. ascertain performance gaps of lecturers in Utilizing SBs for improving students engagement, motivation and learning outcomes in technical education courses
5. find out constraints against the utilization of SBs in improving SEMLOs in technical education courses

Research Questions

The following research questions guided the study:

1. What are the performance gaps of lecturers in setting up SBs for improving SEMLOs in technical education courses?
2. What are the performance gaps of lecturers in operating SBs for improving SEMLOs in technical education courses?
3. What are the performance gaps of lecturers in solving problems arising from using SBs when teaching

technical education courses?

4. What are the performance gaps of lecturers in Utilizing SBs for improving students' engagement, motivation and learning outcomes in technical education courses?
5. What are the constraints against the utilization of SBs in improving SEMLOs in technical education courses?

Hypotheses

The hypotheses 1 and 2 were tested:

1. There is no significant difference in the mean responses of respondents on the performance needs of lecturers in Utilizing SBs for improving students engagement, motivation and learning outcomes in technical education courses
2. There is no significant difference in the mean responses of respondents on the constraints against the utilization of SBs in improving SEMLOs in technical education courses

Method

The study adopted descriptive survey research design and function of industry. Descriptive research design, according to Martyn (2008), is a scientific method which involves observing and describing the behavior of a subject without influencing it in any way. Function of industry on the other hand is a model that provides the limitations that help to provide shortfall of a program in meeting the requirement of the same program through emergency of new technology into the industry (Olaitan, Asogwa, & Abu, 2013). These design and model were found very suitable for the study and they were adopted.

The area of the study was south east Nigeria. The population for the study was 135 lecturers of industrial technical education program s in the federal, state universities and colleges of education who run technical education program s of universities in Anambra, Abia, Imo, Ebonyi, and Enugu State. These lecturers were categorized into experienced and less experienced individuals. Experienced lecturers (N= 43) as stated in the introduction of this paper are individuals who had been teaching technical education courses for the past ten years while less experienced lecturers (N= 92) are people who had less than ten years in teaching technical education courses at university level. They all partake in the teaching of technical education courses. Researchers considered their comparism suitable than making use of gender (male & female) or age (old & young) as basis for comparison. This was because the number of female or old as against the male or young counterpart is so infinitesimal and this could affect the result of the hypotheses tested. Population according to schools stood at 22 lecturers from University of Nigeria, Nsukka, 12 from Michael Okpara University of Agriculture, 13 lecturers from Ebonyi State University, Abakaliki, 12 from Enugu State University of Science and Technology, 17 from Alvan Ikoku College of Education, Imo State, 19 lecturers from Federal College of Education, Umunze Anambra State, 26 lecturers from Enugu State College of Education (Technical) Enugu, and seven lecturers from Abia State College of Education. There was no sampling because of the small size of the population. The instrument for data collection was a structured questionnaire that contained 43 competency/skill

items. The questionnaire on research questions 1-4 was divided into two categories of needed and performance. The needed category has a 4-point response scale of Highly Needed, Averagely Needed, Slightly Needed and Not Needed; while the performance category also has 4-point response scale of High Performance, Average Performance, Low Performance and No Performance with a corresponding value of 4, 3, 2 and 1 for the two groups of scales respectively. The questionnaire items on research question 5 were assigned a Likert five point response scale of strongly agree, agree, undecided, disagree and strongly disagree with values of 5, 4, 3, 2 and 1. An instrument can be considered good for validity and reliability if it has between four (4) and seven (7) alternative responses (Lozano et al., 2008). However, fewer options are acceptable depending on the purpose and scope of the study (Bendig 1954; Mattell & Jacoby 1971; Jones & Scott 2013, Bakare et al, 2020). The instrument was validated by three experts in the Department of Industrial Technical Education, University of Nigeria, Nsukka. Cronbach alpha reliability method was used to determine the internal consistency of the entire questionnaire items and 0.98 reliability coefficient value was obtained. One hundred and twenty nine copies of the questionnaire were administered by the researchers on lecturers of technical education programs in universities and colleges of education in the study area with a three days interval for the completion of the questionnaire. One hundred and thirty five copies of the questionnaire were administered while 129 copies were retrieved and analyzed. The researchers used SPSS version 22 to manage and analyze the data collected. Weighted mean and improvement needed index (INI) were used in analyzing data for answering research questions. The improvement needs were determined as follows: (i) the mean (X_n) of the needed category was determined for each item, (ii) the mean (X_p) of the performance category was also determined for each item (iii) the performance gap (PG) was therefore determined by finding the difference between X_n and X_p for each item; that is $PG = X_n - X_p$. That is:

- (a). Where the value of PG is positive (+), it means improvement is needed because, the level at which the lecturers were performing in the utilization of SBs is lower than what is needed.
- (b). Where PG is negative (-), it means improvement is not needed because the lecturers were performing the operations of the item more than what is needed.
- (c). Where PG value is zero (0), or ($X_n - X_p = 0$) it means improvement is also not needed because; the level at which the lecturers were performing in Utilizing SBs is equal to the level that was needed.

T-test was used to test the null hypotheses formulated and any items whose their p-values were greater than 0.05 have to be accepted and any ones whose the p-values were lower than 0.05 have to be rejected.

Results

Table 1 reveals the division of lecturers amongst universities and colleges of education as follows: 49.61% (64) of lecturers are from the universities while 50.38% (65) from affiliated colleges of education in the south east Nigeria. Thirty nine (30.23%) of the lecturers were regarded as experienced lecturers; they had 10 years and above in lecturing technical education courses in either universities or affiliated colleges of education, while 90 lecturers (69.76%) are termed in this study as less experienced lecturers because they have less than 10 years lecturing experience. Furthermore, 41 (31.78%) lecturers had bachelor degree, 59 (45.73%) with master's degree, whilst 29 (22.48%) lecturers had Ph.D in technical education. This therefore guarantees validity of the responses.

Table 1. Profile of Responding Lecturers

Group	Responses	Population/sample	Percentage (%)
Tertiary institutions	University	64	49.61
	Affiliated Colleges of Education	65	50.38
Category of lecturer based on years of lecturing experience	Experienced Lecturers (10 years and above)	39	30.23
	Less Experienced Lecturers (less than 10 years)	90	69.76
Educational qualifications	Bachelor degree	41	31.78
	Master's degree	59	45.73
	Ph.D. degree	29	22.48

Table 2 shows the performance gaps of lecturers in setting up smart boards for teaching technical education courses in Nigerian universities. The performance gaps of 32 out of 34 items ranged from 0.82 to 2.63; all the performance gap values are positive indicating that the lecturers need improvement in setting up smart board for teaching technical education courses in Nigerian universities. Performance gaps of items 1 and 4 were -0.05 and 0.10 respectively which means that lecturers do not need improvement in performing the items. Generally the lecturers need improvement in form of capacity building in performing all the items.

Table 2. Performance Gap Analysis of Lecturers in Setting up Smart Boards for Teaching Technical Education Courses

S/N	Item statements	Xn	Xp	PG= Xn-Xp	Explanations
IOSSB1	Connect interactive white board system to a good power socket	3.67	3.72	-0.05	INN
IOSSB2	Use the screen switching key on the laptop to get the view of the interactive whiteboard	3.70	2.07	1.63	IN
IOSSB3	Calibrate in other to unlock the Interactive whiteboard for use	3.83	2.00	1.83	IN
IOSSB4	Boot a laptop for use with interactive white board system	3.26	3.36	-0.10	INN
IOSSB5	Connect IWB to a laptop correctly	3.85	1.22	2.63	IN
IOSSB6	Configure different function on interactive whiteboard	3.79	2.15	1.64	IN
IOSSB7	Upgrade various smart or high end interactive whiteboard before the commencement of the teaching	3.85	2.14	1.71	IN
IOSSB8	Connect adapter to data port on Video CS	3.95	2.18	1.77	IN
IOSSB9	Lift the connector up to unplug the screen that is attached to the circuit ribbon when setting up interactive whiteboards	3.79	2.15	1.64	IN

<i>IOSSB10</i>	Identify a good projector screen and a laptop for use	3.80	2.08	1.72	<i>IN</i>
<i>IOSSB11</i>	Identify various parts of interactive whiteboard system for lesson	3.72	2.18	1.54	<i>IN</i>
<i>IOSSB12</i>	Mount interactive whiteboard on a floor stand or hang it on the wall when necessary	3.80	2.19	1.61	<i>IN</i>
<i>IOSSB13</i>	Align touch screen surface of interactive whiteboard with images to be displayed	3.69	2.04	1.65	<i>IN</i>
<i>IOSSB14</i>	Plug in the USB lead from the interactive whiteboard into your computer USB port	3.67	2.16	1.51	<i>IN</i>
<i>IOSSB15</i>	Install the interactive whiteboard presentation tools for effective teaching	3.73	2.91	0.82	<i>IN</i>
<i>IOSSB15</i>	Calibrate the board with stylus in controlling the computer while writing	3.66	2.14	1.52	<i>IN</i>
<i>IOSSB16</i>	Install ultra short throw projector to reduce the intensity of the shadow of the user	3.77	2.16	1.61	<i>IN</i>
<i>IOSSB17</i>	Connect interactive whiteboard to other peripherals wirelessly	3.82	2.01	1.81	<i>IN</i>
<i>IOSSB18</i>	Identify a good projector and a laptop for use	3.80	2.17	1.63	<i>IN</i>
<i>IOSSB19</i>	Identify various parts of interactive whiteboard system for lesson	3.75	2.15	1.6	<i>IN</i>
<i>IOSSB20</i>	Connect a projector to an interactive whiteboard successfully	3.89	2.14	1.75	<i>IN</i>
<i>IOSSB21</i>	Connect two shorter cable and serial adapter correctly	3.75	2.13	1.62	<i>IN</i>
<i>IOSSB22</i>	Place computer and projector on a suitable/right platform	3.68	2.52	1.16	<i>IN</i>
<i>IOSSB23</i>	Prepare interactive whiteboard to perform operations like addition, animation, pasting items, recall and saving of document	3.82	2.09	1.73	<i>IN</i>
<i>IOSSB24</i>	Install classroom response software on the interactive whiteboard	3.79	2.13	1.66	<i>IN</i>
<i>IOSSB25</i>	Connect the VGA cable to link the computer and projector	3.87	2.14	1.73	<i>IN</i>
<i>IOSSB26</i>	Clean the interactive whiteboard screen with soft material and water	3.72	2.13	1.59	<i>IN</i>
<i>IOSSB27</i>	Connect a projector to an interactive whiteboard	3.84	2.19	1.65	<i>IN</i>
<i>IOSSB28</i>	Unlocked interactive whiteboard before use	3.72	1.90	1.82	<i>IN</i>

<i>IOSSB29</i>	Connect interactive whiteboard serial and service cable to the laptop	3.90	2.16	1.74	<i>IN</i>
<i>IOSSB30</i>	Prepare interactive whiteboard to perform operations like addition, animation, pasting items, recall and saving of document, opening document	3.65	2.23	1.42	<i>IN</i>
<i>IOSSB31</i>	Align touch screen surface of interactive whiteboard with the image to be displayed	3.69	2.19	1.50	<i>IN</i>
<i>IOSSB32</i>	Calibrate the board with stylus in controlling the computer while writing	3.57	2.05	1.52	<i>IN</i>
<i>IOSSB33</i>	Clean the interactive whiteboard screen with soft material and water	3.72	2.07	1.65	<i>IN</i>
<i>IOSSB34</i>	Adjust image on the screen through the projector	3.76	2.12	1.64	<i>IN</i>
<i>IOSSBT</i>		3.75	2.13	1.61	<i>IN</i>

Second, the Table 3 contained 20 performance gaps of lecturers in items on operation of SBs for teaching technical education courses. The performance gaps of all the items ranged from 0.72 to 2.57; all the performance gap values are positive indicating that the lecturers need improvement in operating smart boards for teaching technical education courses in Nigerian universities.

Table 3. Performance Gap Analysis of Lecturers in Operating Smart Boards for Teaching Technical Education Courses

S/N	Item statements	X_n	X_p	PG= X_n-X_p	Explanations
<i>IOOSB1</i>	Use appropriate interactive whiteboard programs/tools for delivering technical education contents	3.99	3.27	0.72	<i>IN</i>
<i>IOOSB2</i>	Use interactive whiteboard system for technical education students' brainstorming sessions	3.70	2.26	1.44	<i>IN</i>
<i>IOOSB3</i>	Create interactive class with learning contents for the students by using the interactive Whiteboard	3.82	2.09	1.73	<i>IN</i>
<i>IOOSB4</i>	Assessing technical education students' class work using IWB	3.78	2.18	1.60	<i>IN</i>
<i>IOOSB5</i>	Use IWB graphics for teaching technical education courses	3.80	2.08	1.72	<i>IN</i>
<i>IOOSB6</i>	Use IWB spreadsheet for grading technical education students' work	3.78	2.28	1.50	<i>IN</i>
<i>IOOSB7</i>	Switch or navigate from one program of	3.70	2.03	1.67	<i>IN</i>

	interactive whiteboard to another during lesson delivery				
<i>IOOSB8</i>	Project technical education images from the projector to interactive whiteboard	3.69	2.19	1.50	<i>IN</i>
<i>IOOSB9</i>	Select relevant technical education pictures/diagrams to support lesson	3.60	2.10	1.50	<i>IN</i>
<i>IOOSB10</i>	Save notes or lessons on the interactive whiteboard system	3.77	2.01	1.76	<i>IN</i>
<i>IOOSB11</i>	Present saved noted/lessons on to interactive whiteboard system	3.87	1.23	2.64	<i>IN</i>
<i>IOOSB12</i>	Create video tutorials to educate technical education students using applications on IWB	3.89	2.12	1.77	<i>IN</i>
<i>IOOSB13</i>	Access internet applications such as search engine while teaching E/E courses using IWB	3.80	2.01	1.79	<i>IN</i>
<i>IOOSB14</i>	Use exclusive electronic pen to control different application program s or files	3.69	2.20	1.49	<i>IN</i>
<i>IOOSB15</i>	Share annotated documents on IWB screen with technical education students	3.68	2.01	1.67	<i>IN</i>
<i>IOOSB16</i>	Press and hold the keyboard and the right mouse button simultaneously until the orientation screen appears	3.78	2.17	1.61	<i>IN</i>
<i>IOOSB17</i>	Identify each slot that has optical sensor when the pens and eraser have been picked up	3.69	2.12	1.57	<i>IN</i>
<i>IOOSB18</i>	Double-press the internet browser icon on the desktop to open a web page	3.67	2.02	1.65	<i>IN</i>
<i>IOOSB19</i>	Write in a different digital ink color, and pick up a different colored pen	3.83	1.26	2.57	<i>IN</i>
<i>IOOSB20</i>	Use the floating tools from the start center like pen tool, highlighter tool, eraser, line tool, Shape Tool and open notebook	3.75	2.06	1.69	<i>IN</i>
<i>IOOSBT</i>		3.76	2.08	1.67	<i>IN</i>

Key: *IN*-Improvement Needed, *INN*- Improvement Not Needed

The researchers determined performance gaps of lecturers in solving problems arising from using SBs for teaching technical education courses. In the Table 4, the performance gaps of the items ranged from 1.29 to 1.93; all the performance gap values are positive indicating that the lecturers need improvement in solving

problems arising from using SBs for teaching technical education courses in Nigerian universities.

Table 4. Performance Gap Analysis of Lecturers in solving Technical Problems arising from using SBs for Teaching Technical Education Courses

S/N	Item statements	Xn	Xp	PG= Xn-Xp	Explanations
IOSTP1	Troubleshoot SB when the system fails to recognize and create meaningful interactive lessons	3.79	2.11	1.68	IN
IOSTP2	Troubleshoot SB when it fails to receive image from a laptop	3.87	2.10	1.77	IN
IOSTP3	Provide solution when SB fails to play video clips on the left side of the board	3.61	1.99	1.62	IN
IOSTP4	Reboot the computer randomly when it hangs or crashes	3.69	2.17	1.52	IN
IOSTP5	Rectify the fault when SB fails to obtain snapshots of the screen to capture critical moments	3.73	2.09	1.64	IN
IOSTP6	Solve problem when power light on the front of the computer is blinking rapidly	3.65	1.99	1.66	IN
IOSTP7	Troubleshoot SB when conflicts between devices appear in window	3.95	2.02	1.93	IN
IOSTP8	Provide solution when SB system fails to run at some point after initial setup	3.78	2.11	1.67	IN
IOSTP9	Identify the source of the problem when SB program s refuse to install nor appear on the computer or hung when trying to run items	3.75	2.19	1.56	IN
IOSTP10	Rectify fault not allowing SB system to start up or shut down	3.68	2.00	1.68	IN
IOSTP11	Provide everlasting solution for a computer/laptop used for SB when it suddenly shuts down during lesson	3.89	2.60	1.29	IN
IOSTP12	Correct SB when program s/write ups on interactive whiteboard screen suddenly disappeared	3.61	2.12	1.49	IN
IOSTP13	Troubleshoot earth leakage on the interactive whiteboard system	3.65	2.19	1.46	IN
IOSTP14	Troubleshoot SB/interactive whiteboard system when shuts down or reboots without warning	3.88	2.08	1.80	IN

IOSTP15	Provide solution to a situation when the image or prepared lessons are not transmitted to the white board or poor	3.78	2.11	1.67	IN
IOSTP16	Correct SB when it fails to record through microphone on the computer	3.77	2.20	1.57	IN
IOSTP17	Troubleshoot SB system when the computer/laptop is not aligned correctly	3.69	2.01	1.68	IN
IOSTPT		3.75	2.12	1.62	IN

Data in Table 5 on research question four reveal that the performance gaps of all the items ranged from + 0.81 to +1.90 indicating that all the lecturers need improvement inform of capacity building in Utilizing SBs for improving students’ engagement, motivation and learning outcomes in technical education courses in Nigerian universities.

Table 5. Performance Gap Analysis of Lecturers in Utilizing SBs for improving Students’ Engagement, Motivation and Learning Outcomes in Technical Education Courses

S/N	Item statements	Xn	Xp	PG= Xn-Xp	Explanations
IOUSB1	Include more clear and enlarge picture or diagrams into the contents of the lessons on smart board	3.87	2.00	1.87	IN
IOUSB2	Include pictorial images to explain a concept on a smart board	3.91	2.01	1.90	IN
IOUSB3	Place a smart board at a strategic place in the class to capture the attention of the students	3.69	2.18	1.51	IN
IOUSB4	Make the smart board to be visible to all students	3.89	1.99	1.90	IN
IOUSB5	Improve smart board colours and animated displace	3.69	2.03	1.66	IN
IOUSB6	Bring out attractive features in the smart board	3.75	2.23	1.52	IN
IOUSB7	Integrate interesting diagrams/pictures to explain the contents of a lesson	3.85	2.20	1.65	IN
IOUSB8	Select and utilize SB that have dynamic and graphical capability	3.73	1.87	1.86	IN
IOUSB9	Mix visual and aural information while using SB	3.79	2.91	0.88	IN
IOUSB10	Present lesson to enable students make connections between what they see and hear	3.68	2.22	1.46	IN

<i>IOUSB11</i>	Present information or contents of the lesson in an interesting way	3.91	2.12	1.79	<i>IN</i>
<i>IOUSB12</i>	Use SB to increase of the interaction between the teacher and the learners	3.63	2.17	1.46	<i>IN</i>
<i>IOUSB13</i>	Develop self-learning skills of the students through SB	3.77	2.21	1.56	<i>IN</i>
<i>IOUSB14</i>	Include motivational questions while teaching with SB	3.84	2.10	1.74	<i>IN</i>
<i>IOUSB15</i>	Build confidence as a teacher while using SB	3.72	2.11	1.61	<i>IN</i>
<i>IOUSB16</i>	Use the smart board to introduce a lesson in order to grab the student's attention	3.87	2.29	1.58	<i>IN</i>
<i>IOUSB17</i>	Introducing a lesson to determine students' prior knowledge and understanding	3.67	2.27	1.40	<i>IN</i>
<i>IOUSB18</i>	Making predictions by using SB	3.69	2.10	1.59	<i>IN</i>
<i>IOUSB19</i>	Building up instructions for practical tasks using SB	3.82	2.01	1.81	<i>IN</i>
<i>IOUSB20</i>	Recording and showing results on the SMART Board effectively and efficiently	3.80	2.10	1.70	<i>IN</i>
<i>IOUSB21</i>	Allow students to group pictures of the objects into the specific area they belong to introduce a lesson and test the students prior knowledge at the same time	3.79	2.45	1.34	<i>IN</i>
<i>IOUSB22</i>	Provide step-by-step instructions on the smart board to help students be able to complete practical tasks easier	3.79	2.33	1.46	<i>IN</i>
<i>IOUSB23</i>	Create extra directions or visuals of directions to help them understand better	3.81	2.15	1.66	<i>IN</i>
<i>IOUSB24</i>	Integrate tables or charts to show results and drag information from one box to another	3.78	2.14	1.64	<i>IN</i>
<i>IOUSB25</i>	Operate smart board to give students the ability to manipulate information on tables and move boxes or shapes to find answers.	3.91	2.19	1.72	<i>IN</i>

<i>IOUSB26</i>	Include videos, audios and other animations to help students engaged	3.71	2.00	1.71	<i>IN</i>
<i>IOUSB27</i>	Include and project audio-visual contents of technical education courses to boost the interest and engagement of students	3.76	2.09	1.67	<i>IN</i>
<i>IOUSB28</i>	Ask provoking questions from students when using SB to catch students' attention	3.89	2.24	1.65	<i>IN</i>
<i>IOUSB29</i>	Use SB to enable two-way interaction between the teacher and the students	2.99	2.18	0.81	<i>IN</i>
<i>IOUSB30</i>	Apply SB to allow captured material to be shared on paper or electronically later	3.88	2.15	1.73	<i>IN</i>
<i>IOUSB31</i>	Provide engaging lesson for a variety of students and diverse learners using SB	3.87	2.22	1.65	<i>IN</i>
<i>IOUSBT</i>		3.76	2.16	1.59	<i>IN</i>

The researchers found out constraints against the utilization of SBs in improving SEMLOs in technical education courses. The Table 6 shows that all the 25 items have their mean values ranged from 3.59 to 3.91. This shows that the mean value of each item was above the cut-off point of 3.50, indicating that lecturers need all the 25 constraints against the utilization of SBs in improving SEMLOs in technical education courses. The standard deviation of the 25 items ranged from 0.59 – 0.87 and each is less than 1.96 (95% confidence limit). This indicates that the respondents were not far from the means or from one another in their responses.

Table 6. Mean Responses of Respondents on the Constraints against the Utilization of SBs in improving SEMLOs in Technical Education Courses

<i>S/N</i>	Item statements	\bar{X}	SD.	Explanations
<i>IOC1</i>	Lack of skills by lecturers to make use smart board for teaching	3.77	0.78	<i>Agreed</i>
<i>IOC2</i>	Lack of technical support officers to maintain SBs when they malfunction	3.59	0.67	<i>Agreed</i>
<i>IOC3</i>	Irregular power supply in schools to make use SB	3.68	0.60	<i>Agreed</i>
<i>IOC4</i>	Lack of strong policies to compel lecturers making use of smart boards	3.69	0.77	<i>Agreed</i>
<i>IOC5</i>	Unwillingness of teachers and students to utilize smart board	3.68	0.79	<i>Agreed</i>
<i>IOC6</i>	Lack of availability or inadequacy of smart boards in schools	3.69	0.78	<i>Agreed</i>

IOC7	Lack of capacity building of lecturers for applying SBs	3.91	0.72	<i>Agreed</i>
IOC8	Lack of time to learn and prepare lessons using SBs	3.78	0.65	<i>Agreed</i>
IOC9	Negative attitudes of teachers towards using SBs	3.72	0.76	<i>Agreed</i>
IOC10	Lack of confidence in using smart boards	3.68	0.76	<i>Agreed</i>
IOC11	Lecturers' established beliefs and practices of teaching	3.81	0.61	<i>Agreed</i>
IOC12	lack of appropriate software used with smart boards for effective learning	3.60	0.78	<i>Agreed</i>
IOC13	Lack of curriculum which accommodates the use modern tools such as smart board	3.75	0.66	<i>Agreed</i>
IOC14	Lack of the equipment and necessary hardware for the use of the smart board	3.81	0.60	<i>Agreed</i>
IOC15	Having few program s in the university of how to use the smart board	3.78	0.64	<i>Agreed</i>
IOC6	Lack of conducive classroom environment to mount smart boards	3.59	0.80	<i>Agreed</i>
IOC17	Students' population explosion	3.68	0.77	<i>Agreed</i>
IOC18	Lecturers' fear (technophobia) for Utilizing smart board for teaching	3.77	0.76	<i>Agreed</i>
IOC19	Lack of professional support	3.67	0.73	<i>Agreed</i>
IOC20	Fear of provoking or downgrading questions from students about the lesson and use of smart board	3.78	0.67	<i>Agreed</i>
IOC21	Disrupted Internet connection	3.59	0.87	<i>Agreed</i>
IOC22	Lack of funds to meet the high cost of offering new technologies	3.89	0.61	<i>Agreed</i>
IOC23	Fear of damaging the smart board during usage	3.82	0.63	<i>Agreed</i>
IOC24	high workload schedules and teachers' lack of enough time to learn and prepare for smart board	3.87	0.59	<i>Agreed</i>
IOC25	Lack of interactive digital learning materials and resources to be used with the smart board	3.77	0.67	<i>Agreed</i>

Hypotheses tested

Table 7 contained data on two hypotheses tested which further shows the study outcomes summary for the experienced lecturers compared to the less experienced lecturers. The Table 7 therefore reveals all the items on performance needs of lecturers in Utilizing SBs for improving students' engagement, motivation and learning outcomes in technical education courses had their P-values greater than .05. This indicated that there was no significant difference in the mean responses of experienced and less experienced lecturers on their performance needs in Utilizing SBs for improving students' engagement, motivation and learning outcomes in technical

education courses. Therefore, the null hypothesis of no significant difference was upheld for all the 31 items on utilization of smart boards.

Table 7. Summary of the t-test Result on the Needs of Lecturers in improving SEMLOs using SBs and Constraints against the Utilization of SBs in improving SEMLOs in Technical Education Courses

Hypotheses	Groups	N	\bar{X}	SD	Df	P-values	Sig.	Explanations
H0₁ (Utilizing SBs)	Experienced lecturers	39	4.25	0.98	127	0.23	0.05	<i>Not significant</i>
	Less experienced lecturers	90	3.98	0.91				
H0₂ (Constraints)	Experienced lecturers	39	3.78	0.87	127	0.12	0.05	<i>Not significant</i>
	Less experienced lecturers	90	3.98	0.88				

In the same vein, hypothesis two (H₀₂) tested on constraints against the use of SBs had their p-values greater than .05. This meant that there was no significant difference in the mean responses of the experienced and less experienced lecturers on the constraints against the utilization of SBs in improving SEMLOs in technical education courses. Therefore, the null hypothesis of no significant difference was upheld for all the 25 items of constraints against the use of smart boards

Discussion

The results of this study revealed that lecturers need improvement because they had low performance in setting up smart boards, operating smart boards and solving technical problems arising from using SBs for teaching technical education courses. These findings agreed with the findings of Bakare, Orji, Wogu, and Ogbonna (2018) who determined effectiveness of teleconferencing in Nigerian universities and found that personnel such as lecturers and instructors lack skills to operate and maintain teleconferencing technologies or gargets such as smart boards. The finding on solving technical problems arising from using SBs for teaching technical education courses agreed with the finding of Korkmaz and Cakil (2013) that teachers lack ability to solve the technical failures by themselves during class hours. The findings of this study also agreed with the findings of Olelewe and Okwor (2017) who found out that majority of lecturers possess low IWB utilization skills. The lack of skills or competence in setting up, operating and solving technical problems arising from the utilization of SBs could be attributed to irregular or lack of training of lecturers on effective utilization of smart boards. This low level of skills among lecturers according to Jegede (2009), Kiru (2018) occurs as a result of inadequate ICT training and orientation given to faculty members on IWB usage. The finding of the study on skills or competencies need of lecturers for setting up and operating smart boards for teaching technical education courses agreed with the results of Olelewe and Okwor (2017) that vocational education teachers lecturers have low skills in inserting

new pages and slides, performing online search and do online collaborative learning and have low skills in adjusting the contrast display, and in inserting pictures, audios, videos, among others from a file line source.

The findings of the study were in consonance with the finding of Korkmaz and Cakil (2013) that teachers find smart boards useful, but do not utilize them adequately because they do not know how to use these tools. The findings of the study also showed that lecturers need improvement in form of capacity building in Utilizing SBs for improving students' engagement, motivation and learning outcomes in technical education courses. The summary of these findings is that lecturers lack technical knowhow to utilize SBs for improving students' engagement, motivation and learning outcomes in technical education courses and they need improvement in form of capacity building in order to improve the situation. In fact there is need to retrain the lecturers for effective use of SBs because using an IWB during lessons has been perceived to motivate and engage students in the learning process (Le Lant & Lawson, 2016). The smart board gives teachers the ability to provide engaging lessons for a variety of students and diverse learners (Parameter, 2012). The hypothesis tested revealed that there was no significant difference in the mean responses of experienced and less experienced lecturers on their performance needs in Utilizing SBs for improving students' engagement, motivation and learning outcomes in technical education courses.

It was also showed that 25 constraints were against the utilization of SBs in improving SEMLOs in technical education courses in Nigerian universities. These findings agreed with the findings of Bingimlas (2015) who conducted a study on the use of smart boards in enhancing learning and teaching in high education found several barriers to the effective use of the smart boards; lack of technical support for smart board, lack of the equipment and necessary software for the use of the smart board and having smart board retraining program. These findings agreed with the findings of Bakare, Orji, Wogu, and Ogbonna (2018) who determined effectiveness of teleconferencing in Nigerian universities and found that lack of constant power supply and lack of personnel to maintain teleconferencing technologies or gargets. The findings also agreed with the results of Olelewe, Orji, Osinem, and Kemelu (2019) that lack of access to institutional Wi-Fi and other gadget like smart board affect the utilization of modern technology. The findings agreed with the opinion of Gast, Mechling, & Thompson (2008) that some teachers believe their lack of familiarity and fear of not knowing how to create meaningful lessons with technology prevents them from doing so. Also, Turbill (2001) found in a study with kindergarten students that the implementation of technology was being hindered by lack of time and expertise to explore and understand the different types of technology that are most beneficial in the classroom. According to teachers' opinions, in Korkmaz and Cakil (2013) the reason for the inadequate use of smart boards is not due to the smart boards but due fact that teachers do not make adequate preparation before the classes. Prominent among the constraints of utilization of SBs include lack of skills for operation of smart boards and lack of good SBs. According to Momani, Alshaikhi, and Al-Inizi (2016), constraints against the utilization of SBs in schools include: high workload schedules and teachers' lack of enough time to learn and prepare for smart board, lack of interactive digital learning materials and resources to be used with the smart board, computer programs and anti-virus protection software in classrooms are not up-to-date and there is no professional development program for teachers to upgrade their skills of using SBs. The finding of the study on lack of SBs in schools disagreed with the opinion of Le Lant and Lawson (2016) that the university has budgets to cater for utilization of ICTs, and

other gadgets like smart boards. In contradiction, Ariyo and Bamgboye (2016) stated that SBs was popularly used by teachers. Momani, Alshaikhi, and Al-Inizi (2016) categorized constraints against utilization of SBs into three: teachers' factors which include lack of competence of teachers, school administration and technical Support factors. Under technical factor, the majority of teachers emphasized that technicians are not available when smart board's problems occur. The number of technicians is a small to deal with all classrooms demands, too. Hypothesis tested also revealed that there was no significant difference in the mean responses of the experienced and less experienced lecturers on the constraints against the utilization of SBs in improving SEMLOs in technical education courses.

Conclusion

The study was carried out to investigate the constraints and performance gap analysis of lecturers in Utilizing smart boards for improving students' engagement, motivation and learning outcomes in technical education courses in Nigerian Universities. A total of five research questions were answered: one was to what are performance needs of lecturers in setting up SBs for improving SEMLOs in technical education courses, second was what are the performance needs of lecturers in operating SBs for improving SEMLOs in technical education courses, third was what are performance needs of lecturers in solving problems arising from using SBs when teaching technical education courses, fourth was what are performance needs of lecturers in Utilizing SBs for improving students engagement, motivation and learning outcomes in technical education courses while the last question was what are the constraints against the utilization of SBs in improving SEMLOs in technical education courses. To answer these questions, both structured and non-structured self-developed questionnaire were employed as the instrument for data collection. In conclusion, the study revealed where lecturers needed improvement in setting up, operating smart boards, and solving technical problems arising from using SBs. The study also showed where lecturers need improvement in Utilizing SBs for improving students' engagement, motivation and learning outcomes in technical education courses. The study finally revealed 25 constraints against the utilization of SBs in improving SEMLOs in technical education courses in Nigerian universities.

Recommendations

The following recommendations were made:

1. All the skills and competencies identified should be packaged into training program to retrain these lecturers through workshops, seminars and short term training in the tertiary institutions
2. Individuals and bodies with enabling abilities should help growing universities by providing equipment like smart boards and other relevant infrastructure
3. Everlasting solutions should be provided to remove constraints and other limitations against effective utilization of SBs for teaching in Nigerian universities
4. Lecturers should also embark on self-training and education about effective use of SBs for teaching technical courses
5. Education technologists should be employed and teachers should be constantly supported and supervised by these experts.

References

- AbdulRahman, M. Al-Zahrani (2011). Preparing Pre-service Teachers for the Effective Use of Educational Technology in Saudi Arabia. *Published M.A thesis*
- Ahmad, W., Ali, Z., Sipra, M., & Hassan Taj, I. (2017). The Impact of Smartboard on Preparatory Year EFL Learners' Motivation at a Saudi University. *Advances in Language and Literary Studies, ISSN, 2203-4714*.
- Ahmet, O., A. & Halit A. (2015). Teachers' Attitudes toward Using Interactive White Boards. *Middle Eastern & African Journal of Educational Research, Issue 22-30*
- Akkoyunlu, B. & Erkan, S. (2013). A Study on student and teacher views on technology use. *Procedia - Social and Behavioral Sciences, 103, 68–76*.
- Al-Faki, I. M and Khamis, A.H.A (2014). Difficulties Facing Teachers in Using Interactive Whiteboards in Their Classes. *American International Journal of Social Science. 3(2) 136-158*
- Alfaki, I. M., & Khamis, A. H. A. (2014). Difficulties facing teachers in using interactive whiteboards in their classes. *American International Journal of Social Science, 3(2), 136-158*.
- Al-Senaïdi, S., Lim, L., & Poirot, J. (2009). Barriers to adopting technology for teaching and learning in Oman. *Computers & Education, 53(3), 575–590*.
- Ariyo, S.O.& Bamgboye, S.O. (2016). Assessment of the Skills Possessed by Teachers of Metalwork in the Use of Interactive Whiteboard in Technical Colleges in Oyo State. *Journal of Technical Vocational Education, Training and Research, 1(2), 84-89*.
- Armstrong, V. & Barnes, S. & Sutherland, R. & S. Curran & Mills, S. & Thompson (2005), 'Collaborative research methodology for investigating teaching and learning: the use of interactive whiteboard technology' university of Bristol, UK; Whitehall Primary School, UK; Teyfant Community School, UK; Sheldon School, UK. *Educational Review, 57(4)*.
- Asigigan, S. I. & Samur, Y. (2021). The Effect of Gamified STEM Practices on Students' Intrinsic Motivation, Critical Thinking Disposition Levels, and Perception of Problem-Solving Skills. *International Journal of Education in Mathematics, Science, and Technology (IJEMST), 9(2), 332-352*.
<https://doi.org/10.46328/ijemst.1157>
- Association for talent development (2007). *Performance Gap analysis*. <https://www.td.org/td-at-work-digital-issues/performance-gap-analysis>
- Aydinli- Mathews, J. & Elaziz, F. (2010) Turkish students' and teachers' attitudes toward the use of interactive whiteboards in EFL classrooms, *Computer Assisted Language Learning, 23(3), 235-252*.
- Aytaç, T. (2013). Interactive Whiteboard factor in Education: Students points of view and their problems. *Educational Research and Reviews, 8(20), 1907-1915*.
- Bakare J. A. & Owodunni, A. S. (2011). Performance improvement needs of lecturers in the application of computer to the teaching of electrical/electronic courses in colleges of education in south west Nigeria. *Nigerian educational research association journal 16(1), 131-138*
- Bakare, J. (2014). Development and validation of cell phone maintenance training modules for national diploma students. *An Unpublished Ph.D Project Submitted to the Department of Vocational Teacher Education, University of Nigeria, Nsukka*.

- Bakare, J., Ifeanyieze F. O. & Olaitan, S.O. (2019). *Educational research types and process: conceptual analysis of troublesome areas to young researchers*. Enugu: Unity Press Limited.
- Bakare, J., Omeje, H.O., Ariyo, S. O., Nwaodo, S. I., Ogunmilade, J. O. & Olaoye, O. A. (2020). Innovations into industrial technology programs of Nigerian universities for effective application of mobile communication technologies and quality assurance of graduates. *Indonesian journal of electrical engineering and computer science*-Accepted and submitted for final publication
- Bakare, J., Orji, C. T., Wogu, J. O. & Ogbonna, C. A. (2018). Effectiveness of teleconferencing in Nigerian universities: a descriptive approach. *IJUNSST*, 11(3), 27-38
- Balta, N., & Duran, M. (2015). Attitudes of students and teachers towards the use of interactive whiteboards in elementary and secondary school classrooms. *Turkish Online Journal of Educational Technology-TOJET*, 14(2), 15-21.
- BECTA (2003), 'What the research says about interactive whiteboards'. Available at: <http://www.becta.org.uk/research>. Accessed 15th June 2003. BECTA= British Education Communication and Technology Association
- Becta (2009), *Harnessing Technology Review 2008: The role of technology and its impact on education*, Coventry, Becta. www.becta.org.uk/publications/htreview08
- BECTA (British Educational Communications and Technology Agency) (2004). *Getting the most from your interactive whiteboard: A guide for primary schools*. Coventry: BECTA.
- Beeland, W. D. (2002). Student engagement, visual learning and technology: Can interactive white-boards help? *Action Research Exchange*, 1(1).
- Bell, M. A., (2002). Teachers' perceptions regarding the use of the interactive electronic whiteboard in instruction, *Teachers.net*. Retrieved August, 2019 from <http://teachers.net/gazette/jan02/mabell.html>
- Bendig, A. W. (1954). Reliability and the number of rating scale categories. *Journal of Applied Psychology*, 38, 38-40.
- Bingimlas, K. A. (2009). Barriers to the successful integration of ICT in teaching and learning environments: A review of the literature. *Eurasia Journal of Mathematics, Science & Technology Education*, 5(3), 235-245.
- Blau, I. (2011). Being a smart teacher in a "smart classroom": Assessing teacher professional development for incorporating Interactive White Boards at schools. *Learning in the Technological Era*, 63-74.
- Blau, I. (2012). The quiet revolution: Interactive whiteboards in school as the foundation for an innovative pedagogy in the 21st century. In *Ma'of Uma'aseh*, 139-156. Achva College. [in Hebrew]
- Brown, L. V. (2007). *Psychology of motivation*. New York: Nova Science Publishers.
- Chen, W., Tan, A., & Lim, C. (2012). Extrinsic and intrinsic barriers in the use of ICT in teaching: A comparative case study in Singapore. In M. Brown, M. Hartnett, & T. Stewart (Eds.), *Future challenges, sustainable futures*. Wellington: Proceedings ascilite Wellington 2012
- Clark, D. (2012). *Interactive whiteboard or souped-up blackboard?* Retrieved August, 2019, from <http://donaldclarkplanb.blogspot.co.uk/2012/10/interactive-whiteboard-or-souped-up.html>
- Coates, H. (2007), A Model of Online and General Campus-Based Student Engagement. *Assessment and Evaluation in Higher Education*. 32(2), 121-141.
- Condry, J., and J. Chambers. (1978). *Intrinsic Motivation and the Process of Learning*. In *The Hidden Costs of*

- Reward, New Jersey: Lawrence Erlbaum Associates, Inc
- Coon, D. & Mitterer, J. O. (2010). *Introduction to psychology: Gateways to mind and behavior with concept maps*. Belmont, CA: Wadsworth.
- Cuthell, J.P. (2005). The impact of interactive whiteboards on teaching, learning, and attainment. *Proceedings of SITE 2005*, 1353-1355Z. AACE: Phoenix, Arizona.
- Davidovitch, N., & Yavich, R. (2017). The Effect of Smart Boards on the Cognition and Motivation of Students. *Higher Education Studies*, 7(1), 60-68.
- De Vita, M., Verschaffel, L. & Elen, J. (2014a). Investigating the distinctive role of the interactive whiteboards for mathematics teaching. In I. Sahin, A. Kiray, & S. Alan (Eds.), *Proceedings from ICEMST 2014 (International Conference on Education in Mathematics, Science & Technology)*, Konya, Turkey (pp. 306–316). Retrieved from http://www.2014.icemst.com/ICEMST_Proceeding.pdf?rnd=968172323
- De Vita, M., Verschaffel, L., & Elen, J. (2014b). Interactive whiteboards in mathematics teaching: A literature review. *Education Research International*, 2014, 1-16. <http://dx.doi.org/10.1155/2014/401315>
- Dev, P.C. (1997). Intrinsic motivation and academic achievement: What does their relationship imply for the classroom teacher? *Remedial and Special Education*, 18(1), 12-19.
- Dhindsa, H. S. & Emran, S. H. (2006). Use of the interactive whiteboard in constructivist teaching for higher achievement. *Proceedings of the Second Annual Conference for the Middle East Teachers of Science, Mathematics, and Computing*. Abu Dhabi.
- Emeagwali, O. L., & Naghdipour, B. (2013). Exploring the usage and user-perception of interactive White boards in higher education in North Cyprus. *Procedia – Social and Behavioral Sciences*, 83, 272-276.
- Ersoy, A. & Bozkurt, M. (2015). Understanding an Elementary School Teachers' Journey of Using Technology in the Classroom from Sand Table to Interactive Whiteboard. *International Electronic Journal of Elementary Education* 8 (1), 1-20.
- Eskja, V., and Edi, P. (2017). The Importance of Motivation in an Educational Environment. *Formazione & insegnamento XV*, 57-66. doi: 107346/-fei-XV-01-17_05
- European Schoolnet (2006). The ICT Impact Report: A review of studies of ICT impact on schools in Europe- European Schoolnet, smarttech.com/ICT_Schoolnet, Retrieved August, 2019, from http://insight.eun.org/shared/data/pdf/impact_study.pdf.
- Farooq, M. U. & Javid, C. (2012). NUM: attitude of students towards E-learning: a study of English learner at Taif university English language centre. *J. Crit. Inq.*, 10 (2), 17-31
- Fredricks, J. A., Blumenfeld, P. C. & Paris, A. H. (2004), "School Engagement: Potential of the Concept, State of the Evidence", *Review of Educational Research*, 74(1), 59-109.
- Gall, D.M., Gall, P.J. & Borg, R.W. (2007). *Educational research. An introduction*. New York: Allyn and Bacon
- Gast, D. L., Mechling, L.C., & Thompson, K.L. (2008). Comparison of the effects of SMART Board technology and flash card instruction on sight word recognition and observational learning. *Journal of Special Education Technology*, 23(1), 34-46.
- Gast, D.L., Krupa, K., & Mechling, L.C. (2007). Impact of smart board technology: An investigation of sight word reading and observational learning. *J Autism Development Disorder*, 37, 1869-1882.
- Giles, R.M., & Shaw, E.L. (2011). Smart boards rock. *Science and Children*.
- Goodison, T. A. (2002). Learning with ICT at primary level: Pupils' perceptions. *Journal of Computer Assisted*

- Learning*, 18, 282-295.
- Great school partnership (2016). *The glossary of education reform*. <https://www.edglossary.org/student-engagement/>
- Hadley, M., & Sheingold, K. (1993). Commonalities and distinctive patterns in teachers' integration of computers. *American Journal of Education*, 101(3), 261–315.
- Harper, S.R. & Quaye, S.J. (2009), "Beyond Sameness, with Engagement and Outcomes for All" in *Student Engagement in Higher Education*, eds. S.R. Harper & S.J. Quaye, Routledge, New York & London, pp. 1-15.
- Higgins, D.G. (2005). Embedding ICT in the Literary and Numeracy Strategies – Final Report, Centre for Learning and Teaching, Newcastle, http://partners.becta.org.uk/upload-dir/downloads/page_documents/research/univ_newcastle_evaluation_whiteboards.doc
- Higgins, S., Beauchamp, G., & Miller, D. (2007). Reviewing the literature on interactive whiteboards. *Learning, Media and Technology*, 32(3), 213-225.
- Hockly, N. (2013). Interactive whiteboards. *ELT Journal*, 67(3), 354-358. <http://doi.org/10.1093/elt/cct021>
- Hu, S., and Kuh, G. D. (2003a). Diversity Experiences and College Student Learning and Personal Development. *Journal of College Student Development*, 44(3), 320-334.
- Hu, S., Kuh, G.D. & Li, S. (2008). "The Effects of Engagement in Inquiry-Oriented Activities on Student Learning and Personal Development." *Innovative Higher Education*, 33(2), 71-81.
- Hurst, M. (2020). *The importance of motivation in an educational environment*. Retrieved from <https://study.com/academy/lesson/the-importance-of-motivation-in-an-educational-environment.html>
- Jegede, P.O. (2009). *Issues in Informing Science and Information Technology Volume 6, Ile-Ife: Assessment of Nigerian Teacher Educators' ICT Training Obafemi Awolowo University*.
- Jones, W. P. & Scott, A. L. (2013). *Optimal number of questionnaire response categories: More may not be better*. SAGE Open 1–10 DOI: 10.1177/2158244013489691 Accessed on November 17, 2016 from <http://sgo.sagepub.com/content/3/2/2158244013489691.full-text.pdf?html>.
- Karsenti, T. (2016). *The Interactive Whiteboard (IWB): Uses, Benefits, and Challenges. A survey of 11,683 students and 1,131 teachers*. Montreal: CRIFPE.
- Khan, M. S. H., Hasan, M., & Clement, C. K. (2012). Barriers to the introduction of ICT into education in developing countries: The example of Bangladesh. *International Journal of Instruction*, 5(2), 61–80.
- Kiru, E.W. (2018). Mathematics teachers' use of information and communication technologies: An international comparison. *International Journal of Research in Education and Science (IJRES)*, 4(1), 165-177.
- Korkmaz, O. & Cakil, I (2013). Teachers' difficulties about using smart boards. *Social and behavioral Sciences* 83 (2013) 595 – 599
- Korkmaz, O. and Cakil, I. (2013). Teachers' difficulties about using smart boards. *Procedia - Social and Behavioral Sciences* 83, 595 – 599
- Kostelecky, K., & Hoskinson, M. (2005). A novel approach to motivating students. *Education*, (125), 438-443. Retrieved June 16, 2008, from ERIC database.
- Krause, K. & Coates, H. (2008), "Students' Engagement in First-Year University." *Assessment and Evaluation in Higher Education*, 33(5), 493-505.
- Kuh, G.D., 2002. *The college student report*. Bloomington, Indiana: Indiana University, National Survey of


- Student Engagement, Center for Postsecondary Research and Planning
- Kuh, G.D., Kinzie, J., Buckley, J.A., Bridges, B.K. & Hayek, J.C. (2007), "Piecing together the student success puzzle: Research, propositions, and recommendations", *ASHE Higher Education Report*, 32(5).
- Lamberth, T. T. (2012). *Interactive whiteboard use: The catalyst of student achievement*: London press
- Lan, T. & Hsiao, T. (2011). A study of elementary school students' viewpoints on interactive whiteboard. *American Journal of Applied Sciences*, 8(2), 172–176.
- Le Lant, C., & Lawson, M. J. (2016). Interactive whiteboard use and student engagement. In *Publishing Higher Degree Research* (pp. 33-42). Brill Sense.
- Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: age differences and academic correlates. *Journal of Educational Psychology*, 97, 184-196.
- Lewin, C., Somekh, B. & Steadman, S. (2008). Embedding interactive whiteboards in teaching and learning: The process of change in pedagogic practice. *Education and Information Technologies*. 13, 291 303.
- Martyn, S. (2008). *Descriptive Research Design*. Retrieved Jun 24, 2020 from Explorable.com: <https://explorable.com/descriptive-research-design>
- Marzano R. J. & Haystead, M. (2009). Final report on the evaluation of the Promethean technology. Englewood, CO: Marzano Research Laboratory. Retrieved August, 2019 from http://www.prometheanworld.com/upload/pdf/Final_Report_on_ActivClass_room_pdf.
- Marzano, R. (2010). *Mounting evidence of active classroom impact on student achievement*. Retrieved on 12/08/2019 from <http://www.prometheanworld.com/upload/pdf/>
- Mattell, M. S. & Jacoby, J. (1971). Is there an optimal number of alternatives for Likert scale items? study I: Reliability and validity. *Educational and Psychological Measurement*, 31, 657–674.
- Momani, M., Alshaikhi, T. Saleh & Al-Inizi, T. H. (2016). The obstacles of using smart board in teaching english at tabuk secondary schools. *Asian Journal of Educational Research*, 4(3), 23-39
- Mowbray, L., & Preston, C. (2008). Use of SMART Boards for teaching, learning and assessment in kindergarten science. *Teaching Science*, 54(2), 50-53.
- NCTE (National Center for Technology in Education) (2009). *Interactive Whiteboards*. Advice sheet 16.
- Nhete, T., Sithole, B. M., & Solomon, G. E. (2016). Pedagogy with interactive whiteboards: perspectives of business education teachers. *Journal of Emerging Trends in Educational Research and Policy Studies*, 7(3), 194-203.
- Njoku, D. O. (1993). *A comparative analysis of some curriculum learning theorist's model*. Owerri: Hudson-Jude Nigeria.
- Nugraha, S. T., Suwandi, S., Nurkamto, J. & Saddhono, K. (2017). The importance of needs assessment for the implementation of e-learning in a language program. *Conference Paper*. DOI: 10.18502/kss.v3i9.2686
- Ogunbodede, O. E. (2020). Technology innovation skills required by lecturers in the use of interactive whiteboards for effective teaching of electrical/electronic technology courses in colleges of education in south west Nigeria. *An unpublished project report*, Department of industrial technical education, university of Nigeria, Nsukka
- Olaitan, S. O., Asogwa, V. C. & Abu, M. (2013). Technology competencies required by secondary school graduates in maintenance, servicing and repairing of electronic machines for agribusiness occupations to minimize wastage. *Journal of Development and Agricultural Economics* 5, (1), 1-6.

- Olelewe, C. J. & Okwor, A. N. (2017). Lecturers' perception of interactive whiteboard for instructional delivery in tertiary institutions in Enugu State, Nigeria. *Journal of Computers in Education*, 4(2), 171-196.
- Olelewe, C.J., Orji, C.T., Osinem, E.C. & Ikemelu, C.R. (2019). Constraints and strategies for effective use of social networking sites (snss) for collaborative learning in tertiary institutions in Nigeria: perception of TVET lecturers. *Education and Information Technologies*, volume 25, pages 239–258
- Parameter, C. (2012). Student learning engagement with Smart boards in reader's workshop. *Education Masters*, Paper 233.
- Pearson, E.L., (2009). Longman Dictionary of Contemporary English. Pearson Press, England, UK.
- Perez-Lopez, D., & Contero, M. (2013). Delivering educational multimedia contents through an augmented reality application: A case study on its impact on knowledge acquisition and retention. *Turkish Online Journal of Educational Technology*, 12(4), 19-28.
- Preston, C., Cox, M., & Cox, K. (2000). *Teachers as innovators: An evaluation of the motivation of teachers to use information and communications technology*. Croydon: Mirandnet.
- Quirk, L. (1995). Longman dictionary of contemporary English. Spain: Longman Group
- Rajabi, A. & Khodabakhshzade, H. (2015). The Effect of Implementation of Smart Board on Iranian Lower-Intermediate EFL Learners' Reading Comprehension and Their Intrinsic Motivation in Reading. *Mediterranean Journal of Social Sciences*, 6(4), 281- 28. Doi:10.5901/mjss.2015.v6n4s1p281
- Schoepp, K. (2005). Barriers to technology integration in a technology-rich environment. *Learning and Teaching in Higher Education. Gulf Perspectives*, 2(1), 1–24.
- Schuck, S., & Kearney, M. (2007). *Exploring pedagogy with interactive whiteboards: A case study of six schools*. Sydney: Sydney University of Technology.
- Smith, F., Hardman, F., & Higgins, S. (2006). The impact of interactive whiteboards on teacher-pupil interaction in the National Literacy and Numeracy Strategies. *British Educational Research Journal*, 32(3), 443-457.
- Sünkür, M. Arabacı, İ.B., & Şanlı, Ö. (2012). Akıllıtahtauygulamalarıkonusundailköğretim II. Kademeöğrencilerinin görüşleri (Malatya İliörneği). *e-Journal of New World Sciences Academy*, 7(1); 313-321.
- Suryaman, M. (2019). Bridging Students' Learning Achievement. *Advances in Social Science, Education and Humanities Research*, volume 100
- Sushma, H. B. (2014). Teachers and students perception towards use of interactive white board: A study. *International Journal of Economic and Business Review*, 2(9), 113-118.
- Teare, R., Atkinson, N. & Westwood, C. (1996). *Achieving quality performance*. London: Redwood books Ltd.
- Teck, W. K. (2013). Affordances of interactive whiteboards and associated pedagogical practices: Perspectives of teachers of science with children aged five to six years. *Turkish Online Journal of Educational Technology-TOJET*, 12(1), 1-8.
- Turel, Y. K. (2010). Developing teachers' utilization of interactive whiteboards. In D. Gibson & B. Dodge (Eds.), *Proceedings of society for information technology & teacher education international conference 2010* (pp. 3049–3054). Chesapeake: AACE.
- Turbill, J. (2001). A researcher goes to school: Using technology in the kindergarten literacy curriculum. *Journal of Early Childhood Literacy*, 1(3), 255-279. doi:10.1177/14687984010013002

- Türel, Y. K. & Johnson T. E. (2012). Teachers' belief and use of interactive whiteboards for teaching and learning. *Journal of Educational Technology and Society*, 15(1), 381- 394.
- Ugwoke, E. O; Babalulu, M. M.; Anorue, H. C.; Amusa, T. A. (2020). Technology training needs of women farmers for enhancing value change in marketing of farm products in Enugu State, Nigeria. *European Journal of Economic and Financial Research*, 4 (1), 188-207. doi: 10.5281/zenodo.3891561
- Valarmathie, G., Juliana, A., Abdul Nasir, Z., Asmidah, A., and Ruzinoor, C. M., (2017). A review of the motivation theories in learning. *Paper presented at the 2nd International Conference on Applied Science and Technology 2017*.
- Winzenried, A., Dalgarno, B. & Tinkler, J. (2010). The interactive whiteboard: A transitional technology supporting diverse teaching practices. *Australasian Journal of Educational Technology*, 26(4), 534-552.
- Wood, R., & Ashfield, J. (2008). The use of the interactive whiteboard for creative teaching and learning in literacy and mathematics: a case study. *British Journal of Educational Technology*, 39 (1), 84-96.
- Yáñez, L., & Coyle, Y. (2011). Children's perceptions of learning with an interactive whiteboard. *ELT Journal*, 65(4), 446-457. <http://doi.org/10.1093/elt/ccq069>
- Yusuf, O. M. (2007). Trends and barriers on the integration of information and communication technology in the Nigerian school system. Retrieved January 10, 2015, from <https://www.google.com/search?q=Yusuf%2C%20M.%20.%282007%29.%20Trends%20and%20barriers%20on%20the%20integration%20of%20information%20and%20communication%20technology%20in%20the%20Nigerian%20school%20system.&ie=utf-8&oe=utf-8>.
- Zittle, F. J. (2004). *Enhancing Native American mathematics learning: The use of Smartboard-generated virtual manipulatives for conceptual understanding*. Retrieved August, 2019 from <http://edcompass.smarttech.com/NR/rdonlyres/3E2A063-6737-400F BD07-1D239C428729/0/Zittle.pdf>

Author Information

Jimoh Bakare


 <https://orcid.org/0000-0003-0503-9003>

University of Nigeria, Nsukka

Department of Industrial Technical Education

Nigeria

Samson O. Ariyo

 <https://orcid.org/0000-0002-1512-5645>


University of Nigeria, Nsukka

Department of Industrial Technical Education

Nigeria

Contact e-mail: samson.ariyo@unn.edu.ng

Samson A. Ojo

 <https://orcid.org/0000-0002-9798-3503>

University of Nigeria, Nsukka

Department of Industrial Technical Education

Nigeria
