

Abstract

This study presents the design and development of an Interactive Web-Based Assessment Tool (IWBAT) for integration into Smart Basic Education Schools in Enugu State, Nigeria. The platform was informed by a needs assessment to ensure that its features align with the specific requirements of teachers and students. Developed using HTML, CSS, JavaScript, PHP, and MySQL, the system offers secure online assignments, quizzes, automated grading, instant feedback, student performance tracking, and real-time reporting.

The IWBAT incorporates enhanced exam security, role-based access for administrators, teachers, and students, as well as incentives for high-achieving learners. The system underwent alpha and beta testing, with results confirming compliance with all specified requirements. Beta testing provided students firsthand experience, and feedback showed strong motivation for adoption due to improved assessment transparency, efficiency, and fairness.

This platform provides a scalable, reliable, and user-friendly solution to modernize basic education assessments in line with digital transformation objectives, ensuring secure evaluations and rewarding student effort.

Introduction

Background of the Study

The advent of the Fourth Industrial Revolution is introducing developments in Artificial Intelligence, Internet of Things, and other technologies in different sectors of our society, including education. This reality leads to a paradigm shift in which web-based cyber-physical environments will shape future learning environments making learning to become ubiquitous, and schools assuming new roles with systemic changes in communication, administration and management. The use of technologies aligned with pedagogical strategies and new methodologies leads to more-personalized smart learning systems (Eden, Onyebuchi & Adeniyi 2024). The landscape of smart learning systems has witnessed this tremendous shift from the traditional system of learning to smart education. Smart education also known as digital education or e-learning is an emerging learning environment that advocates the necessity for learners to learn in real-life situation technologies (Gros, 2016, Spector, 2014). With the help of cutting-edge real-world technologies like artificial intelligence, virtual reality, and the internet of things, smart education can accomplish its objectives of teaching, learning, research, and learning assessment while becoming more individualized, interactive, and accessible (Ray 2016). As stated by Zhu et al. (2016) The idea of "smart education" is based on two categories of technology: intelligent technologies and smart devices.

Smart devices represent those electronic devices connected to other devices that can operate independently and interactively to a certain extent in classroom instructional and learning contexts (Liu & Cao 2020). They are emerging instructional and learning tools such as flipped classroom, mobile apps, clickers' devices, interactive multimedia, audio devices, internet, telephone and VoIP, mobile gadgets, instructional television, computer games, teaching machines, interactive whiteboards and programmed instruction, etc., Edurne, Olatz, Ana, Jose, Nestor, (2020), with computing capacity and sensing function, which play a vital role in the classroom to create effective teaching and learning. There is a growing body of literature that recognizes the importance of smart devices use in the classroom settings (Liu & Cao 2020, Li, Wang & Ruan 2016, Bédard, Lison, Dalle, Côté, and Boutin, 2012). For example, Bédard, et al (2012) maintained that Smart devices are those latest technologies or devices and concepts used in classroom among students to students and students to teacher interaction. These

tools have been making an increasing impact on the classroom and individualized instruction. Also, these tools have been used in science as an effective way of communicating ideas and concepts to students and have greatly improved students' performance especially those with special needs and slow learners (Oshinaike & Adekunmisi, 2012, Shan Fu 2013). It has also been pointed out in Kiboss, Ndirangu, and Wekesa, (2004) that the knowledge, skills and use of these smart instructional tools, can enable the teacher to perform some activities that most scientists employ to describe, predict and control the world around them. However, with the researchers' in-depth views of smart devices' working mechanisms in educational settings, the concept of "smart" in smart devices are not are not independent of intelligent technologies.

Intelligent technologies which have been categorized according to Ray (2016) on the basis of Internet of Things technology are used just like smart devices to create, analyze and personalize educational activities in an intelligent learning environment. According to Ikechukwu and Amos (2023), an intelligent learning environment comprises both smart devices and intelligent technologies to give room to a more personalized form of educational activities in smart educational landscapes. Smart schools are few examples of smart educational landscapes.

Smart schools are learning institutions that have been systemically reinvented in terms of smart teaching-learning practices and school management using smart devices and intelligent technologies to prepare smart students for the Information Age (Recalde, Palau, Agustí & Cebrián 2021). According to the authors, smart schools are institutions that integrates technology to enhance education, leading to personalized and improved learning. Current research on smart schools explores the integration of technology to enhance education, focusing on areas like personalized learning, online learning, and the use of technology for administrative tasks, while also examining the challenges and ethical considerations of implementing and leveraging such systems (Khan, Abbas, Alruwaili, Nazir, Siddiqi, & Alanazi,

(2024). Research investigates how implementing and leveraging technology and AI, can enhance personalized learning experiences, focusing on increased engagement, improved student outcomes, and providing teachers with data-driven insights to better tailor instruction (Ayeni, Al-Hamad, Chisom, Osawaru & Adewusi 2024). Findings from [Caroline, Oroh and Pada](#) (2023) on the effectiveness of online learning platforms and the impact of technology on student engagement and learning outcomes, also revealed that learning experiences, facilitated by smart school technologies, can lead to significant improvements in standardized test scores. On smart classroom, the authors explore the use of interactive whiteboards, educational apps, and other technologies to create engaging and dynamic learning environments and reported that teachers can use these smart technologies to provide targeted interventions and support to students who are struggling, leading to improved learning outcomes.

Apart from enhancing teaching and learning, Ayeni et al (2024) stated that these smart technologies can help in streamlining administrative tasks, such as attendance tracking, grade management, and resource allocation, freeing up educators' time for teaching and student support. Smart schools use technology to also facilitate communication and collaboration between teachers, students, and parents, creating a more connected and supportive learning community. Smart schools also explore the use of data analytics to monitor student progress, identify areas for improvement, and make data-driven decisions about teaching and learning.

In Enugu State Nigeria, Smart schools project has been inspired by all of these key areas of current research on smart schools as well as similar projects undertaken by other countries of the world ([Attarana, Aliasb & Sirajc](#) 2012). For example, Enugu State proposed the idea

of smart schools in 2023 and it became operational in 2024. This was to improve current activities of smart school and attempts to provide a standard framework for development of smart education in the state. In addition, one of the major concerns was also to balance education facilities in rural areas and urban areas in order to reach educational justice. Reaching educational justice in this regard involves integration of sustainable IT infrastructures in both the rural areas and urban areas schools. By sustainable IT infrastructure we refer to the integration of physical systems and technologies that has different roles in the school system from facilitating teaching, learning, assisting the school management to assessment of students' performances in a smart and effective way ([Shahzad, Walke, Dahat & Kurmi](#) 2023).

Assessment of students' performance is an essential part of educational practice, as it allows the measurement of the achievement of learning objectives by students, and improves the quality of the instructional needs and curricula ([Arnold](#) 2022). Assessment itself is a process designed to identify, collect and interpret information on the knowledge, skills and attitudes achieved by the students ([Albert, 2010](#)). It is one of the processes of measurement that leads to the appraisal of a good outcome from methods of teaching and learning in a school's curriculum. It is also part of the curriculum implementation process, the essence of which is to ascertain what has been learned by the students within a stipulated period and at a certain level of education ([Ogbuanya and Usman, 2020](#)). According to [Phakiti and Steinhoff](#) (2023) students' assessment is the process of administering tests, observation, or exams to the students to find out what they have learned from what they were taught. Similarly, [Mbiriyakura and Kasowe](#) (2022) emphasized that assessment is an important stage of curriculum implementation which typically take place at the end of the learning process, without which teaching and learning will remain immeasurable. This concept has undergone significant evolution over the past few decades, moving from an isolated activity taking place at the

end of the learning process with the only purpose of giving a mark to the student to a continuous and systematic process directed toward making decisions for the improvement of the educational practices (Joshi, 2015). Considering the aims and the way assessment is administered, (Hassan, Tomalá, Coello, Silva (2024) maintained that assessment encompasses two broad spectrums of method - formative and summative.

In order to give students feedback on their progress and identify areas for improvement, formative assessment is a methodical and ongoing activity that takes place throughout the learning process (Joshi, 2014). Instead of assigning a grade, the focus of formative assessment is on giving the student written or verbal feedback from the instructor. According to Popham (2011), formative assessment is a deliberate process where teachers modify their ongoing instructional procedures or students modify their current learning approach based on assessment-elicited evidence of students' status. According to the author, this kind of evaluation can be created by having students complete self-assessment tasks and by having teachers observe the work that the students have completed.

On the other hand, summative assessments are used to provide a summary of the student's level of proficiency at the conclusion (or at a specific point) of the learning process through a specific grade or certification. The purpose of the assessment is to ascertain what students have learned at the conclusion of a particular lesson, unit, program, or school period. According to OECD/CERI (2008), it measures what students have learned at the end of a unit to promote students, ensure that they have met the requirements for certification upon completion of a level or school period, and identify candidates who have met the requirements to enter specific occupations. According to Hoover (2010), other applications of summative assessment include classifying and ranking students, giving grades to specific students, and assessing curricula and educational institutions (Hall, 2011; Hoover, 2011).