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Introducing E-Portfolio as Authentic Assessment Tool for the Fourth Industrial Revolution: Imperatives for Smart Green Schools

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Abstract: The Smart and Green Schools initiative of Enugu State Government is an innovative and skill-oriented programme aimed at preparing pupils and students at basic education level to function effectively and responsibly in the era of Fourth Industrial Revolution. Assessment is crucial to effective and innovative educational practices. However, some forms of assessment hinder innovative educational practices. Education stakeholders are expressing concern over their inability to use standardised test for authentic assessment of students. This paper focused on introducing e-portfolio as an authentic assessment tool for pupils and students in the Smart and Green Schools in Enugu State. The paper x-rayed the current assessment practices in the schools and how pupils and students can develop functional skills such as critical thinking through the use of e-portfolios. The e-portfolio facilitates holistic assessment of learning. However, despite the relevance of e-portfolio towards robust and authentic assessment practices, the paper highlighted that most teachers do not possess sufficient knowledge to use e-portfolio for assessing the students' knowledge and skills. In addition, the paper noted that the teachers, pupils and students' digital literacy level is low for effective utilization of e-portfolio for authentic assessment of learning in the Smart and Green Schools. The study recommended among others, urgent and extensive training of teachers, pupils and students on the application of e-portfolio for effective delivery of authentic assessment of learning in the schools.
Keywords: E-portfolio, authentic assessment, smart and green school initiative, fourth industrial revolution

Introduction

Assessment is central to innovative educational practices. It is a critical part of the educational process that involves collecting and analysing data to evaluate student learning and inform teaching strategies. There are several key purposes and forms of assessment in education. Traditional assessment otherwise known as conventional assessment and authentic assessment are forms of assessment employed in education. Some forms of assessment inhibit innovations in education. Assessment practitioners, teachers, lecturers, guidance and counsellors are expressing concerns over the continued use of paper-pencil test as assessment tools despite the technological advancement and applications. These expression of concerns by the assessment stakeholders have become obvious as many learners who academically performed excellently in traditional assessment of paper-pencil examinations find it difficult to apply their knowledge in workplace (Daizeabdao, 2015). In other words, learners who excelled in traditional assessment cannot put the theory they learnt in schools into practice despite their outstanding results.

The curricula of Smart and Green Schools (S&GS) recently introduced by Enugu State government integrate experiential learning. The S&GS is designed to prepare the students to fit effectively into the real-world activities. Using the traditional assessment to evaluate experiential learning is difficult. Kohn (1996) cited in Hodgman (2014) remarked that some teachers are not satisfied using traditional assessment. This development has resulted to the clamour for better and more comprehensive mode of assessment that could capture experiential learning. The researchers are of the view that authentic assessment may be effective in assessing experiential learning. Authentic assessment is an approach that evaluates whether students can successfully apply the knowledge and skills gained in the school environment to real-world contexts, scenarios, and situations beyond the academic setting. It measures what students know by demonstrating how they can use their knowledge to do in the society or workplaces (experiential learning) which is the hallmark of the Smart and Green Schools' curricula.

One of the tools used for authentic assessment is portfolio. The portfolio could be in form of physical folder or electronic portfolio. The electronic (e-portfolio) otherwise called digital portfolio, is a digital collection of artifacts such as essays, posters, photographs, videos among others prepared by the students. The portfolios are used in crucial educational programmes like brainstorming, reading and critical thinking. The students' e-portfolio can be used to assess students' cognitive, affective, and psychomotor skills by collecting and evaluating their work over time which fosters more comprehensive and authentic assessment (Wibawa & Paidi, 2019). The implication is that e-portfolio facilitates collection and holistic assessment of students' learning.

However, despite the numerous benefits associated with the use e-portfolio in assessment of learners, there are issues with its applications. The inherent challenges include teachers and learners' inadequate digital literacy skills (Cheng, 2022; Mak & Wong, 2018), unreliable access to technology and weak internet connection. Additionally, e-portfolio consumes time to create, maintain, and update (Cheng, 2022). There is also the risk of losing or damaging learners' e-portfolios or having their personal information or work misused or stolen by others. Unfortunately, too, the traditional method of assessment cannot be used to assess experiential learning which is the hallmarks of the curricula of Smart and Green Schools. In addition, the researchers have no knowledge of any researched papers on the adoption of electronic-portfolio for assessment of learning in the S&GS in Enugu State. This paper, therefore, x-rayed the current assessment practices in the Smart and Green Schools in the State. It discussed how the introduction of e-portfolio promotes authentic assessment of learning and the development of functional skills among pupils and students to thrive in Fourth Industrial Revolution (4IR). The e-portfolio will enable the pupils and students use their acquired skills, competencies and knowledge to solve contemporary societal problems not only in Enugu state but across the globe.

Traditional and Authentic Assessments

Undoubtedly, assessment is crucial to effective and innovative educational practices. It is central to educational practices especially in the teaching and learning environment (Amua-Sekyi. 2016; Anigbo, 2014; Ebuoh, 2024; Wibawa & Paidi, 2019). There are two major types of assessment, namely traditional and authentic assessments. While traditional assessment methods such as multiple-choice, true/false, short answer, and essay questions are valuable for assessing certain aspects of student learning, they do not fully capture the complexities of students' abilities or provide insights into practical applications of knowledge in the real-world tasks. Conventionally, tests used in large-scale traditional assessment are standardised and designed to evaluate the cognitive abilities of the testees. In essence, traditional assessment focuses on what the student knows and does not necessarily reflect students' experience. Many learners who obtained distinction or credit from traditional assessment of written

examinations often experience difficulties in real life activities due to their inability to put the theory into practice in workplaces despite their academic accomplishments. The traditional assessment environment is the teacher- or assessor-centred with practically no contribution from the pupils or students. The key responsibility of the teacher or assessor is to present tests developed from the curriculum.

Nonetheless, development of quality traditional assessment tests requires conscientious efforts. It is for this reason that Fatima (2021) argued that developing a large-scale standardised assessment requires the developer to clearly define the learning objectives and content to be assessed; the appropriate assessment format (e.g. multiple-choice, essay, performance-based); establish the test length, time limits, and scoring criteria; generate unambiguous test items that align with the learning objectives; ensure usage of appropriate language and avoid bias in the questions; ensure the difficulty level matches the intended purpose of the assessment, among others. The goal for the highlighted traditional test development activities is to develop assessments that are accessible, engaging, and accurately measure student learning in a fair and inclusive manner. Careful planning, item construction, and review are essential for creating high-quality large-scale traditional assessments. Assessments of pupils and students' academic performance alone using test do not factor their ability to perform in the field. The effect is a sharp disconnection between the students' academic achievement and their doing the job in the field.

As educational assessment practices evolve, there is a growing emphasis on integrating authentic assessments that better reflect real-world skills and applications. This may be the reason why educators are expressing concerns over the continued use of traditional assessment by most public examination bodies in Nigeria with an eye towards introducing authentic assessments. Authentic assessment measures students' proficiency by asking them to perform real-life tasks (Hodgman, 2014) and to provide students with many avenues to learn and demonstrate best what they have learned (Asamoa, 2019). The curricula of S&GSs are designed to prepare the pupils and students to fit into the real-world activities effectively. The experiential learning programme of the S&GS enables pupils and students experience while in the schools, situations and scenarios which they might encounter in the field. Using the traditional assessment to evaluate experiential learning is difficult. Experiential learning is a task-oriented, skill-oriented and performance-oriented learning. Experiential learning is essential for preparing students to thrive in the 4IR by equipping them with practical skills, fostering adaptability, and enhancing their engagement with real-world challenges. Specifically, workplaces in the era of 4IR require recruits to apply all abilities acquired in schools in their places of work. Unfortunately, assessment of all these attributes cannot be achieved using traditional assessment of tests and examinations. This is where the authentic assessment using tools like electronic portfolio (e-portfolio) comes into play.

Authentic assessment closes the gap between academic learning and real-world application by integrating tasks in meaningful contexts that require the coordination of multiple skills and knowledge areas. Authentic approach enhances the relevance of learning, preparing students for the complexities of real-life challenges. Instead of relying solely on theoretical knowledge, these assessments require students to apply their learning in practical, meaningful contexts. Furthermore, it provides opportunities for students to rehearse, practice, get feedback, and refine their work which may be containing complex tasks that may not have a single right answer. In a nutshell, while traditional assessments like examinations provide a snapshot of student learning, authentic assessments evaluate how students apply knowledge over time in real-world contexts. This form of gathering evidence on students' performance engenders holistic assessment covering cognitive, affective and psychomotor domains. However, this mode of gathering evidence on students' learning outcomes is time consuming and rigorous. On

this note, Ukashatu et al. (2021) remarked that authentic assessment is time consuming to develop by teachers, pupils and students because the teachers need to carefully craft realistic, complex tasks that align with learning objectives. It requires conscientious efforts and training of the assessors (teachers) to enable the use of e-portfolio to be effective particularly in S&GSs in Enugu state.

The e-portfolio

Introduction of electronic portfolio in assessment activities in Nigeria is novel. Students' electronic or e-portfolio is a collection of all works of students deposited in digital form. The work can be in form of recorded voices, pictures, YouTube among others. In the words of Tatnall (2020), an e-portfolio is students' work in the school compiled electronically on the Web. Students use e-portfolio to compile and share learning and assessment outcomes (Kunnari & Laurikainen, 2017). The e-portfolio enables students to collect and organise (Michael, 2015) as well as showcase their work (Bruckner, 2015) reflecting their learning progress and achievements which supports formative assessment to improve future learning outcomes (Wuisan et al., 2019). The e-Portfolio facilitates students' engagement, motivation, and control over their learning. It provides medium for pupils, students, teachers, and parents to share the learning process in real-time.

The e-portfolio supports student-led, parent, and teacher discussions about learning. The e-portfolios are deployed for the assessment of students' cognitive, affective, and psychomotor skills by collecting and evaluating their work overtime which fosters more comprehensive and authentic assessment (Wibawa & Paidi, 2019). The digital and portable nature of e-portfolios make them convenient for managing, accessing, and distributing student work for evaluation and feedback (Prastiwi, et al. 2020). The real-time feedback feature of e-portfloio facilitates innovative teaching and learning required for the Fourth Industrial Revolution. In many countries across the globe, e-portfolio assessment is very well applied in the learning process at all levels of education; from primary school to university level. According to Vernazza et al. (2011), Netherlands, United Kingdom, Taiwan, and South Africa are at the forefront of using competency-based e-portfolios. E-portfolios offer a dynamic platform for assessing competencies through various artifacts like assignments, projects, and reflections. Mokhtaria (2015) highlights that e-portfolios contribute to educational accountability by offering a transparent and systematic approach to tracking and evaluating student progress. The e-portfolios document not only the outcomes but also the learning process, which can be valuable for both students and educators in assessing growth and areas for improvement.

The e-portfolio is based on Social Constructivism theory. The theory was propounded by Soviet psychologist, Lev Vygotsky (1896-1934). Social constructivist theory posits that human development is socially situated, and knowledge is constructed through interaction with others. This educational theory promotes an educational environment where learning is a collaborative, interactive process facilitated by the teacher. This approach underscores the importance of social interactions in constructing knowledge and supports a more dynamic and participatory learning experience. According to Lohman and Hurst (2023), this approach shifts the role of the teacher from being a mere source of information to acting as a facilitator who guides and supports students' learning through interaction and collaboration. As Hepler et al. (2023) suggest, social interaction is fundamental in this approach. Learning is seen as a communal process where knowledge is constructed through dialogue and shared experiences. This contrasts with traditional methods where learning might be viewed as an individual process where information is transmitted from teacher to student.

The current world order and workplaces require learners to possess soft skills. The e-portfolio facilitates the development functional skills such as communication skills, collaborative skills, and the ability to solve real-life

problems among students (Centre for Teaching Excellence, University of Waterloo, 2024). The e-portfolio generates and documents learning. The authentic assessment using e-portfolio is holistic covering cognitive, affective and psychomotor domains of educational objectives. The affective and psychomotor domains are assessed through the use of observation, anecdotal records, checklist, interviews questionnaire, attitude rating scales, inventories and socio-metric techniques (Anigbo, 2014 and Hoque, 2016) which are the core contents of e-portfolios. In other words, e-portfolios are useful in documenting pupils and students' experiential learning as encapsulated in the Enugu Smart and Green Schools' curricula.

Preparing learners in the Smart and Green Schools for the Fourth Industrial Revolution: Are we Ready?

The world is in the era of the Fourth Industrial Revolution (4IR) and no nation or state would want to be left behind. The key features of the revolution (also known as industry 4.0) include automation, cyber-physical systems (CPS), internet of things (IoT) and cloud computing (Hermann et al., 2016 & Kagermann, et al., 2013), cognitive computing, and artificial intelligence Gazzaneo, et al. (2020). According to World Economic Forum (2016), the 4IR facilitates interactions of billions of people who are connected by mobile devices for the purpose of assessing knowledge. These developments have serious implications on educational programmes; assessment practices in particular - indeed electronic assessment (e-assessment) or digital assessment will be in vogue. Correspondingly, e-assessment tools such as e-portfolios will be applied for the assessment outcomes to be relevant to the demands of 4IR era.

However, there is paucity of literature on educational plans and strategic options put in place in Nigeria for the 4IR, especially in the area of using e-portfolio in assessment of learning. It therefore means that the introduction of Smart and Green Schools by Enugu State government is very apt. The S&GS is a digital technology-based institution equipped with renewable energy sources for sustainable carbon free environment designed to prepare learners at basic education level of nine (9) years (pupils from primary 1-6 and students in Junior Secondary Schools 1-3) for the 4IR. Digital technology is the pillar of Smart and Green Schools (Omidinia et al., 2013). In addition, Smart and Green Schools programme is concerned with the application of smart and digital technologies to facilitate resource efficiency in the institutions' operations and developments. The application of smart and digital technologies will deliver value to society and reduce carbon emissions and pollution as well as prevent loss of biodiversity and ecosystem services (United Nations Environment Programme [UNEP], 2024).

The SGS initiative of Enugu State was introduced to redefine the landscape of teaching, learning and assessment in the state. The 260 Smart and Green School campuses spread across each political ward of the state are designed to integrate technological advancements, human capital development, and environmental sustainability into the programmes. According to Enugu State Ministry of Education (2023), the campuses are hubs of innovation, equipped with cutting-edge facilities to ensure a holistic learning experience. The schools are powered by clean and renewable energy, particularly the solar. The state government envisions that in the next four years, it will recruit and train 19,500 – 25,480 basic education teachers and 2,080 administrators to enhance effective operations of the programme (Enugu State Ministry of Education, 2023). The ministry is actively engaging in multifaceted initiatives geared towards improving infrastructure and providing comprehensive teacher training for optimal teaching, learning (Shallpella, 2023) and assessment experiences.

Central to the training of teachers is the acquisition of digital assessment skills including the use of e-portfolio. Adoption of e-portfolio will enhance holistic and authentic assessment of knowledge and skills including experiential learning which the current traditional item-test cannot do. However, out of 25,480 teachers

envisioned to teach in the schools only 100 of them have been trained on the application of digital technology in teaching and assessment (Enugu State Ministry of Education, 2023). Although recruitment and training of teachers are still on going, remaining 25,380 teachers do not possess adequate digital literacy skills required for effective teaching, learning and assessment (including the development and use of e-portfolios) in the schools. The implication is that at the moment, the teachers are using traditional assessment option which does not yield assessment results that can be termed as authentic.

To this effect, the researchers visited the pilot Smart and Green School in the state where some teachers were interviewed using Smart Phone Recorder. One of the yet-to-be trained female teachers of the S&GS who was orally interviewed and designated as first respondent (R1) when asked of her digital literacy level responded that she has very low level of digital technology literacy with the following remark:

"I do not know how to use computer at all but believe that if am selected for the next batch of the training, I would, hopefully, be able to acquire the basic digital technology skills needed for the smooth teaching, learning and assessment in the school… Indeed, majority of us (teachers) in the schools have not been trained on the use of digital technology in assessment".

Another teacher, this time a male who was designated as the second respondent (R2) in the S&GS was among the first batch of teachers who received training on how to use digital equipment in teaching, learning and assessment. The R2's response to the researchers' interview on his capacity to develop and use e-portfolio to assess learners did not provide desirable response. The R2 asserted:

"What is it used for… even though we were trained on how to use digital tools like computers and smart boards to teach and record scores of students, I do not know anything about e-portfolio. During one the days of the training, I over-heard the trainer mentioned portfolio assessment but was not taught what it is and how to develop and use it. Besides, electricity is not stable and the strength of internet connectivity is weak here… I wonder how the tool could be effectively deployed in this school".

The findings of the paper have serious implications on effective introduction of e-portfolio for authentic assessment of experiential learning as enshrined in the curricula of the Smart and Green Schools. Applying traditional assessment procedures of one-off examination cannot give desirable outcomes because it cannot be used to assess complex cognitive, affective and psychomotor behavioural domains. One of the key implications of the findings is that the level of preparedness for effective adoption of e-portfolio in assessment of experiential learning in the schools to enable the student's function effectively in the era of Fourth Industrial Revolution is low.

Conclusion and Recommendations

The introduction of Smart and Green Schools is a laudable initiative by Enugu State government. The e-portfolio is the most appropriate tool for authentic assessment of learners in the schools. However, human and infrastructural resources are found to be inadequate for the effective application of e-portfolio for authentic assessment of the learners in the schools to function effectively in the society of Fourth Industrial Revolution.

Arising from the findings and conclusion, the paper therefore, recommends that:

1. E-portfolio should be used to assess the experiential learning of pupils and students in the Smart and Green Schools.
2. Facilities such as renewable energy sources should be provided in the schools to enable steady and stable power supply.

3. Telecommunication network with strong internet connectivity should be provide in each of the 260 schools.
4. Teachers should be trained on the development and utilisation of e-portfolio for authentic assessment of pupils in the Smart and Green Schools.

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