Enhancing Educational Assessment in Smart Green Classrooms for the 4th Industrial Revolution

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Abstract

Smart green classrooms have emerged as a promising solution to enhance the learning environment and promote sustainability in educational institutions. This research article explores the role of educational assessment in smart green classrooms and discusses strategies to enhance assessment principles and practices in this innovative learning spaces for the fourth industrial revolution. The study highlights the importance of integrating technology and sustainability principles into assessment methods to foster student engagement, critical thinking, and environmental awareness for the fourth industrial revolution by leveraging the capabilities of smart green classrooms, educators can create more meaningful and effective assessment experiences that support student learning and promote sustainable practices.

Keywords: ***Smart Green Classroom, Revolution, Assessment***

Introduction

Smart green classrooms are revolutionizing the way education is delivered through the combination of advanced technology and sustainable practices to create dynamic and eco-friendly learning environments. These classrooms are equipped with state-of-the-art technology,

such as interactive whiteboards, digital learning tools, and energy-efficient lighting systems, to enhance teaching and learning experiences. In addition, smart green classrooms are designed to promote environmental sustainability through features like natural lighting, green building materials, and recycling programs.

The term “S.M.A.R.T” Classroom is an acronym that stands for Showing, Manageable, Accessible, Real-time Interactive, and Testing (Nworgu., 2020), and refers to the learning environment where the physical space is infused with carefully constructed digital tools and resources to encourage student connection on various social levels, enhance face-to-face interaction in real-time, and record the collective knowledge of the entire class along with eco-friendly constituents to give it a green class look. (Lui & Slotta, 2014). A green smart classroom is defined as an eco-friendly classroom with the combination of several high-end technologies that aim to assist educators and students in optimising their overall leaning experience (Morgan, 2021). A Smart green classroom combines school education, eco-friendly variables and technology (lia, 2019) such as mobile technologies, automatic communication and learning tools, video projectors, cameras, sensors, facial recognition software, and other modules that keep track of a variety of environmental factors (Mircea, 2021). The role of teachers in the smart green classroom is to enhance students' performance, creative and thinking skills (Peter, 2020) with the use of complex processes involving change and interaction, such as dominance, competition, flow of energy, equilibrium and new teaching methodologies such as social learning, mobile learning, ubiquitous learning (Chen, 2016). Although a smart class combines technology with other elements, such as teaching strategies and classroom models, in this paper we focus our attention on the technological dimension of a smart class.

The introduction of Artificial Intelligence (AI) combined with emerging technologies having the form of interactive, remote, and mobile computing in physical and/ or virtual environments as well as eco-friendly variable constitutes an evident trend in the development of the concept of smart green classroom. Most of the technologies employed in a smart green class depends on the green learning environment and Artificial Intelligence (AI) that empowers the interactive, adaptive, and smart usage of those technologies during the learning process.

Overview of Green Smart Education

There is no argument against the fact that we are in the optimum level of this era often referred to as the 4th industrial revolution. The future of the next generation will be in trouble if the 4th industrial revolution is not properly understood and manipulated to the fullest owing to its high level technological demand and ecological dynamism. For this, we need to develop a Green Education system that includes zero energy infrastructure, zero water discharge, the wise consumption of energy (Amed, 2020) and eco-friendly resources, a green curriculum and green management (Jeevan, 2019). Many things can be changed in teaching at school in such a way that infrastructures like building, energy, material resources should be taken in the light of the concept of green. One fundamental reality from UNO (2005) is the declaration of 2005 -2014 as the decade of green education. It was aimed to create awareness in society and among the students about greenness and sustainability. At the same time, we have to make every endeavour so that our future generation can create a green and sustainable environment. Green education is not a mere introduction and inculcation of environmental ethics, norms and values in the curriculum but at the same, it will use smart ways to make the learning outcomes more healthy, precise and sustainable manner with fulfilling Industrial needs through addressing the socio-

environmental issues. So, the concept of green and sustainability are two major pillars of green smart education The construction material used for building the educational institutes should use environmentally friendly materials like usages of less water, energy efficiency and generate less waste by creating less impact on the environment (Manna & Banerjee, 2019) The educational institutes should transform themselves into zero energy buildings through producing renewable energies for themselves as for examples solar energy and wind energy can be used to meet the requirements. Moreover, energy consumption is minimized with smart technologies. Lighting is the most important physical factor which affects learners‘ performance. The lighting should be controlled specially in the classroom because lighting has a direct impact on learners‘ performance and achievements (Kola, 2022). The lighting can be induced into a smart classroom equipped with smart teaching devices making learning more adaptive and hyper-personalized stimulating psychological and cognitive domains such as attention, attitude, motivation and visual pleasure. LED lights in classrooms have better engagement and activities of the students and especially for the students with developmental difficulties. Buildings are built keeping the philosophy of optimal utilization of sunlight and solar energies. The physical design of the classroom should retain naturalness because it directly affects students, progress (Barrett, 2020). The green infrastructure ensures supply of safe drinking water. The World may be facing acute scarcity of water within next 50 years according to report from research conducted by the United Nation (2020). The educational institutes use significant amount of water for drinking, laboratory use and for sanitation. The supply of safe water is prime concern to ensure healthy living of all associates of institutions. Water budgeting, water auditing, water harvesting and zero water discharge mechanism should be incorporated in education institutions by incorporating smart sensors to reduce wastage of water. The teaching equipment should be eco-friendly.

Environmental Metamorphosis Scenario

The existence of human being on this planet is over millions of years, with different activities for survival ranging from fire and extraction of mineral resources thereby causing harm to Mother Nature knowingly and unknowingly. The unprecedented blue-print of development escalated resource depletion. Forces of the industrial revolution and survivalistic struggle has in many ways pushed humanity into indiscriminate exploiting of biotic and abiotic resources unwisely, throwing self-understanding and self-reliance as an obsolete philosophy. Ecological imbalance has been a case of concern globally that exerted changes on many phenomenon negatively over few decades. The effect of this imbalance has multifaceted impact on many variables including climate change, loss of biodiversity, the decline in food production and decline in quality of soil, erosion, leaching, flooding, air pollution, and water (Verma, 2019). In the findings of IUCN Red Data Book (United Nations, 2021) The Universe have lost 100 million hectares of land within two decades (2000-2020) and 37,400 plants and animal species are on the verge of extinction owing to unfriendly ecological practices and manipulation. When more than 3 billion people are directly dependent on oceans, the dead zones are increased from 400 to 700. The emission of millions of tons of greenhouse gases leads to global warming threatening the existence of human civilization on this blue planet in a multi-faceted way. The UNO warns that in the next 30 years the world is going to witness severe scarcity in food production if no action is taken to reduce the GHGs. The global demand for wheat will reach 700 million for which we have to increase the wheat production by 60 per cent of the present production to feed approximately 9.6 billion people. A study has shown that global food production must be increased by 100 to meet the global demand (Tilman, 2020). Further, this will accelerate poverty. When tons and tons of edible oil and foods are lost or wasted every then the contrasting scenario is poverty is slowly

increasing since 2014 (Cervantes, 2014). It is estimated that around 17 per cent of global food production is wasted. According to a UN report, 7 million people die at premature age due to environmental pollution (Air Pollution – Deadly Effects on Life, 2019). Many deadly diseases like asthma, bronchiolitis, Chronic Oppressive Pulmonary Disorder (COPD), the neurological disorder are geometrically increasing at an alarming rate along with several deadly viruses stimulating mortality and morbidity rates (Deziani, 2023) and badly hampering the health of the future citizens. The students are the worst victim of environmental degradation (Paulinus, 2023). The problem is grave in developing countries due to lack of development, overpopulation and hunger. Household air pollution (HAP) has crossed the threshold limit in developing countries as a silent killer. It wasreported that around 1.5 million died alone in South East Asia due to HAP (Ahmed, 2019). Three out of ten have access to safe drinking water and six in ten people lack safe sanitation (UN News, 2019).

Impact of Environmental Degradation on the Learners

The environmental degradation proves to be a catastrophe for the children, the asset of every nation hampering health and education with increasing the ratio of diseases like asthma due to exposure to polluted air (Hulin, 2020), pneumonia (Jary 2020). the cases of eye-related diseases like cataract, glaucoma, (Díaz, 2022), irritation and swelling of eyes (Person, 2020). According to the estimation of WHO, 785 billion people lack safe drinking water access and 2 billion people are using contaminated surface water with faeces (Bachelet, 2019). Due to unsafe water, sanitation, hygiene and lack of awareness, every year around 87500 children below 15 years dies of diarrhoea (UN News, 2019). With the onset of global climate change, natural disasters are also increasing at an increasing rate which diarrhoea such as the recent earthquake of Haiti exposes

around 540000 children to life-threatening waterborne diseases (UN News, 2021). Moreover, the school poor environmental infrastructure has a deep impact on the learners‘ health (Joshi, 2020) and also learning process along with lack of nutrition (Paulson & Barnett, 2022). The onset of heat waves, overcrowding, increase vector borne diseases have impacted the learners' health (Landrigan, 2020). It suffices to say that the neurocognitive development of the learners and their learning comprehension, respiratory and ophthalmic health (World Health Organization, 2017) and overall progress are influenced by the institutional environment. The emergence of a green-smart education system: There is indeed no perfect and unified demarcation of ―smart education, it only implies that technology can play an important role in the bridge between teachers and learners. Different from conventional education, Smart learning comprises technology aided advancement of digest knowledge and skills more conveniently, effectively and efficiently.

According to Adama (2022) though technology has an important role to support smart learning, focusing more on learners and content rather than using devices so that learners can become a proactive leader under the mentorship of teachers.

From the perspective of Adama, Smart learning is the outcome of the Three T‘s –―Total Transformational Thinking- that involves the application of technology in teaching and learning instructional delivery and assessment of outcome. Among the variables of smart green class mentioned above, this paper shall as a matter of interest dwell on educational assessment.

Educational assessment in green smart class refers to the use of technology and environmentally friendly practices to evaluate students' learning progress and performance. This can include using digital tools for quizzes, tests, and assignments, as well as incorporating sustainability and

environmental awareness into the assessment process. Ojoma (2020) Educational assessment in green smart class can either take the form of formative assessment or summative assessment, depending on the intention for the assessment. It is said to be formative if the eco and technological facilities are employed periodically to ascertain the level of progress, evaluate, measure and document the academic readiness, learning progress, skill acquisition or educational needs of the students.

In other words, educational assessment in this context is seen as a systematic process of documenting and using empirical data on the knowledge, skills, attitude and beliefs to refine programs and improve students' learning using the technological and eco-friendly approaches on periodic basis. Educational assessment in green smart class can be formative or summative. Chullam (2023) formative assessment is the type of assessment carried out during the process of curriculum implementation for the purpose of getting feedback and possible amendment to teaching and learning where need be. It involves the application of technology and modern tools of conducting assessment in periodic basis. On the other hand Chullam sees summative assessment as the type of assessment carried out by the end of the implementation of the curriculum with the aid of the instrumentality of the green smart classroom facilities.

Educational assessment plays a crucial role in measuring student learning outcomes and providing feedback to educators on the effectiveness of their teaching strategies. In smart green classrooms, assessment practices can be enhanced by leveraging the capabilities of technology and sustainability principles to create more engaging and environmentally conscious assessment experiences for students. By incorporating these elements into assessment methods, educators can better align assessment with learning objectives, promote critical thinking and problem-

solving skills, and cultivate a culture of sustainability among students either on formative or summative basis.

Similarly, in the view of Okoye (2020), Assessment in the green smart classroom performs various roles that can be broadly classified into facilitating and inhibiting. Assessment becomes facilitative when it motivates learning, reinforces learning goals and access to good life. On the inhibitory and preventive side, assessment has been argued to eliminate the learner from the process and enjoyment of learning. For instance, failure reduces self-esteem in the learner. Asta (2019). Elaboratively, functions of assessment are classified under six main headings:

- Diagnostic
- Evaluative
- Guidance
- Prediction
- Selection and
- Grading.

A more extensive classification can be made from above classification even though there may be some overlapping between categories. Generally, assessment performs the following functions:

1. Certification and qualification
2. Selection and social control
3. Clear recording and reporting of attainment
4. Prediction
5. Measurement of individual differences (psychometrics)

6. Student-pupil motivation (whether teaching-learning structures are competitive, co-operative or individualistic).
7. Monitoring students' progress and providing effective feedback to students
8. Diagnosing and remediation of individual difficulties
9. Guidance
10. Curriculum evaluation
11. Provision of feedback on teaching and organization effectiveness
12. Teacher motivation and teacher appraisal
13. Provision of evidence for accountability and distribution of resources
14. Curriculum control and
15. Maintaining or raising of standards.

In other to be innovative and effective in carrying out assessment in the green smart class, Ojoma, (2020) postulated the following guiding principles:

- Clearly specifying, what is to be assessed: the effectiveness of assessment depends as much on a careful description of what to assess as it does on the technical qualities of the assessment procedures used. Thus, specification of the characteristics to be measured should precede the selection or development of assessment procedure. When assessing student learning the intended learning goals should be clearly specified before selecting the assessment procedures to use bearing in mind the available technology and eco-friendly environment.

- An assessment procedure should be selected because of its relevance to the characteristics or performance to be measured. It is to be noted that assessment procedures are frequently selected on the basis of their objectivity, accuracy or convenience.
- Comprehensive assessment requires a variety of procedures. It is important to note that no single type of instrument or procedure can assess the vast array of learning and development outcomes emphasized in a school programme. Multi-choice and short-answer tests of achievement are useful for measuring knowledge, understanding and application outcomes, but essay tests and other written projects that require students to formulate problems, accumulate information through library research or collect data (for example, through experimental observations and interviews) are needed to measure certain skills in formulating and solving problems.
- Proper use of assessment procedures requires an awareness of their limitations. Assessment procedures range from very highly developed measuring instruments, for example, achievement tests, to rather crude assessment devices, for example electronic self-report technique. It is important to note even the best educational and psychological measuring instruments yield results that are subject to various types of measurement error.

Carrying out assessment with the application of technology is perceived to be the easiest method of assessment owing to the speed of operations, reduced energy consumption, accuracy, good predictive indices, flexibility, familiarity, environmentally friendly, Accessibility, Immediacy

Methods: To explore the role of educational assessment in smart green classrooms, a literature review was conducted to identify key principles and best practices in assessment and sustainability education. The study also involved interviews with educators and students who

have experience with smart green classrooms to gather insights on their perspectives and experiences with assessment in these innovative learning spaces. Based on the findings from the literature reviewed and interviews, the study developed a set of recommendations for enhancing assessment practices in smart green classrooms.

Results: The study found that integrating technology and sustainability principles into assessment methods can enhance student engagement, critical thinking, and environmental awareness in smart green classrooms. By incorporating digital tools, such as online quizzes, interactive simulations, and virtual labs, educators can create more interactive and personalized assessment experiences for students. In addition, assessment tasks that focus on real-world sustainability issues, such as energy conservation, waste reduction, and green building design, can help students develop a deeper understanding of environmental concepts and foster a sense of responsibility towards the planet.

Conclusion

Educational assessment in smart green classrooms offers a unique opportunity to promote sustainability education and enhance student learning outcomes. By leveraging technology and sustainability principles in assessment practices, educators can create more engaging and environmentally conscious assessment experiences that support student learning and promote sustainable practices. Moving forward, it is important for educators to continue exploring innovative ways to integrate technology and sustainability into assessment methods to enhance the overall educational experience in smart green classrooms.

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