

## The role of Smart Education (SE) in supporting Digital Eco-Literacy (DEL)

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**Abstract.** The rapid development of computer technology today has implications for high quality educational services and resources. Meanwhile, this era of Smart Education (SE) has given a new picture that the openness and sharing of global knowledge become a top priority for the advancement of education, especially in Digital Eco-Literacy (DEL) learning. The study aims to understand in depth the role of Smart Education (SE) in supporting the development of Digital Eco-Literacy (DEL). The research method used is a qualitative technique with a review paper approach. The findings show that SE will be the key to effectively and efficiently developing DEL Learning. A positive impact on improving student achievement and the ability to understand various environmental problems with a more dynamic and innovative perspective should be considered.

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### 1. Introduction

The COVID-19 pandemic has completely changed the way people live in the world. Furthermore, massive quarantines that lock up life activities occur in every country and cause drastic social and economic changes (Singh *et. al.*, 2020). Al Shafi (2020) also stated that the COVID-19 pandemic would impact changes in the social and economic sectors for the country's development. Prevention to break the chain of virus spread by closing access to open activities in every educational institution. The effort can be supported by adding renewable technology devices to optimize the learning process during a pandemic. This technology is in the internet, mobile applications, and digitalized media.

Drastic changes in the current educational process, create an important momentum to improve effectiveness and quality learning with computerized-based technology tools. The current era of education has found that high-quality education can support increasing student achievement abilities. Therefore, the era of intelligent education became the originator in introducing the concept of openness and supporting the creation of compatible learning (Zhao, Di, He, & Zhun, 2020). Minuto, Pittarello, & Nojholt (2015) reported that technology-based knowledge development strategies would encourage creativity and student involvement to increase academic achievement.

Efforts are made by delivering intelligent material compiled comprehensively as the key to excellence in dynamic learning. The increase in the pace of the education system, resulted in high demand for adaptive educational methods in terms of content, presentation, and navigation optimize the ability of educators (El Janati, Maach, & Ghanami, 2018). Kahn (2010)

also stated that applying a digital-based curriculum does not necessarily have advantages, but there are weaknesses in this process. Furthermore, when teacher does not have competent skills in Information and Communication Technology (ICT), it will have a negative impact on the development of learning.

Sad (2012) stated that improving the skills of teachers is an obligation to support the creation of Smart Education (SE). The positive benefits are making the classroom atmosphere dynamic, effective, and productive. ICT assist teachers create learning materials that are more meaningful and illustrated with attractive models or designs. Lochner, Rieckmann, & Robischon (2021) argued that the decline in environmental quality requires Environmental Education (EE) as the main agenda in the context of creating Education for Sustainable Development (ESD). The integration of each party, both schools, teachers, students, and technology media can support the creation of ESD.

The strategy of developing transformative education with digitalization can foster the relevance of global solidarity in supporting the goals of the 17 SDGs. The main role of EE should be understood as a solution to solving environmental problems with the active collaboration of all these aspects. Digitalization is a key determinant of success in global action for ESD towards sustainability as the key basis for promoting EE (Lochner, 2021).

Reid, Dillon, Ardoin, & Ferreira (2021) found that the urgency of real action in supporting the merging of all branches of science would be a unity like an interconnected ecosystem. Submission of this integrated information in digital learning can further expand understanding and change behavior towards pro-environment. The important role of SE will

determine the direction of the Eco-Literacy learning process. The right application of SE is the key to increasing student's understanding of the material. Therefore, the research is to understand the role of SE in supporting the development of Digital Eco-Literacy (DEL).

## 2. Methods

The research method used is qualitative with a review paper approach related to SE and digital eco-literacy. This technique is used to examine in depth the phenomenon of SE, ICT, and DEL which is very urgent, especially during this pandemic. DEL is the output of a form of Digital-based SE from the ecological science family. These two concepts are the core part of the ICT component. Furthermore, the process of compiling this study begins with the initial stages, namely the selection of 51 relevant articles related to the topic of study, namely SE, Digital Learning, and DEL. The second stage evaluates the 31 articles that have been collected, the third stage synthesizes important findings from the results of relevant articles, while the fourth provides conclusions to the results of previous findings.

## 3. Result and Discussion

The application of effective environmental education supports changes in student behavior. Therefore, the role of digital technology should be managed properly to maximize the function of teachers (Monroe, Plate, Oxarart, Bowers, & Chaves, 2017). Norat, Herreria, & Rodriguez (2016) also stated that the application of DEL would help change attitudes to support the process of increasing competence in behaving under Sustainable Development Goals (SDGs). Therefore, the individual transformation can be largely determined by the direction of digital media development.

Kopnina (2015) stated that the promotion of DEL would create a balance in the learning process of a democratic EE. Students can contribute as subjects who move productively, creating openness and balanced cooperation. Meanwhile, Hampson (2012) added that Ecology is a multidisciplinary science and unification with technology media can be a means of strengthening the educational process. Eco-Literacy will provide a reflection that nature teaches many values of life as the key to success in creating DEL.

Wersun *et al.*, (2019) found that innovations created with DEL form will support changes in skills improvement, understanding, and behavior for SDGs. The main center in this learning process is students with competencies under the objectives of ESD. Pitman & Daniels (2016) stated that ecosystems are processes interrelated in forming connected bonds.

Sustainability is a component in creating this pattern of interaction. Human understand the concept of nature and the importance of the universe for mutual balance. One of the actions implemented is a continuous effort to enhance a real and unwavering commitment to other factors in supporting the development of Eco-Literacy as a conscious proof (Howard, 2012). Abiolu & Okere (2012) stated that ICT had become the most dominant tool used, especially during the last few decades. The wheel of education development is very dependent on this technology. Higher competence can support this development more competitively and attractively.

However, it is important to understand that the widespread use of this technology has two sides. As an opportunity for excellence, or an obstacle detrimental to its users. Technology

should be a supporting factor in balancing the natural and human aspects (Vanni & Crosby, 2020). Hougham, Nutter, & Graham (2018) added that the main role of EE is to create sensitivity to encourage changes in pro-environmental behavior by using technology in the learning process. For example, the application of Smart Class (SC) in changing the traditional education order to be more interactive.

This integration of pure science and technology attracts student's interest in learning about the natural surroundings (Phoong, Phoong, Moghavvemi, & Sulaiman, 2019). Freitas, Rousell & Jager (2019) stated that technology had become an important communication tool in every process of human life. The related automatic sensors of internet technology interact to form a wide and open network.

This concerns students who are candidates for the younger generation and thirsty for technological developments. Generations Z (1996-2009) and Alpha (2010-current) are quite highlighted in their development. Gen Z and Alpha are the leaders in using this technology, and they are the largest users. Therefore, the generation should often be given direction and monitored in the healthy and responsible use of ICT. Since the impact of ICT is like two sides of a coin, it becomes an advantage, when managed properly. On the other hand, when it fails, it becomes a boomerang, such as cybercrime, online gambling, and others. Therefore, it takes an active role in all parties in supporting, parents, teachers, government, the private sector, and educational institutions. Active and real collaboration in supporting healthy campaigns in the use of technology regularly will be a positive culture in dispelling the rampant negative flow of this technological development. It is important to remember that technology is only a tool hence, the full steering holder is the human.

Farrell and Phungsoonthorn (2020) also reported that Generation Z is likelier to be media users and create new innovations. Therefore, understanding the essence of the value of this generation becomes very important for the achievement of appropriate technology. Smith (2021) also found that two similar factors are shared by Generation Z and Alpha, namely: 1) digitalization is their lifestyle, 2) technology literate, and 3) quick to adapt and socialize. Therefore, the challenge for these educators is to be observant in improving their digital competencies to carry out pedagogical practices effectively. Bennett *et al.*, (2015) also reported that the generation Alpha has proven to have stronger and tougher skills in accepting diversity. This is in line with the research on managers from the generation Alpha who have proven to be superior in entrepreneurial business in the Australian economic market.

Nicula, Botan, Gligor, & Cocis (2020) found that various types of convenience generated in the application of smart technology can further increase the optimization and efficiency of educational services in all fields of science. An important point to remember in this online learning is internet penetration and smartphone use. The potential contained in this technology can provide solutions and answer the challenges of increasing community access, availability, and affordability (Suneja & Bagai, 2021).

Sharma *et al.*, (2016) stated that increasing digital literacy in society would encourage the creation of fair and prosperous growth in supporting the country's socio-economic activities to advance sustainable opportunities. Therefore, knowledge is the main driver of sustainable development. Furthermore, Mondejar *et al.*, (2021) stated that digitalization presents a new set of tools carefully balanced to ensure their smart

applications and green character. The ability to make well-informed decisions to use resources and services more efficiently can significantly impact on sustainability and access as well as the potential benefits to society and the environment.

Santoalha, Consoli & Castellacci (2021) added that workforce skills associated with the use and development of ICT are important determinants. Therefore, the provision of electronic skills is a positive predictor of a region's ability to specialize in new technology domains, especially in green specialties. Castro, Fernandez & Colsa (2021) also stated that the interaction between digitalization and sustainability opens up bright opportunities to shape a greener environment for the economy and society, as well as pave the way and drive the transformation toward the SDGs. Responsible governance driven by ethics and regulations should be transparent and accountable.

Digitalization technology can become a strong umbrella in supporting the creation of real changes in knowledge, skills, and attitudes that lead to sustainable development. The DEL development strategy can be a complementary component and support the final goal of ESD.

## Conclusion

Opportunities exist to increase student achievement and the ability to explore various environmental problems with a more dynamic, productive, and innovative perspective. Students explore various findings of creative ideas about the environment by using sustainable technology. Educators, as a bridge in the learning process, will be one of the determinants of SE. Moreover, it has become crucial during the COVID-19 pandemic, which requires learning to be online. SE further supports creating an effective understanding of DEL for all students without any limitations of space, distance, and time. However, it is also important to re-evaluate the shortcomings in using this digital technology (Krista, 2014). Zocher & Hougham (2020) added that facing these challenges requires a strong commitment to seeking appropriate solutions. Environmental education aims to produce literate humans, and individuals with solutions to solving complex environmental problems along with the times.

This technology is a bridge in adding real-time information for selecting the best decisions. Digital literacy has become a new focus in showing the breadth of information managed dynamically and interactively. This is known as the internet, multimedia, cyber, online, and information literacy. Digital literacy is useful in supporting users to engage in social and cultural activities through various types of interactive media (Noh, 2016). Lawrence & Sherry (2021) stated that using digital literacy is a determinant in the success of communication producing compatible feedback. Comprehensive information sharing further enhances the capacity for finding, compiling, and using relevant information in changing a person's behavioral order. For example, the application of the SE method using online video stimulation in the teaching process is proven to encourage students to develop effective argumentation strategies to grow the expected competencies.

The use of technology in this learning media has proven to be effective in supporting the increase in the effectiveness of student's knowledge. Furthermore, the combination of audio and visual media can encourage a stimulus effect that attracts student's attention to understanding (Zuhriyah, Astra, & Yufiarti, 2021). ICT dominant in the SE development strategy.

The selection of the right technology based on the needs and abilities of students can be an important asset in supporting the creation of a smart classroom. The creation of intelligent learning is an effective and intelligent method, adapted for learning based on a sophisticated Information Technology (IT) infrastructure while focusing on student achievement.

Soroya *et. al.*, (2021) reported that digital literacy skills help internet literacy become more effective and efficient in assisting students improving their ICT skills. This is because young students use internet resources in all their education, social interaction, and entertainment activities. Therefore, coordinated education to mix formal curricula and internet literacy are very important in achieving successful SE. Skogberg *et. al.*, (2022) added that today's children are familiar with digital devices and applications from a very early age. Therefore, schools need to offer attractive digital-based learning settings for children and age-appropriate content by identifying the weaknesses and strengths of implementing these tools.

Educators also continue to uphold their duties in growing the ability of their students to recognize and understand global interrelationships and relationships, which are part of systems thinking competencies. Furthermore, they will awaken student's critical thinking competencies through DEL reflection, including their prejudices and stereotypes, in a better and more creative way. Saltoz-Rivaz, Hernandez, & Rodriguez (2021) stated that higher education institutions play an important role in supporting digital competence for the educational community in integrating different strategies according to the demands of the modern world of work.

However, there are still various obstacles to implementing SE, but the use of digital-based ICT is low due to the lack of human resources expertise in this field. The government's role as a facilitator should continue to be maximally intensive in disseminating the importance of digitalization practices in all aspects, especially in education supported by maximum budget allocations in providing facilitation of technology training in each of these lines. Meanwhile, digitizing should become a daily culture as a leading example of accepting open and responsible information. It can positively impact the success and progress of development when society is aware of the technology.

This is in line with Indonesia's 2045 vision on pillar 1, namely; human development and mastery of science and technology. The populations's quality and high productivity are highly dependent on aspects of education that are technologically literate from all components of society. This includes the widespread trend of digitalization technology which is a big opportunity in the world of education and provides a broad and integrated transformation of knowledge. It is consistent with the statement from the Indonesia Gold 2045 Competency Direction Book on the scope of the direction of competence in basic sub-competencies at point 3, which emphasizes digital competence. Therefore, digital skills and competencies should provide the main and important provisions for their application for Generation Z and Alpha in facing challenges and maximizing existing opportunities as evidence of transformational education strategies. These prospective young Indonesians can excel in following the development of diversity to become a strong, character, and independent nation.

## Recommendation

1. The application of DEL can be implemented with Games Based Learning (GBL) because generations Z and Alpha are technology literate and creative. Therefore, designing learning with Games Theory is proven to increase user engagement involvement, high interest, best motivation, and achievements.
2. Increasing digital-based competence should become a culture applied to every line of daily life to support the vision of Indonesia 2045. Therefore, the training conducted for educators should continue to be developed comprehensively until they become successful educator resources.

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## Conflict of Interest

There is no conflict of interest to declare for this publication.

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