



ICT-Based Teaching Materials on Science Learning to Improve 21st-Century Skills : A Systematic Review

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DOI: <https://doi.org/10.46245/ijorer.v5i5.679>

Sections Info

Article history:

Submitted: July 23, 2024

Final Revised: August 20, 2024

Accepted: September 1, 2024

Published: September 30, 2024

Keywords:

21st-Century Skills;

Education;

ICT;

Science Learning.



ABSTRACT

Objective: This research aims to evaluate how integrating ICT teaching materials in science learning enhances students' active involvement and develops critical 21st-century skills necessary for their daily lives and future careers. **Method:** A Systematic Literature Review (SLR) method is used in this study to review recent research on ICT teaching materials to improve skills for the 21st century. The results obtained were 23 articles. **Results:** The analysis shows that 1) E-modules are the most widely used teaching material, 2) Improving 21st-century skills, namely critical thinking. Thus, e-modules are an ideal solution to support the development of critical thinking skills in the modern era. **Novelty:** The novelty of this study lies in its emphasis on e-modules as a particularly effective tool for nurturing critical thinking skills among students. This focus represents a significant advancement in the educational field by demonstrating how e-modules can serve as a targeted and strategic approach to cultivating essential 21st-century skills. Using modern technology in learning, e-modules make learning more exciting and help students think critically. This is important for succeeding in today's world, which is becoming more complex and relies on technology.

INTRODUCTION

Science education necessitates a student-centered approach, engaging students actively in learning. Therefore, students must be involved and participate actively in educational activities. Science instruction should include hands-on experiences to enhance understanding rather than relying solely on rote memorization. As a subject, science is integral to various educational levels due to its significant role in achieving established educational objectives. Thus, mastery and understanding of science is important for every student (Supena, 2021). Effective science learning can aid students in cultivating critical thinking, analytical abilities, and problem-solving skills (Fitriani et al., 2020; Saphira et al., 2022b, 2022a; Xu et al., 2023; Zulyusri et al., 2023). Consequently, science stands as a vital discipline for preparing students to face future challenges (Belbase et al., 2022; Darling-Hammond et al., 2020; Dishon & Gilead, 2021; Manz et al., 2020; Matthews, 2024). Therefore, incorporating practical experience in science education is crucial for equipping students with the essential skills for their daily lives and future careers.

Advancements in information and communication technology (ICT) enable the adaptation of teaching and learning methods to meet the preferences and needs of students. ICT encompasses technologies used to manage, process, and transmit information without restrictions on location or time, making data flow highly accessible (Ateş & Garzón, 2022). In addition, Akcil (2021) stated that ICT significantly influences education by enhancing students' interest, creativity, and motivation to learn. Consequently, integrating ICT into education facilitates learning and is crucial in motivating students to pursue continuous learning.

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