Impact of Integrating Artificial Intelligence and Digital Tools on Enhancing Student Motivation and Learning Achievement in Science Education

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In the face of 21st-century educational transformations, integrating Artificial Intelligence (AI) and digital tools has become vital for revitalizing student engagement. The primary research problem addressed in this study was the declining motivation of students toward complex science topics and the limitations of traditional, teacher-centered methods in a resource-limited setting. Underpinned by the constructivist learning theory and self-determination theory, this study specifically aimed to evaluate the impact of an AI-blended approach on enhancing student motivation and to determine its effectiveness in improving learning achievement. This action research was conducted through two iterative cycles among 15 grade 11 students in a 1C category school in the Udugama education zone. In Cycle 1, the intervention utilized YouTube and generative AI tools like ChatGPT and Gemini. Structured observations during this phase revealed critical gaps in students' AI literacy; while highly motivated by digital and gamified elements, students struggled with accurate prompt generation, which initially yielded irrelevant results, over-relied on AI outputs as absolute truths, and lacked awareness of responsible AI use. To mitigate this, the teacher provided scaffolding by demonstrating model prompts to realign student queries. Reflecting on these dynamics, Cycle 2 incorporated a more interactive digital ecosystem, featuring Mentimeter for brainstorming, Padlet for collaborative critical analysis, and Kahoot for gamified evaluation, successfully transforming students into active knowledge constructors. Data triangulation involved a mixed-method approach. Quantitative analysis via a paired t-test showed a statistically significant improvement ($p < 0.05$) in learning achievement, with pre- and post-test mean scores rising from 8.2 to 16.5. Qualitatively, thematic analysis of observations and student reflections confirmed a profound surge in intrinsic motivation. The study concludes that an iterative, multi-tooled AI-blended approach effectively minimizes passive learning while shifting the teacher's role to a facilitator. Crucially, it highlights the need to systematically integrate AI literacy within continuous classroom practices to foster responsible technology habits.

Keywords: artificial intelligence, digitalization, science education, student motivation, action research