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Multiple Intelligences in Digital Physics Learning for Education for Sustainable Development

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ABSTRACT

Objective: *This study aims to synthesise research on the application of Multiple Intelligences (MI) in digital physics learning within the framework of Education for Sustainable Development (ESD). The goal is to map trends, highlight opportunities for personalised, sustainability-oriented learning, and identify gaps that hinder the integration of MI and digital technologies to foster sustainability competencies.* ***Method:*** *A Systematic Literature Review (SLR) was conducted following the PRISMA 2020 guidelines. Articles were collected from Google Scholar, Scopus, IEEE Xplore, ERIC, and ScienceDirect, limited to peer-reviewed studies published between 2018 and 2023 in English or Indonesian. Forty eligible studies were analysed thematically and through content analysis.* ***Results:*** *The findings show that MI-based digital learning enhances students' motivation, engagement, conceptual understanding, and academic performance. Interactive simulations, video-based modules, virtual experiments, and AR/VR applications offer personalised learning aligned with students' dominant intelligences. MI also supports ESD competencies such as critical thinking, collaboration, and sustainability awareness, though aspects like environmental literacy, social responsibility, and ethical reasoning remain underexplored.* ***Novelty:*** *This review uniquely links the MI, physics education, and ESD domains, which are rarely integrated in prior studies. It emphasises MI's potential to enhance cognitive outcomes while embedding sustainability values into physics education. A conceptual roadmap is proposed to align MI-based digital physics learning with the Sustainable Development Goals.*

INTRODUCTION

21st-century education faces significant challenges in preparing students to adapt to rapid technological developments and cross-border issues such as sustainability and equity, which push schools toward evidence-based, competency-oriented reform (Cebrián & Junyent, 2020; Leal Filho et al., 2021). Accordingly, Education for Sustainable Development (ESD) under the ESD for 2030 framework calls for whole-institution change and the cultivation of key sustainability competencies such as systems thinking, critical thinking, collaboration, and action competence (UNESCO, 2020; UNESCO, 2021). Within this agenda, digital and inclusive pedagogies that personalise learning are prioritised to help diverse learners engage with complex socio-scientific problems (UNESCO, 2020).

One widely used personalisation lens in classrooms is Multiple Intelligences (MI), operationalised in recent studies to design student-centred tasks that tap linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalistic strengths (Syamira et al., 2023; Haxhihyseni & Andoni, 2023). Recent empirical and review work reports positive but modest or context-dependent effects of MI-inspired instruction on academic outcomes, urging careful design and evaluation (Yildirim, 2022; Aydın et al., 2021). At the same time, scholars caution against neuromyth