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Profile of Students' Physics Problem-Solving Skills and the Implementation of Digital Book-Assisted PBL for SDG 4

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ABSTRACT

Objective: *This study aims to analyze the profile of students' physics problem-solving skills as a basis for applying the digital book-assisted Problem-Based Learning (PBL) model to sound wave material at the high school level. This analysis was conducted to determine the level of students' problem-solving abilities and to identify differences in abilities based on gender as a basis for developing more effective learning strategies.* ***Method***: *This study used a quantitative descriptive approach involving 108 high school students as research subjects. The research instruments included a physics problem-solving skills test, a student response questionnaire, and interviews with physics teachers. The test was compiled based on problem-solving skill indicators that included understanding the problem, planning the solution, implementing the strategy, and evaluating the solution. The data were analyzed using the Rasch model to obtain more accurate measurements of student ability levels and question difficulty levels.* ***Results***: *The results showed that students' physics problem-solving skills were generally still in the low category. Most students had difficulty understanding problems conceptually, determining the appropriate solution strategy, and evaluating the results of the solution. Analysis based on gender shows that the abilities of male and female students are relatively balanced. However, female students tend to be more thorough in descriptive and evaluative aspects, while male students are more prominent in the solution planning stage.* ***Novelty***: *The novelty of this study lies in the analysis of students' physics problem-solving skill profiles from a gender perspective using the Rasch model as an empirical basis for developing a more interactive and contextual 3D digital book-assisted PBL model to improve students' physics problem-solving skills.*

INTRODUCTION

Quality education is a key pillar of global sustainable development, as outlined in the United Nations Sustainable Development Goals (SDGs), particularly SDG 4, which ensures inclusive and equitable quality education and promotes lifelong learning opportunities for all. To achieve SDG 4 targets, especially target 4.4, which emphasizes the mastery of skills relevant to 21st-century education, there has been a paradigm shift. This shift requires a learning process that was originally dominated by the role of the teacher (teacher-centered) to now shift to learning that places the student at the center (student-centered) (Muliana et al., 2024).

This paradigm shift encourages students to master 21st-century skills, which are a set of abilities needed for them to participate effectively in education and the world of work in the current era (Saphira et al., 2022). Learning and innovation skills are one of the main aspects in the development of 21st-century skills (Tika, 2024). These skills are known as the 4Cs, which include creative thinking, critical thinking and problem solving, communication, and collaboration (Viyanti et al., 2025).