

ENHANCING HIGH SCHOOL STUDENTS' HIGHER ORDER THINKING SKILLS AND LEARNING MOTIVATION THROUGH BAAMBOOZLE-ASSISTED DISCOVERY LEARNING MODULES

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Abstract. In the current era of globalization, education faces increasingly complex challenges. Rapid technological and informational advancements demand that educational systems continuously adapt and innovate. This study aims to develop a Discovery Learning-based instructional module, supported by the Baamboozle platform, to enhance students' motivation to learn and Higher Order Thinking Skills. This inquiry-based learning model encourages students to learn independently, constructing knowledge and concepts through their learning activities. Using a Research and Development (R&D) methodology based on the ADDIE model, the study involved eleventh-grade students at SMA Negeri 2 Siak Hulu. Data were gathered through expert validation sheets, a learning motivation questionnaire, and a Higher Order Thinking Skills post-test. The expert validation results indicated that the developed module was highly feasible, achieving an average score of 4.50 in the "very valid" category. Furthermore, the instrument analysis showed that the learning motivation questionnaire was highly reliable, yielding Cronbach's alpha coefficients of 0.935 for the experimental group and 0.962 for the control group. The Independent Samples T-Test revealed a significant difference ($t = 7.794$, $p < 0.001$), with post-test mean scores of 68.82 and 34.38, respectively. Integrating the Baamboozle game platform into the Discovery Learning stages effectively optimizes technology-based learning, fosters students' enthusiasm and motivation, and creates an interactive, enjoyable learning environment that significantly improves and refines students' conceptual understanding.

Keywords: Discovery learning; baamboozle; learning motivation; higher order thinking skills; physics education; addie model.

INTRODUCTION

Current technological advancements have revolutionized the educational sector by introducing innovative learning methods based on mobile devices, the internet, learning management systems (LMS), and interactive Web 2.0 media (Irhamni & Ashari, 2023). Digital technology is no longer merely a personal communication tool but has become an essential instrument for schools to prepare students for the modern era. This phenomenon has prompted numerous countries to formulate macro-level policies on ICT-based educational reforms, which are subsequently implemented at the school level through technical means, focusing on classroom pedagogical practices (Allayarova, 2025). Conventional teacher-centered education typically focuses on transmitting knowledge and information to meet curricular requirements, where the curriculum frequently dictates instructional content. Consequently, the flow of information is generally unidirectional, with minimal effort directed toward engaging in meaningful interactions with students.

In this context, students are frequently perceived as passive recipients of information, continuously instructed on what they must know and do (Wang, 2023). Physics is fundamentally learned through a systematic sequence of scientific processes (De Bézenac et al., 2019). Consequently, the instructional approach in Physics should be oriented so that the comprehension and concepts acquired by students do not merely remain theoretical but can be tangibly applied to resolve various real-world problems (Elvi & Suparno, 2019). Higher-order thinking skills are defined as the extensive utilization of the mind to construct or discover something unique (Singh & Marappan, 2020). However, these higher-order thinking skills cannot develop optimally if students lack motivation during learning.

Learning motivation plays a vital role in fostering stimulation, enthusiasm, and enjoyment in learning, thereby enabling students to engage in the instructional process, sustain effort, strengthen cognition, and improve learning outcomes (Howard et al., 2021). The use of technology as an educational tool has become paramount due to its effectiveness, efficiency, and ability to engage students and foster creativity (Isabirye et al., 2025). The implementation of a game-based Discovery Learning module to support learning addresses students' lack of concentration (Loderer et al., 2020). This approach not only cultivates a more dynamic learning environment but also encourages active student participation (Nandhini & Rasyidah, 2024). In the context of digital learning, Baamboozle is a web-based gamification platform that offers interactive, engaging quiz games and incorporates entertainment elements (Saud et al., 2022).

Baamboozle also serves as an educational platform that offers group quizzes without requiring students to create accounts beforehand (Sa'diyah et al., 2020). Previous research by Munthe et al. (2019) demonstrated that learning through the Discovery Learning model can construct knowledge from new information in an exploratory learning environment. This can be achieved through concrete experiences, thereby making the knowledge students acquire more meaningful and relevant. Furthermore, a study conducted by Alimova (2023) examined the efficacy of the Baamboozle internet service in stimulating student interest and engagement. The use of this online service aims to create a gamified classroom environment.

The novelty of this study lies in the development of a Discovery Learning-based instructional module, in which the Baamboozle game platform is structurally integrated as a learning complement through the use of barcodes at the beginning of the student worksheet (LKPD) activities. This approach ensures that students can focus on constructing deep analysis to achieve Higher-Order Thinking Skills (HOTS) through the instructional module. Furthermore, the provided access to the Baamboozle game serves as an interactive and effective tool for conceptual reinforcement and for mitigating learning fatigue. Through this design, the research can generate a balanced and optimal increase in both Higher-Order Thinking Skills and learning motivation.

METHODS

Research Design

This study applies a Research and Development (R&D) approach utilizing the ADDIE model. This model comprises five stages: analysis, design, development, implementation, and evaluation (Rahawarin & Ghufon, 2026). The R&D objective is to develop a Physics instructional module based on Discovery Learning integrated with the Baamboozle game platform. The ADDIE model has become one of the most widely adopted frameworks in instructional design. Since its introduction, this model has proven effective across various educational contexts, ranging from primary to higher education (Torang & Zulhadi, 2025).

Participants and Research Sample

Sampling is a crucial instrument in research design, given that target populations generally comprise too many individuals to be fully integrated as participants in a single research project. An ideal sample provides a statistical representation of the target population and is sufficiently large to address the research questions (Hossan et al., 2023). The population of this research comprised all eleventh-grade (XI) students at SMA Negeri 2 Siak Hulu during the even semester of the 2025/2026 academic year. Sampling was conducted using the cluster random sampling technique, in which each class within the population had an equal probability of being assigned to either the experimental or control group. The instruments utilized in this study included: expert validation sheets to measure the feasibility of the developed module, a student learning motivation questionnaire to assess the students' affective domain following the implementation of the module assisted by the Baamboozle platform, and a Higher Order Thinking Skills post-test essay encompassing C4 (analyzing), C5 (evaluating), and C6 (creating) cognitive levels.

RESULTS AND DISCUSSION

Results

Expert Validation Results

This section presents the validation data for the developed discovery learning module integrated with the Baamboozle platform, collected prior to field testing the product with students. The validation data include evaluations from material, media, and pedagogical experts, all summarized in Table 1.

Table 1. Summary of Expert Validation Results

No.	Assessment Aspects	Average Validity Score	Criteria
1.	Content Expert	4.48	Highly Valid
2.	Media Expert	4.56	Highly Valid
3.	Pedagogical Expert	4.46	Highly Valid
Overall Average		4.50	Highly Valid

The development of the discovery learning module integrated with the Baamboozle platform achieved an overall average score of 4.50, placing it in the highly valid category according to the established validation criteria. This outcome indicates that the instructional module is highly feasible and possesses a robust structure for senior high school Physics education. Furthermore, the characteristics of discovery learning depend on students possessing adequate literacy and numeracy, independent learning abilities, and self-management skills (Tushar & Sooraksa, 2023).

Instrument Reliability

The most commonly used method for measuring internal consistency is calculating Cronbach's alpha. Cronbach's alpha values typically range from 0 to 1, though they can occasionally be negative if certain items correlate negatively with others in the questionnaire. If a negative Cronbach's alpha is obtained, the reverse-scored items must be re-examined and corrected to ensure proper scoring alignment, if necessary (Aithal & Aithal, 2020).

Table 2. Reliability Parameters for the Motivation Questionnaire

No.	Goup	Cronbach's Alpha	Criteria
1.	Experimental Group	0.935	Highly Reliable
2.	Control Group	0.962	Highly Reliable

Table 2 shows that the values significantly exceed the minimum threshold of 0.60, confirming that the questionnaire is highly stable and reliable for measuring student motivation. The reliability

of a questionnaire is not absolute; rather, it depends heavily on the responses of a specific sample. Consequently, it must be recalculated every time the instrument is administered to a different group of respondents.

Hypothesis Testing (Independent Samples T-Test)

An Independent Samples T-Test was applied to the post-test scores to evaluate the effectiveness of the Discovery Learning module integrated with the Baamboozle game platform. The statistical comparison between the experimental and control groups is presented in Table 3.

Table 3. Independent Samples T-Test Results for Higher Order Thinking Skills and Motivation

No.	Variable	Group	N	Mean
1.	Higher Order	Experimental	34	68.82
2.	Thinking Skills and Motivation	Control	34	34.38

The t-test revealed a highly significant difference between the two groups ($t = 7.794$, $p < 0.001$). The experimental group achieved a post-test mean score of 68.82, which is remarkably higher than the control group's mean score of 34.38. Thus, the null hypothesis (H_0) was rejected, indicating that the developed instructional module significantly enhanced students' higher-order thinking skills and motivation to learn.

Discussion

In the context of digitally based learning, instructional media must be systematically structured to prevent direct distraction from digital devices, thereby allowing students to remain focused on understanding complex concepts. During the initial phase of module implementation, the strategic placement of barcodes in the introductory section of the Student Worksheets (LKPD) serves as a practical orientation tool. Once scanned, these barcodes provide students with direct access to interactive, gamified review quizzes on the Baamboozle platform (Pranata et al., 2024).

This concept is intentionally designed to ensure that students maintain deep focus during rigorous print-based, pen-and-paper inquiry stages, particularly the data collection and processing phases. By prioritizing seamless cognitive engagement at this foundational stage, students can optimally practice complex analytical behaviors and critical thinking skills, which serve as essential prerequisites for constructing Higher Order Thinking Skills in Physics topics (Wahyudi et al., 2019). Furthermore, the module has been proven highly valid and is exceptionally feasible for classroom deployment.

The introduction of Baamboozle's competitive, team-based, gamified environment serves as an effective psychological catalyst for breaking classroom monotony and encouraging active participation. As an educational medium, this platform offers group quizzes that stimulate students' interest and enjoyment without imposing burdensome administrative burdens. Given that the Cronbach's alpha values for both groups exceed 0.90, the motivation questionnaire exhibits excellent reliability, indicating it is highly consistent and stable in measuring the research target.

Since the hypothesis testing confirmed that the data are normally distributed and possess homogeneous variances, a parametric statistical analysis, specifically the Independent Samples t-Test, was legitimately employed for the mean comparison. The analysis reveals a striking mean difference of 34.44 in favor of the experimental group. This demonstrates that the implementation of the physics module based on Discovery Learning integrated with the Baamboozle game platform is significantly effective in enhancing the post-test assessment outcomes of senior high school students compared to conventional methods.

CONCLUSION

This research yields an innovative instructional product, a module that systematically integrates the Discovery Learning approach with gamification technology. This product is an effective solution for Physics teachers to optimize 21st-century learning, enhance the quality of teaching and learning, and prepare students for increasingly complex global demands. This interactive module represents a highly feasible alternative for modern Physics education in fulfilling the pedagogical requirements of technology-integrated instruction. Furthermore, the strategic integration of the Baamboozle platform via barcodes on the Student Worksheets (LKPD) has been shown to create a balanced synergy between print-based and digital learning. This approach avoids disrupting students' concentration during the scientific inquiry phase while simultaneously reinforcing concepts through interactive games that enhance motivation and alleviate learning fatigue.

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