Research Article

Investigating The Effectiveness Of JBS Module On Higher Order Thinking Skills Among Year 5 Students: A Quasi-Experimental Approach

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Abstract: The goal of this study is to ascertain how the Jom Bijak Sains Module affects fifth-year students' higher-order thinking abilities. A quasi-experimental approach with pre- and post-tests is used in the investigation. This module's development is based on ADDIE models, which include the phases of analysis, design, implementation, evaluation, and implementation. 33 students from the treatment group and 33 from the control group were randomly chosen as the samples. Pre-test and post-test are the instruments that are employed. The study demonstrates that the treatment group showed greater achievement in scores compared to the control group, as evidenced by the significant difference between the treatment and control groups. The results also showed that no significant differences were observed in students' higher-order thinking skills when considering gender. The Jom Bijak Sains module, helps Year 5 students develop their higher-order thinking skills and abilities. The results of the study indicate that year 5 students' Higher Order Thinking Skills can be improved by using this module in primary school science classes.

Keywords: Edutainment, Higher Order Thinking, Module, quasi-experimental

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1. INTRODUCTION

Traditional learning is a classroom-based process where students are seated in rows at desks and teachers give lectures at the front. Typically, a learning environment is perceived as a physical space, such as a school, classroom, or library, where teaching and learning occur. However, in today's world, learning environments must incorporate a range of places, ideas, and people (Abdullah & Hendon, 2016; Amran et al., 2021; Khan, 2021). To align with 21st-century learning, students must develop skills that allow them to participate actively in their own learning (Prensky, 2008), and one of the crucial skills is Higher Order Thinking Skills (HOTS).

Mai et al (2019) emphasize that science is a crucial subject that can enhance learners' abilities to comprehend facts, acquire knowledge, and develop various mental, practical, and social skills. Nevertheless, teaching science encounters numerous challenges, particularly the use of traditional teaching methods and strategies by teachers. These approaches often restrict students' participation, interaction, and academic integration, which do not align with their preferences and requirements. Consequently, students may become disinterested and reluctant to learn science.

Katsaliaki and Mustafee (2015) highlight that edutainment is an effective method that can address several issues and challenges that some students face while learning science, such as anxiety and fear of making mistakes due to the complexity of the subject. Bulunuz (2015) contends that incorporating entertaining tasks and activities into science lessons can promote students' enjoyment of learning, which, in turn, can stimulate positive emotions such as joy and happiness. This positive environment can encourage and support learners, promote teamwork, and facilitate learning in a fun and engaging way. Ultimately, edutainment can enhance both teachers' and students' engagement and involvement in science lessons.

On the other hand, edutainment is a modern approach that incorporates technology and entertainment in traditional teaching methods such as lectures, lessons, classes, workshops, and master classes. With the integration of television programs, desktop and video games, movies, music, websites, and multimedia software, modern education, and communication are impossible to imagine without it. This method allows for classes and activities to be conducted in various settings, such as cafes, parks, museums, offices, galleries, and clubs, providing a relaxed atmosphere for learners to acquire knowledge on informative topics (Anikina & Yakimenko, 2015).

The Malaysian Education Development Plan (MEDP) 2013-2025 is a long-term strategic plan designed to improve the quality of education throughout the country by implementing a comprehensive transformation of the education system. To achieve this goal, all stakeholders must collaborate and play their part. Teachers must acquire new knowledge, skills, and teaching practices that are relevant to the 21st century, and prioritize the development of thinking skills in all disciplines among their students. The development of teacher and student thinking skills, particularly in the context of Higher Order Thinking Skills (HOTS), is crucial in determining the success of the education transformation envisioned in MEDP 2013-2025 (MOE, 2015).

The readiness of students to use Higher Order Thinking Skills (HOTS) is measured by international standards such as TIMSS and PISA, which evaluate students' proficiency in science and mathematics. Many studies have shown that teachers perceive a lack of critical thinking and problem-solving skills among students today (Fensham & Bellocchi, 2013; Gough, 2014; Haahr, 2005; Ritz & Fan, 2014), which suggests that the current teaching approach and strategy at the school level may need to be reconsidered (Fensham & Bellocchi, 2013; Gough, 2014). Additionally, students often misunderstand science (Kurniawan & Maryanti, 2018; Suma et al., 2019), leading to cognitive conflict that can affect their performance (Nixon & Rackebrandt, 2016).

Bloom's taxonomy of higher-order thinking skills encompasses the ability to analyze, evaluate, and create. Istiyono et al. (2020) identify science as belonging to this category of thought. There is already a scientific process involved in analysis (Danielsson, 2014). Female pupils tend to excel in language arts while male students are typically stronger in mathematics (Rolin, 2008). Males tend to prioritize intellectual, abstract, and objective concerns, whereas females tend to prioritize concrete, practical, emotional, and personal (Geary, 2000). This difference may be attributable to the structural differences in the sexes' brains. Gender disparities can be influenced by a variety of factors, including but not limited to economic status, social and cultural norms, beliefs, and ideology (Forde et al., 2014). According to Faizah et al. 2021, there was a significant effect of gender on students' higher-order thinking skills. Boys' higher-order thinking skills are higher than that of girls and are influenced by the factors of differences in thinking patterns, self-confidence, and interest. Even though boys and girls should have the same educational chances, a gender gap occurs in terms of both achievement and motivation in the classroom (Kollmayer et al., 2018).

The JBS module is designed to use edutainment to facilitate students' learning of scientific concepts and improve their critical thinking and problem-solving skills. By incorporating fun and engaging activities, the module aims to increase students' interest in science and motivate them to actively participate in class. Additionally, the JBS module is meant to help teachers save time by providing pre-made teaching materials that are aligned with the MEDP 2013-2025 and 21st-century learning needs. Through the implementation of the JBS module, this research aims to contribute to the improvement of science education in Malaysia and help students develop the necessary skills to succeed today.

The objectives of this research:

1. To investigate the effectiveness of JBS module to enhance higher-order thinking skills (HOTS) among year 5 students.

2. To investigate the different levels of higher-order thinking skills (HOTS) among year 5 students according to gender.

2. METHOD

A quasi-experimental method is a suitable research design for this study as it allows for a comparison between groups, which is necessary to determine the effectiveness of the JBS module in enhancing higher-order thinking skills. The use of pre-and post-tests is also a common practice in quasi-experimental research designs and is necessary to measure any significant changes in the participants' learning outcomes. The inclusion of a control group is also crucial as it provides a basis for comparison against the treatment group and helps to minimize the impact of extraneous variables that may affect the results. Overall, the chosen research design is appropriate for investigating the effectiveness of the JBS module in enhancing higher-order thinking skills among students with moderate or poor achievement in Science. The design of this study is shown in Table 2.1 below.

Table 2.1 Research Design

Sample	Group	Pre test	Treatment	Post test
Year 5	Treatment	Yes	Yes	Yes
Year 5	Control	Yes	No	Yes

The needs analysis phase involved identifying the problems and needs of the students in learning science and the development of the JBS module to address those needs. The design phase involved the creation of the JBS module based on the principles of edutainment and the integration of higher-order thinking skills. The development phase involved the actual development of the module using multimedia software. The implementation phase involved the actual use of the JBS module in the experimental group and the conventional learning process in the control group. Finally, the evaluation phase involved the comparison of the mean scores of the pre-post test between the experimental and control groups to determine the effectiveness of the JBS module in enhancing the students' understanding of science and their higher-order thinking skills.

To achieve the objectives, the following hypothesis was taken.

$H_0$1 There is a significant difference in the mean score of the students' higher-order thinking skills in the post-test for the treatment group and the traditional method group.

$H_0$2 There is a significant difference in the students' higher-order thinking skills in the post-test according to gender.

3. FINDINGS

The independent t-test was conducted to compare the pre-test means of higher-order thinking skills (HOTS) in students from the experimental and control groups. The results presented in Table 3.1 revealed that there was no statistically significant difference between the two groups ($p = 0.119$). Therefore, it can be concluded that the experimental and control groups exhibited similar levels of higher-order thinking skills prior to the implementation of the treatment, specifically the use of the JBS module.

This finding suggests that any subsequent differences observed between the groups after the treatment cannot be attributed to initial variations in their higher-order thinking skills. It provides a baseline understanding that the groups were comparable in terms of their cognitive abilities related to higher-order thinking skills before the intervention was introduced.

Table 3.1 HOTS of Students before treatment (Pre-test)

Group	N	Mean	df	t	p
Experimental	33	17.03	64	-1.580	.119
Control	33	20.18			

In order to assess the effectiveness of using the JBS module in developing higher-order thinking skills among science students, An independent-sample t-test was conducted to examine the difference in higher-order thinking skill ratings by a comparison made between the mean scores of students in the experimental and control groups on the post-test measuring higher-order thinking skills. The results, presented in Table 3.2, indicate significant differences between the two groups.

Table 3.2 HOTS of Students after treatment (Post-test)

Group	N	Mean	df	t	p
Experimental	33	78	64	6.171	.000
Control	33	64.9			

The analysis revealed a statistically significant result, with a t-value of 6.171 and a p-value of .000. These findings suggest that the experimental group, who received the JBS module, had significantly higher mean scores ($m = 78$, $sd = 8$) in higher-order thinking abilities compared to the control group ($m = 64.9$, $sd = 9.194$). This indicates that the implementation of the module effectively assisted students in the experimental group to enhance their level of higher-order thinking skills. Furthermore, an effect size measure, Eta-square (η^2), was employed to determine the magnitude of the effect the module had on the development of higher-order thinking abilities and to gauge the extent of its effectiveness. The calculated effect size (η^2) was found to be .161, indicating a sizable and significant effect. These findings affirm that substantial differences exist in the higher-order thinking skill ratings

between the two groups, and the JBS module had a considerable impact on enhancing students' higher-order thinking abilities.

Taken together, these results provide strong evidence to support the effectiveness of the JBS module in fostering the development of higher-order thinking skills among science students, as demonstrated by the significant mean differences and the substantial effect size observed between the experimental and control groups.

To investigate whether there are differences in students' higher-order thinking skills based on gender, an independent t-test was conducted. The analysis revealed in Table 3.3 that there were no statistically significant differences in higher-order thinking skills between male and female students, as indicated by the t-value of -1.818 and the p-value of 0.074.

Table 3.3 HOTS of Students according to gender

Gender	Mean	SD	t	p
HOTS				
Male	70.0	10.695	-1.818	0.074
Female	75.33	10.381		

Based on this finding, it can be concluded that there are no significant disparities in students' abilities to think critically about science when considering gender. The results imply that gender is not a determining factor in students' higher-order thinking skills within the context of this study.

4. DISCUSSION AND CONCLUSION

The primary goal of implementing the JBS module was to promote awareness of HOTS and improve problem-solving skills through an engaging and educational medium. By combining entertainment and education, the module aimed to make learning more enjoyable and effective. The results showed that students in the treatment group, who received the JBS module, performed better on the post-test compared to those in the control group. However, the overall findings were inconclusive, suggesting that the use of the JBS module alone may not have been the primary factor in enhancing problem-solving abilities. Several variables could have influenced the outcomes of the study. For example, the involvement of parents, the academic offerings of the institution attended by the students, and individual initiative could all have played a role. These variables highlight the need for further research to better understand their impact on problem-solving abilities.

On the other hand, the comparison between the treatment and control groups revealed that they did not perform similarly on the post-test regarding problem-solving abilities. This discrepancy emphasizes the potential of using an edutainment module based on the HOTS framework to help students improve their problem-solving skills. The discussion references a study by Syder (2000) that supports the findings of the current study. Syder's research also found that students in the treatment group outperformed the control group in solving complex problems. This alignment strengthens the argument for utilizing the JBS module as a means to enhance problem-solving abilities.

Moreover, the HOTS-based lessons include appropriate assignments that allow students to apply their newly acquired knowledge in novel or real-world contexts. By practicing problem-solving in various scenarios, students can strengthen their skills and develop a deeper understanding of how

to tackle complex problems. The JBS module facilitated collaboration among students, allowing them to work together to solve challenging problems and share their ideas. This collaborative learning approach proved beneficial for enhancing problem-solving abilities. Students were able to leverage their collective knowledge and skills to tackle difficult tasks, which is consistent with the findings of a previous study by Chu, Hwang, Tsai, and Chen (2009). The study by Chu et al. (2009) concluded that students' problem-solving abilities were unintentionally improved through collaborative learning. This finding suggests that fostering a collaborative learning environment can have positive impacts on students' problem-solving skills.

Furthermore, the concept of cognitive apprenticeship, as defined by Collin et al. (1989), emphasizes learning through guided experiences and places emphasis on cognitive and metacognitive processes rather than physical skills and processes. This approach aligns with the collaborative and problem-solving-oriented nature of the HOTS-based module, where students can learn and develop their cognitive and metacognitive abilities through active engagement and guided experiences.

Most importantly, this study can serve as a valuable resource for educators interested in introducing new approaches to the classroom. By incorporating a JBS module that incorporates edutainment, educators can develop better strategies for teaching problem-solving skills. The collaborative aspect of the module can be particularly effective in promoting student engagement and enhancing problem-solving abilities. The HOTS-based program has the potential to enable even inexperienced students to become proficient in scientific disciplines. By engaging in activities and tasks within the module, students can acquire a deep understanding of scientific concepts and develop their problem-solving skills in the context of those disciplines.

In summary, the collaborative nature of the JBS module allows students to collaborate and share ideas, thereby enhancing their problem-solving abilities. This study, along with the concept of cognitive apprenticeship, supports the efficacy of this approach. Educators can utilize the JBS module to develop better strategies for teaching problem-solving skills and promoting proficiency in scientific disciplines, even among inexperienced students.

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