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The Effect of Anatomical Torso Media in Problem-Based Learning on Students' Responsibility Attitudes and Cognitive Learning Outcomes in the Digestive System Topic

Ayu Liani, Sri Nopita Primawati*, Ida Royani
Program Studi Pendidikan Biologi, Fakultas Sains, Teknik, dan Terapan (FSTT)
Universitas Pendidikan Mandalika
*Corresponding e-mail: srinopitaprimawati@undikma.ac.id

Abstract: This study aimed to analyze the effect of using anatomical torso media in Problem-Based Learning (PBL) on students' responsibility attitudes and cognitive learning outcomes in the digestive system topic. The study employed a quantitative approach with a quasi-experimental method and a pretest-posttest control group design. The participants were 50 Grade XI students of SMAN 3 Selong, East Lombok, in the 2024/2025 academic year, consisting of 25 students in the experimental class and 25 students in the control class. The experimental class received PBL assisted by anatomical torso media, whereas the control class received PBL without torso media. The research instruments consisted of a four-point Likert-scale questionnaire on responsibility attitudes and cognitive learning tests in the form of multiple-choice and essay items. Responsibility attitude data were analyzed descriptively based on categories, while cognitive learning outcomes were analyzed using normality testing, homogeneity testing, and an independent-samples t-test with SPSS. The results showed a descriptive improvement in responsibility attitudes in the experimental class, with 13 students in the very high category, 11 students in the high category, and 1 student in the moderate category after the treatment. In the control class, no student reached the very high category. The independent-samples t-test showed a significant difference in cognitive learning outcomes between the experimental and control classes, $t(48) = 3.128$, $p = 0.003$, with a medium-to-large effect size ($d = 0.885$). Therefore, the use of anatomical torso media in PBL had a significant effect on students' cognitive learning outcomes and descriptively supported the improvement of responsibility attitudes.

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Introduction

Learning is the core of the educational process. In this process, teachers play an important role in determining the success of teaching and learning activities in the classroom. Competent teachers are able to create an effective learning environment, manage the classroom well, and encourage students to achieve optimal learning outcomes (Fadhilaturrahmi, 2018; Romadona et al., 2021). However, in biology learning practice, the learning process is still often dominated by teacher-centered lecturing. This condition can make students passive, easily bored, and less involved in problem-solving activities, which in turn affects their low cognitive learning outcomes (Asih, 2018).

The results of observations and interviews with teachers and students at SMA Negeri 3 Selong on July 31, 2024, showed that biology learning, particularly in the digestive system

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topic, was still largely conducted verbally. Students were less active in asking questions, some students did not pay attention to the teacher's explanation, and some learning outcomes were still below the Minimum Mastery Criteria (KKM) of 75. In addition to learning outcome problems, issues related to responsibility attitudes were also found, such as late assignment submission, cheating habits, passive attitudes in group work, and playing around while the teacher was explaining the material.

One effort to overcome these problems is to implement the Problem-Based Learning (PBL) model. PBL is a problem-based learning model that encourages students to be active, collaborate, identify problems, seek information, and formulate solutions independently or in groups. Problem-based learning enables students to build understanding through meaningful learning experiences that are related to real-life situations (Istiqomah, 2023; Khusen & Hardini, 2023).

In addition to the learning model, media also play an important role in helping students understand biological concepts. The digestive system topic has conceptual and visual characteristics, so it is not sufficient to teach it only through lecturing. Anatomical torso media were selected because they can display the arrangement of body organs in a more concrete model, are easy to observe, do not depend on electricity, and can help students connect anatomical concepts with the actual structure of digestive organs (Aripin, 2017; Karim & Asrijal, 2022). Previous studies have also shown that the use of torso media can improve students' understanding and learning outcomes in biology topics (Astuti, 2017; Isnaini et al., 2015).

Based on this explanation, the present study was conducted to determine the effect of using anatomical torso media in PBL on students' responsibility attitudes and cognitive learning outcomes in the digestive system topic. The main emphasis of this study was to compare PBL assisted by anatomical torso media with PBL without torso media, so the analyzed effect was more specifically directed toward the contribution of torso media within the implementation of PBL.

Research Method

This study was a quantitative study using a quasi-experimental method. The design used was a pretest-posttest control group design, which compares the experimental and control classes through measurements before and after the treatment (Sugiyono, 2019). The experimental class received Problem-Based Learning (PBL) assisted by anatomical torso media, while the control class received PBL without torso media.

Table 1. Research Design

Class	Pretest	Treatment	Posttest
Experimental	O1	X1	O2
Control	O1	X2	O2

Notes: O1 = initial measurement before treatment; O2 = final measurement after treatment; X1 = PBL assisted by anatomical torso media; X2 = PBL without torso media.

The population of this study consisted of all Grade XI students of SMA Negeri 3 Selong in the 2024/2025 academic year, distributed across seven classes. The sample was selected using cluster random sampling from intact classes. The study sample consisted of 50 students with complete data, including 25 students from Class XI IPA 3 as the experimental class and 25 students from Class XI IPA 1 as the control class.

Data were collected using a responsibility attitude questionnaire and a cognitive learning outcome test. The questionnaire was developed using a four-point Likert scale and was used to

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measure indicators of responsibility, including punctuality in submitting assignments, honesty in completing tasks, participation in group work, attention during learning, and seriousness in completing assignments. The cognitive learning outcome test was administered in the form of multiple-choice and essay items during the pretest and posttest to measure students' mastery of the digestive system topic.

Responsibility attitude data were analyzed descriptively by grouping students' scores into the categories of very high, high, moderate, low, and very low. Cognitive learning outcome data were analyzed using the Shapiro-Wilk normality test, Levene's homogeneity test, and an independent-samples t-test. The normality test showed that the data were normally distributed at the 0.05 significance level. The homogeneity test showed that the variances of the two classes were homogeneous, with a significance value of 0.109 > 0.05. Therefore, hypothesis testing was continued using an independent-samples t-test at the 5% significance level. The effect size was calculated based on the t-value and the sample size of each class to determine the strength of the treatment effect.

Result and Discussion

Results

The research data were obtained from the administration of the responsibility attitude questionnaire and the cognitive learning outcome test before and after instruction. The results of the responsibility attitude questionnaire in the control and experimental classes are presented in Table 2.

Table 2. Distribution of Students' Responsibility Attitude Categories

Category	Control Before	Control After	Experimental Before	Experimental After
Very high	0 (0%)	0 (0%)	0 (0%)	13 (52%)
High	7 (28%)	13 (52%)	11 (44%)	11 (44%)
Moderate	17 (68%)	12 (48%)	12 (48%)	1 (4%)
Low	1 (4%)	0 (0%)	2 (8%)	0 (0%)
Very low	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Total	25 (100%)	25 (100%)	25 (100%)	25 (100%)

Based on Table 2, students' responsibility attitudes in the experimental class showed a stronger improvement than those in the control class. After PBL assisted by anatomical torso media, 13 students (52%) were in the very high category and 11 students (44%) were in the high category. Meanwhile, in the control class, 13 students (52%) reached the high category, and no student was in the very high category. These findings indicate that the use of torso media in PBL descriptively supported the improvement of students' responsibility attitudes.

Cognitive learning outcomes were analyzed using an independent-samples t-test after the data were declared normal and homogeneous. A summary of the hypothesis test results is presented in Table 3.

Table 3. Summary of the Hypothesis Test for Cognitive Learning Outcomes

Variance Assumption	Levene Sig.	t	df	Sig. (2-tailed)	Cohen's d
Equal variances assumed	0.109	3.128	48	0.003	0.885

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Table 3 shows that the t-test significance value was 0.003, which is lower than 0.05. Thus, H0 was rejected and Ha was accepted. This means that there was a significant difference in cognitive learning outcomes between the class taught using PBL assisted by anatomical torso media and the class taught using PBL without torso media. Cohen's d value of 0.885 indicates a medium-to-large effect.

Discussion

The improvement in responsibility attitudes in the experimental class can be explained by the characteristics of PBL, which positions students as active subjects in the learning process. In PBL, students do not merely receive information; they are also required to identify problems, work collaboratively in groups, express opinions, and complete assignments. When PBL is combined with anatomical torso media, learning activities become more concrete because students have a clear object to observe. This condition can help students focus more, feel that they have a role in the group, and take responsibility for completing learning tasks.

Anatomical torso media provide visual and manipulative experiences relevant to the digestive system topic. Anatomical material that was initially abstract becomes easier to observe through the body organ model. Students can see the position of the organs, the sequence of the digestive system, and the relationships among components more realistically. Therefore, torso media function not only as visual aids but also as triggers for discussion and problem solving in PBL. This is in line with Aripin's (2017) view that biology learning should involve direct experience or concrete media so that students can understand concepts more easily.

Regarding cognitive learning outcomes, the t-test results showed that the use of torso media in PBL had a significant effect. This indicates that the difference in treatment between the experimental and control classes, namely the presence of torso media, contributed to students' improved understanding. Torso media helped students connect the digestive system concepts with more concrete forms of organs, so the information learned was not merely verbal. These findings support the studies of Astuti (2017), Isnaini et al. (2015), and Suryati (2020), which showed that torso media can improve students' learning outcomes in biology topics.

Nevertheless, the interpretation of the responsibility attitude variable should be made carefully. The attitude data in this study were analyzed based on category distribution, so conclusions about responsibility attitudes are more appropriately stated as descriptive improvement rather than an inferentially tested effect. To strengthen future findings, responsibility attitude scores should be analyzed using appropriate statistical tests, such as a gain score difference test or a nonparametric test if the data do not meet parametric assumptions.

Overall, the use of anatomical torso media in PBL can serve as an effective alternative for biology learning, especially in topics that require visualization of organ structures. The combination of contextual problems, group work, and concrete media can increase learning engagement, facilitate conceptual understanding, and encourage students to become more responsible in the learning process.

Conclusion

Based on the research findings, the use of anatomical torso media in Problem-Based Learning (PBL) had a positive impact on students' responsibility attitudes and cognitive learning outcomes in the digestive system topic. Students' responsibility attitudes in the experimental class improved descriptively, as shown by the increase in the number of students in the very high category after the treatment. Students' cognitive learning outcomes also showed a significant difference between the experimental and control classes, with t(48) =

3.128 and p = 0.003. Therefore, anatomical torso media in PBL had a significant effect on students' cognitive learning outcomes and descriptively supported the improvement of responsibility attitudes.

Recommendation

Biology teachers are advised to use concrete media such as anatomical torso models when teaching anatomy or organ system topics so that students can more easily understand visual concepts. Schools need to support the availability of learning media and provide opportunities for teachers to implement active and collaborative problem-based learning. Future researchers are encouraged to expand the sample size, clarify the duration of the treatment, present complete pretest and posttest mean data, and conduct statistical tests on the responsibility attitude variable so that conclusions about the effect of the treatment become stronger.

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