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Enhancing Critical Thinking in Junior High School Students through Problem-Based Learning on the Human Digestive System Material

Rindi Atika[1], Ani M. Hasan[2,] Djuna Lamondo[3], Margaretha Solang[4], Elya Nusantari[5], Frida Maryati Yusuf[6]

[1,2,3,4,5,6]Study Program of Biology Education, Department of Biology, Faculty of Mathematics and Natural Sciences, Universitas Negeri Gorontalo, Gorontalo, Indonesia.

Corresponding Author: Ani M. Hasan

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ABSTRACT

The general objective of this study seeks to examine the implementation of the Problem-Based Learning (PBL) model on students' critical thinking abilities in the topic of the human digestive system in Grade VIII at SMP State 1 Bulawa Junior High School. The specific objectives are: 1) to assess the implementation of the learning process, 2) to evaluate student activities, and 3) to gauge student responses when applying the PBL model to the topic of the human digestive system. The method used was an experimental method with a pre-experimental design in the form of a one-group pretest-posttest. The study's subjects were 24 students of Grade VIII at SMP State 1 Bulawa. Data collection techniques included written tests, observations, and response questionnaires, analyzed using descriptive quantitative analysis techniques. The results showed that the overall average percentage for the pre-test was 48%, categorized as less critical, while the post-test average was 73%, categorized as critical. This indicates that the implementation of the PBL model on the topic of the human digestive system can improve students' critical thinking abilities. The implementation of the learning process achieved an average percentage of 89%, categorized as very good. Student activities reached an average percentage of 74%, categorized as good, and student responses obtained an average percentage of 93%, categorized as very good. It can be concluded that the implementation of the PBL model in the topic of the human digestive system was well-executed, and students were actively engaged and received the learning process positively.

Keywords: Problem-Based Learning, critical thinking, human digestive system

INTRODUCTION

The rapid advancement of science and technology in the 21st century has profoundly impacted the educational landscape. In response, education is tasked with nurturing highly competitive and adaptable individuals capable of thriving in an era of constant change. Central to this mission are teachers, who play a pivotal role in enhancing the quality of education. They are entrusted not only with fostering active and skilled students but also with cultivating critical thinking abilities essential for navigating today's complexities (Boso et al., 2021). By designing learning experiences that prioritize critical thinking, teachers empower students to engage thoughtfully and logically in their academic pursuits (Firdaus et al., 2019). These skills are integral as they encourage students to make

informed decisions and discern the most effective solutions, illustrating the indispensable value of critical thinking in education.

Based on initial observations conducted at SMP State 1 Bulawa Junior High School, the current learning approach in science classes, specifically regarding the human digestive system, primarily emphasizes rote memorization. However, the science curriculum for this topic demands more than mere memorization; it requires comprehension, analytical skills, and the ability to articulate findings from investigations. As a result, critical thinking abilities are not adequately fostered within the learning process. Furthermore, there is a noticeable deficiency in teacher-student interaction, characterized by predominantly teacher-centered activities where students passively receive information rather than actively engaging in discussions or inquiries.

Learning approaches centered around memorization do not effectively encourage students' independent learning and critical thinking skills (Mareti & Hadiyanti, 2021). According to Prihanti (2015), critical thinking abilities within the educational context not only enhance students' memory but also foster deeper engagement, expand students' knowledge, and enable students to critically evaluate information and learning resources. This perspective underlines the importance of integrating critical thinking into teaching practices to promote more meaningful and effective learning experiences.

To address these challenges, an effective alternative is the implementation of a structured learning model. Hasan et al. (2017) emphasize that such models enable teachers to guide students not only in acquiring information and skills but also in developing their thinking processes and methods of expressing ideas. One prominent example is Problem-Based Learning (PBL), which directs students to engage actively with a specific problem. In this model, the teacher assumes the role of a facilitator rather than a lecturer, encouraging students to collaboratively solve the presented problem (Al-Fikry et al., 2018). This approach harnesses real-world issues to stimulate critical thinking and enhance problem-solving abilities, thereby deepening students' understanding of fundamental concepts and principles in the subject matter.

METHODS

This study was conducted at SMP State 1 Bulawa, situated on Jl. Simpang Tiga Kaidundu, Kaidundu Subdistrict, Bulawa District, Bonebolango Regency, Gorontalo Province. The research employed an experimental method with a pre-experimental design specifically using the One Group Pretest-Posttest approach. The participants consisted of 24 eighth-grade students from SMP State Junior High School 1 Bulawa. Data collection methods included written tests, observations, and response questionnaires. Quantitative descriptive analysis was utilized to analyze the gathered data, which included assessments of students' critical thinking abilities, the implementation of the learning model, students' engagement levels, and their feedback.

Students' Critical Thinking Abilities

The analysis of students' critical thinking abilities was conducted through a structured process. Initially, the total scores from both pre-tests and post-tests are calculated for each student. Subsequently, students' critical thinking abilities are assessed using a percentage formula, as outlined by Novantoro (2019). This approach ensures a comprehensive evaluation of how students' critical thinking skills develop over the course of the study, providing insights into the effectiveness of the educational interventions employed.

$$P_i = \frac{nx_t}{nx_i} \times 100\%$$

Details:

P_i : Percentage of critical thinking skills
nx_t : Total score of students for each indicator
nx_i : Ideal total score for each indicator

In the final stage, after obtaining the percentage of critical thinking abilities, it is subsequently interpreted according to the criteria presented in Table 1 (Arikunto in Badi'ah et al., 2023).

Table 1. Criteria for Critical Thinking Abilities

Critical Thinking Abilities (%)	Criteria
81-100	Very critical
66-80	Critical
56-65	Adequate
41-55	Less critical
0-40	Not critical

Analysis of Learning Implementation

The analysis of learning implementation involves a systematic approach where observers assign scores to various indicators on the learning implementation sheet, utilizing the Likert scale for consistency and accuracy. This method allows for a detailed assessment of how effectively teaching methods and strategies are executed in the classroom. Subsequently, the data collected from the learning implementation sheet is analyzed using the percentage formula, as prescribed by Marlina and Tamrin (2015). This structured analysis provides valuable insights into the extent to which educational practices align with intended objectives, offering a quantitative basis for evaluating the overall effectiveness of teaching approaches.

$$P = \frac{\text{total score obtained by the teacher}}{\text{Maximum total score}} \times 100\%$$

The resulting percentage of learning implementation is subsequently interpreted according to the criteria presented in Table 2 (Mustamiin, 2020).

Table 2. Criteria for Implementation of Learning

Implementation (%)	Criteria
0-20	Very poor
21-40	Poor
41-60	Fair
61-80	Good
81-100	Very good

Analysis of Student Activities

To evaluate student activities comprehensively, observers assign scores to various indicators on the student activity sheet, employing the Likert scale for consistency and clarity. This structured approach allows for a detailed assessment of how students engage during the learning process. The data collected from these activity sheets are then analyzed using the percentage formula, as recommended by Marlina and Tamrin (2015). This methodical analysis provides valuable insights into the extent and nature of student participation and involvement in classroom activities, offering a quantitative basis for understanding their learning behaviors and interactions.

$$P = \frac{\text{The total number of indicators performed by students}}{\text{Total number of students}} \times 100\%$$

The resulting percentage of student activities is interpreted according to the criteria presented in Table 3 (Sugiyono, 2017).

Table 3. Criteria for Student Activities

Student Activities (%)	Criteria
0-20	Very poor
21-40	Poor
41-60	Fair
61-80	Good
81-100	Very good

Student Response

To assess students' responses accurately, scores are assigned to each statement in the student response questionnaire using the Likert scale. This method allows for a structured evaluation of students' perceptions and attitudes towards the learning process. The data collected from the questionnaire responses are then analyzed utilizing the percentage formula, as outlined by Agustina in Efendi (2021). This approach ensures a systematic and quantitative assessment of how students perceive various aspects of their learning experience, providing valuable insights into their engagement and satisfaction levels.

$$P = \frac{\text{total number of respondents' answers}}{\text{Total number of ideal scores}} \times 100\%$$

The resulting percentage of student responses is subsequently interpreted according to the criteria presented in Table 4 (Riduwan in Khartaningtyas & Rosdiana, 2020).

Table 4. Criteria for Student Responses

Student Responses (%)	Criteria
81-100	Very Good
61-80	Good
41-60	Fair
21-40	Good
0-20	Very Good

RESULT

Students' Critical Thinking Abilities

The results of the pre-test and post-test scores for students' critical thinking abilities using the Problem-Based Learning model on the human digestive system topic can be seen in Figure 1.

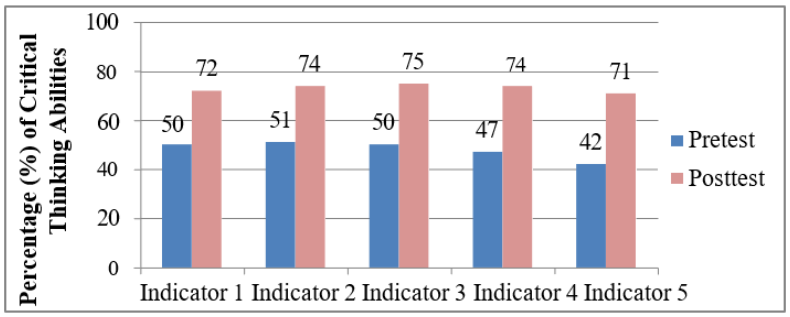

Figure 1. Graphical Analysis of Student's Critical Thinking Abilities

Details:

Indicator 1: Providing simple explanations
Indicator 2: Building basic skills
Indicator 3: Concluding
Indicator 4: Providing advanced explanations
Indicator 5: Strategies and tactics

Figure 1 illustrates significant findings regarding students' critical thinking abilities using the Problem-Based Learning model in the context of the human digestive system topic. Initially, the average percentage for each indicator on the Pre-test falls within the range of 41% to 55%, indicating a classification of "less critical." In contrast, the average percentage for each indicator on the Post-test is notably higher, ranging from 66% to 80%, indicating a classification of "critical." Overall, the average percentage for the Pre-test is 48%, reflecting a "less critical" categorization, while the average percentage for the Post-test increases to

74%, indicating a shift towards a "critical" classification. These results highlight the positive impact of Problem-Based Learning on enhancing students' critical thinking skills in the study of the human digestive system.

Learning Implementation

The results of learning implementation using the Problem-Based Learning model on the human digestive system topic can be seen in Figure 2.

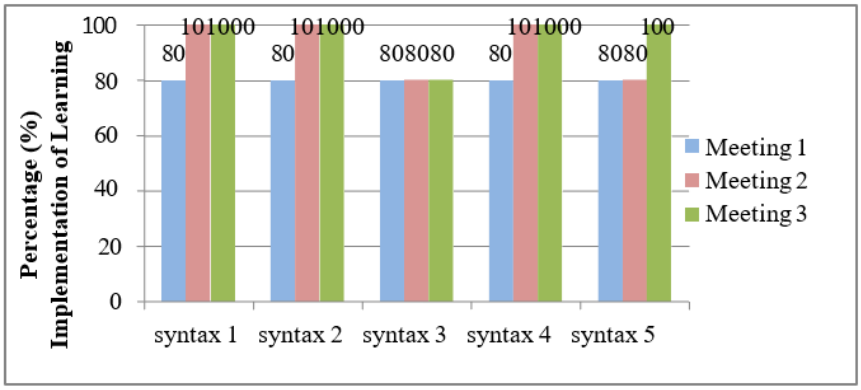

Figure 2. Percentage Graph of Learning Implementation Results

Details:

Syntax 1: Student's orientation towards the problem

Syntax 2: Organizing students for learning

Syntax 3: Membimbing Guiding individual and group investigations

Syntax 4: Developing and presenting works

Syntax 5: Analyzing and evaluating problem-solving processes

Figure 2 illustrates the percentage of learning implementation across three sessions, structured according to the Problem-Based Learning model applied to the topic of the human digestive system. The range of percentages varies from 61% to 100%, with the lowest falling within the 61%-80% bracket, categorized as "good," and the highest within the 81%-100% bracket, categorized as "very good." On average, the implementation of Problem-Based Learning for the human digestive system material achieves an overall percentage of 89%, reflecting a "very good" level of implementation.

Student Activities

The results of student activities using the Problem Based Learning model on the human digestive system topic can be seen in Figure 3.

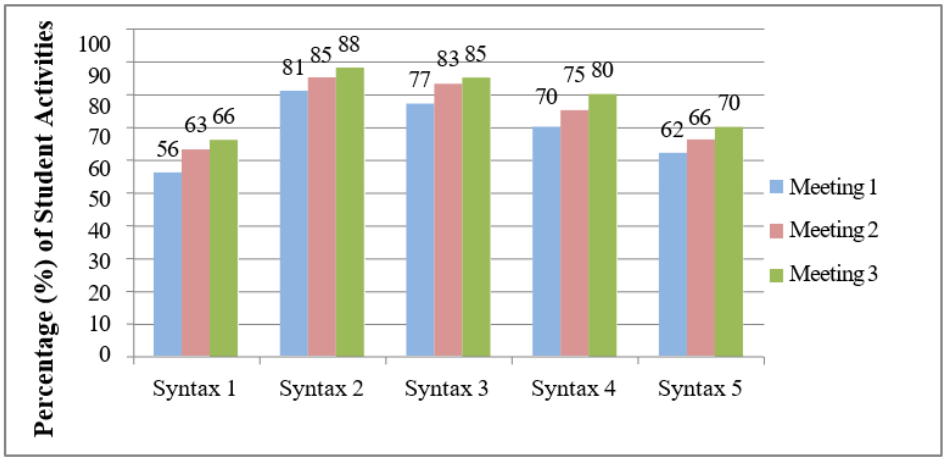

Figure 3. Percentage Graph of Student Activities Results

Details:
Syntax 1: Student's orientation towards the problem
Syntax 2: Organizing students for learning
Syntax 3: Membimbing Guiding individual and group investigations
Syntax 4: Developing and presenting works
Syntax 5: Analyzing and evaluating problem-solving processes
Figure 3 illustrates the percentage of student activities over three meetings, following the syntax of the Problem-Based Learning model on the human digestive system topic. The lowest percentage is within the range of (41%-60%) categorized as fairly good, and the highest percentage falls within the range of (81%-100%) categorized as very good. The average percentage of student activities using the Problem-Based Learning model on the human digestive system material is (74%), categorized as good.

Student Responses
The results of student responses after implementing the Problem Based Learning model to the human digestive system topic can be seen in Figure 4.

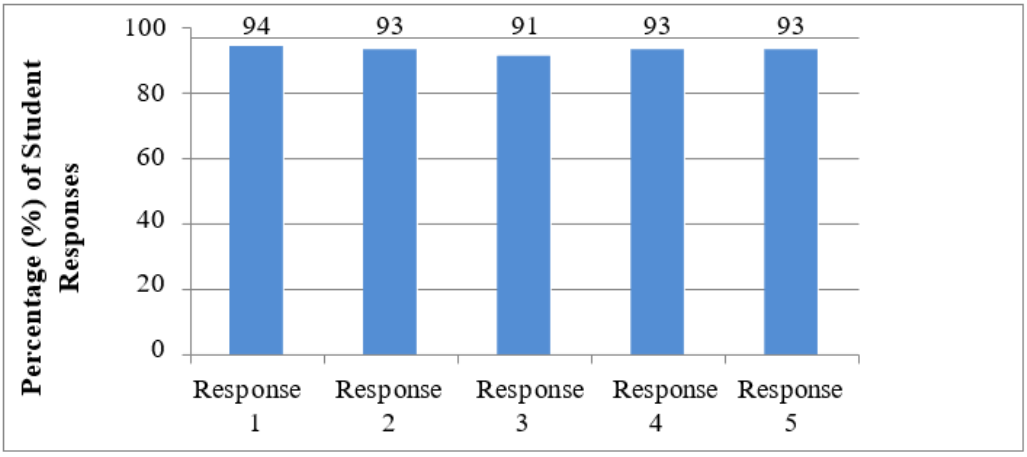

Figure 4. Graphical Analysis of Student Responses

Details:
Statement 1: With the application of the newly learned Problem-Based Learning model, I am happier to participate in learning about the human digestive system.
Statement 2: With the application of the newly learned Problem-Based Learning model, I am more active in participating in learning about the human digestive system.
Statement 3: With the application of the newly learned Problem-Based Learning model, I find it easier to understand the topic of the human digestive system.
Statement 4: With the application of the newly learned Problem-Based Learning model, I am more confident in asking questions to the teacher or classmates.
Statement 5: I enjoy learning in groups with the application of the newly learned Problem-Based Learning model on the topic of the human digestive system.
Figure 4 shows the percentage of student responses after implementing the Problem-Based Learning model on the human digestive system material, ranging from (81%-100%) with the classification of very good. The average percentage of student responses after implementing the Problem-Based Learning model on the human digestive system material is (93%) with the classification of very good.

DISCUSSION

The critical thinking abilities of students were assessed through written tests. The initial test was administered before applying the Problem-Based Learning model (Pre-test), and the final test was administered after implementing the Problem-Based

Learning model (Post-test). The test consisted of 15 items, referring to indicators of critical thinking abilities. Crismasanti (2017) identified the indicators of critical thinking abilities as follows, 1) Providing simple explanations, 2) Building basic skills, 3) Drawing conclusions, 4) Making further explanations, 5) Strategies and tactics. This is consistent with the statement by Dewina et al. (2017) that applying the Problem-Based Learning model can influence students' analytical abilities.

The results of students' critical thinking abilities using the Problem-Based Learning model on the human digestive system topic indicate that in the first indicator, which is providing simple explanations, with the sub-indicator used in both the Pre-test and Post-test being analyzing arguments, the average percentage for the Pre-test was (50%), categorized as less critical, while in the Post-test, the average percentage was (72%), categorized as critical. This shows an increase in critical thinking ability in the first indicator by 22%. Students' ability to analyze arguments can be improved by implementing the Problem-Based Learning model because, during the learning process, students are faced with a problem that encourages them to find solutions by analyzing arguments effectively.

The second indicator involves building fundamental skills with sub-indicators assessed in both Pre-test and Post-test questions, focusing on observing and considering observation outcomes while evaluating the credibility of sources. Participants scored an average of 51% in the Pre-test, categorized as less critical, whereas in the Post-test, the students achieved an average score of 74%, categorized as critical. This reflects a 23% enhancement in critical thinking abilities for the second indicator. Participant capabilities can be optimized by implementing Problem-Based Learning models, such as utilizing observation to solve problems and seek evidence-based answers to enhance critical thinking abilities (Mareti & Hadiyanti, 2021).

The third indicator involves concluding, with sub-indicators assessed in both pre-test and post-test questions focusing on making and evaluating decision values, making deductions, and considering deduction outcomes. Participants scored an average of 50% in the Pre-test, categorized as less critical, while in the Post-test, they achieved an average score of 75%, categorized as critical. This reflects a 25% enhancement in critical thinking abilities for the third indicator. Participants' abilities in making and evaluating decision values, making deductions, and considering deduction outcomes can be trained by implementing Problem-Based Learning models. This aligns with Husna's statement (2023) that by applying Problem-Based Learning models, participants can develop critical thinking abilities as a step in solving problems and drawing conclusions based on participants' understanding.

The fourth indicator involves providing a further explanation, with sub-indicators assessed in both Pre-test and Post-test questions focusing on identifying assumptions. Participants scored an average of 47% in the Pre-test, categorized as less critical, while in the Post-test, they achieved an average score of 74%, categorized as critical. This reflects a 27% improvement in critical thinking abilities for the fourth indicator. Participants' critical thinking abilities can be improved by implementing the Problem-Based Learning model. Nafiah & Suyanto (2014) argue that when learning using the Problem-Based Learning model, participants are based on a confusing problem, which stimulates curiosity and interest in participants to investigate the problem.

The fifth indicator focuses on strategies and tactics, with sub-indicators assessed in both Pre-test and Post-test questions centered around determining actions. Participants scored an average of 42% in the Pre-test, categorized as less critical, while in the Post-test, they achieved an average score of 71%, categorized as critical. This reflects a 29% improvement in critical thinking

abilities for the fifth indicator. Participants' abilities to determine actions can be improved by implementing the problem-based learning model. During investigation, participants utilize critical thinking stages to explore problems, analyze based on evidence, and make decisions or take actions based on the investigation results (Nafiah & Suyanto, 2014).

The results of students' critical thinking abilities, when implementing the Problem-Based Learning model to the topic of the human digestive system, showed an overall average percentage of 48% in the Pre-test, categorized as less critical, and an overall average percentage of 73% in the Post-test, categorized as critical. These categories align with those outlined by Arikunto in Badi'ah (2023), where the range of (41%-55%) is included within the less critical category, and the range of (66%-80%) included within the critical category.

Research supporting the outcomes of students' critical thinking abilities through the implementation of the Problem-Based Learning model includes studies conducted by Rahmawati (2019). The results of her research indicate that implementing the problem-based learning model significantly influences students' critical thinking abilities, particularly in science subjects. Similar findings were observed in the study by Mareti & Hadiyanti (2021), where it was found that students' critical thinking abilities improved through the implementation of the Problem-Based Learning model, leading to improved learning outcomes. This is further supported by Agnezi (2020), who found that the Problem-Based Learning model, or problem-based learning, can be effectively used by teachers to develop students' critical thinking abilities.

Furthermore, there are the results of the implementation of learning by applying the Problem-Based Learning model, obtained through a learning implementation sheet containing steps tailored to the steps of the Problem-Based Learning model outlined in the Lesson Implementation Plan (RPP), which includes five stages: (1) Orienting students to the problem, (2) Organizing students for learning, (3) Guiding individual or group investigation, (4) Developing and presenting work results, (5) Analyzing and evaluating the problem-solving process.

The implementation of learning during three sessions achieved an average percentage of (89%), categorized as very good. Mustamiin (2020) revealed that the range of learning implementation (81%-100%) is included in the very good category. This proves that the implementation of the Problem Based Learning model was successful. Similar research was also conducted by Harizon et al. (2016), showing that the implementation of learning using the Problem Based Learning model can be successful, with an average percentage of (87.96%).

The Problem-Based Learning (PBL) model emphasizes problem-solving activities that can sharpen students' critical thinking abilities. Ayuningsih et al. (2019) state that there are ways to improve students' critical thinking abilities by implementing learning models that encourage active engagement. This forms the basis for the idea that the Problem-based Learning instructional model is capable of improving students' critical thinking abilities.

The active participation of students during the learning process can create a conducive learning atmosphere. The involvement of students in the learning process will foster interaction between the teacher and the students. Effective student learning activities will lead to acquiring knowledge and skills that contribute to achievement. The student activity observation sheet follows the steps of the Problem Based Learning model. Observations were conducted over three sessions. The results of student activities achieved an average percentage of (74%), categorized as good. This aligns with what Sugiyono (2017) stated, that an average percentage within the range of (61%-81%) can be categorized as good. Thus, this indicates that students were active during the learning process by implementing the Problem Based Learning

model to the topic of the human digestive system.

The teaching model implemented by the teacher can be well-received if it receives positive feedback from the students. Student response questionnaires are necessary to understand students' responses after participating in learning activities using the Problem Based Learning model on the topic of the human digestive system. The average percentage of student response obtained after implementing the Problem Based Learning model on the topic of the human digestive system is (93%), categorized as very good and includes within the range of (81%-100%) (Riduwan as cited in Khartaningtyas & Rosdiana, 2020). This proves that the students very well-received the implementation of the Problem Based Learning model on the topic of the human digestive system. Research supporting the results of student responses after implementing the Problem-Based Learning model includes a study conducted by Imelda & Anzelina (2019), where students' response to learning using the Problem-Based Learning model received positive feedback. Similarly, Kusuma & Candramila (2017) conducted a study where students' responses received positive feedback with an average percentage of (87.8%).

CONCLUSION

Based on the study conducted on the implementation of the Problem Based Learning model on the critical thinking abilities of students in the topic of the human digestive system in grade VIII at SMP State 1 Bulawa Junior High School, it was found that the overall average percentage for the Pre-test (48%) fell into the category of less critical thinking, while on the Post-test, the overall average percentage (73%) fell into the critical thinking category. This demonstrates that the implementation of the Problem Based Learning model on the human digestive system material can improve students' critical thinking abilities. The implementation of the learning process achieved an average percentage of (89%) with a classification of very good, student activities obtained an average percentage of (74%) classified as good, and student responses obtained an average percentage of (93%) classified as very good. In conclusion, it can be inferred that the implementation of the Problem Based Learning model on the human digestive system material was successful, and throughout the learning process, students appeared to be active and received positive responses.

Declaration by Authors

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