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A Profile of the Critical Thinking Skills of Prospective Elementary School Teachers Regarding the Concept of the Human Digestive System

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ABSTRACT
Critical thinking skills are essential competencies that students who are prospective elementary school teachers must possess to face the challenges of the 21st century. This research aims to analyze the critical thinking ability profile of prospective elementary school teacher students on the concept of the human digestive system. The research method used was quantitative descriptive with 48 research subjects of the second semester of the PGSD Study Program. The data collection instrument was in the form of an essay test of 10 questions that included five indicators of critical thinking. The results showed that the average score of students' critical thinking ability was 23.19 (57.97%) which was included in the medium category. Based on the achievement of indicators, the highest percentage was achieved in the concluding indicator (66%), while the lowest percentage was found in the indicator of building basic skills (51%). This shows that although students are able to draw contextual conclusions, they are still weak in formulating in-depth scientific arguments.

Keywords: critical thinking, pgsd students, digestive system, science literacy.

INTRODUCTION

The 21st century demands the availability of high-quality human resources that are able to compete globally (Nuraini, 2017). These changes occur in all areas of life and are aimed at improving the quality of life of the community; therefore, each individual needs to develop their potential and various skills in order to adapt quickly (Achmadi et al., 2020; Ciftci & Guven, 2021). Universities bear a great responsibility to produce competent graduates through the cultivation of the 4C skills—Critical Thinking, Creativity, Communication, and Collaboration. This is intended to bridge academic material with the realities that exist in people's lives (Arsanti et al., 2021; Simarmata et al., 2020).

Critical thinking skills are among the main pillars a person needs to achieve success in life (Amin, 2022). These skills help individuals solve problems, make decisions, and distinguish between facts and opinions (Siahaan et al., 2023). Given their importance, the Indonesian Ministry of Education has established critical thinking as a key skill in the education curriculum since 2013. Therefore, prospective teachers must be trained to integrate these skills into the learning process in the future (Firdaus & Mukhtar, 2020). This is particularly important because prospective teachers, especially elementary school teachers, play a crucial role in providing foundational skills that shape students' mindsets at the next level of education. In addition to the cognitive aspect, the development of these skills is also closely related to the formation of student character in higher education (Sihombing, 2020) and the mastery of concepts that serve as preparation for becoming professional teachers (Hasnawati et al., 2023).

However, several studies have shown a gap between the demands for critical thinking and the reality in practice (Wang et al., 2025). These studies indicate that the critical thinking

skills of prospective teachers are still in the low category. Research by Sulistyaningrum et al. (2019) concluded that the 21st-century skills of prospective elementary school teachers remain low, with an average critical thinking ability of less than 30%. Similar findings were reported by Laeni & Retno (2025), who stated that the critical thinking skills of prospective elementary school teachers are still low, especially in topics related to temperature and heat. In that study, the weakest indicator was the ability to draw conclusions, which only reached a score of 28.66 (very low category). This issue needs to be addressed because it will impact the competence of elementary school teacher graduates once they begin teaching in schools (Rahmawati & Annita, 2020).

During their studies, prospective elementary school teachers learn various fields, one of which is Natural Sciences (IPA). This area of study covers a wide range of concepts, from physics and chemistry to biology. Studying biological sciences plays an important role for college students because it helps them understand the complexities of life, from the molecular level to ecosystems (Reiss, 2022).

However, in general, students' low critical thinking skills are often caused by teachers not optimally fulfilling their role as facilitators who encourage active learning (Susilo, 2020). This condition certainly impacts the biology learning process, where critical thinking should develop dynamically when students encounter new problems (Munawwarah et al., 2020). Therefore, biology learning for students must be directed toward developing 21st-century skills through active learning models such as the 4Cs, which can stimulate problem-solving skills (Jamil et al., 2024; Sari & Siregar, 2020).

One of the biological concepts that requires in-depth analysis is the human digestive system. This material represents a complex biological phenomenon because students must analyze the relationships between organ functions, enzyme activity, and the process of nutrient absorption (Ramdani et al., 2024). Therefore, mapping the profile of critical thinking skills in this material is essential as a basis for designing more effective learning strategies (Nursyamsi et al., 2023).

In this context, students are not only required to master theory but must also be able to understand information through real or contextual problem-solving (Lusi et al., 2023). Based on this background, this study aims to analyze in depth the Critical Thinking Ability Profile of Prospective Elementary School Teacher Students regarding the concept of the human digestive system as an effort to prepare competent educators in the global era. The findings of this study are expected to provide both theoretical and practical benefits. Theoretically, this research contributes to the development of educational science, particularly in understanding the characteristics and distribution of critical thinking skills among prospective teachers in science learning contexts. Practically, the results of this study can serve as a reference for lecturers and curriculum developers in designing more effective, student-centered, and problem-based learning strategies to enhance critical thinking skills. In addition, this study is expected to provide insights for educational institutions in improving the quality of teacher education programs, ultimately supporting the preparation of professional and competent elementary school teachers who can face the challenges of the 21st century.

METHODS

This research used a quantitative descriptive approach that aimed to describe the profile of students' critical thinking skills. The subjects of the study were 48 second-semester students from Class 2E of the Elementary School Teacher Education Study Program (PGSD) who were taking a Science Literacy course. Data were collected through a test instrument consisting of 10 essay questions that had been declared valid and reliable through instrument trials. The distribution of critical thinking indicators and the material focus of the test instrument are presented in detail in Table 1 below.

Table 1. Critical Thinking Ability Test Grid

Indicator	Squirt	Question number
Provide a simple explanation	Presented with a problem, students are able to identify and explain information related to the problem.	1,2
Build basic skills	Presented with a statement or case, students are able to determine reliable information and provide logical reasons.	3,4
Summing up	Presented with a statement or situation, students are able to draw appropriate conclusions based on the available information.	5,6
Provide further explanation	Presented with a phenomenon or situation, students are able to explain the concepts or assumptions underlying the problem in more depth.	7,8
Setting strategies and tactics	Presented with data or problems, students are able to determine the right strategy or action in solving problems.	9,10

Source: Adapted from Ennis's critical thinking indicators and processed by the researcher, 2025

The score of student answer results was a quantitative data variable that is processed statistically descriptively to calculate the average ($\bar{x}$), maximum score, and standard deviation (SD). The average calculation is carried out by referring to the formula according to Kariadinata & Abdurahman (2015) as follows:

$$\bar{x} = \frac{\Sigma xi}{n}$$

$\bar{x}$	:	average (read: "x bar");
$\sum xi$	:	a lot of data;
n	:	The sum of all data.

Furthermore, to map the profile of students' abilities, the data is categorized into three levels (High, Medium, Low) by referring to the following group criteria:

Low : $X < M - 1SD$
Medium : $M\text{-}1SD \leq x \leq M+1SD$
Height : $M+1SD \leq x$

Further analysis was carried out on the average score on each indicator to dissect the contribution of each aspect of critical thinking, from the ability to provide simple explanations to setting problem-solving strategies. By calculating the percentage of achievement in each indicator, this study can map the cognitive strengths and weaknesses of prospective elementary school teacher students specifically on the concept of the human digestive system. The results of the analysis per indicator are the basis for comprehensively describing the profile of critical thinking skills.

RESULTS AND DISCUSSION

The results of the average score of students' critical thinking ability can be seen in Table 2. The average score of students' critical thinking ability was 23.19 out of a maximum score of 40, or equivalent to 57.97%, with a standard deviation of 4.09.

Table 2. Average Student Critical Thinking Ability Score

Average score/ percent	23,19/ 57,97%
Standard Deviation	4,09
Maximum score	40

Source: Primary data processed, 2025

Based on grouping using average and standard deviation, students' critical thinking skills are classified into three categories, namely low, medium, and high. The results of the grouping are presented in Table 3.

Table 3. The level of critical thinking ability in students

Categories	Score	Quantity	Percentage
Low	*Less than 19.1* (48%)	11	23%
Medium	19.1 to 27.28 (48% to 68%)	30	62%
Height	*Over 27.28* (68%)	7	15%

Source: Primary data processed, 2025

Based on Table 3, it is known that of the 48 students, as many as 11 students (23%) are in the low category, 30 students (62%) are in the medium category, and 7 students (15%) are in the high category. The data shows that most students have the ability to think critically in the medium category.

Students' critical thinking skills are also analyzed based on the achievement of each indicator. The results of the analysis of the achievement of indicators are presented in Table 4.

Table 4. Achievement of Each Critical Thinking Ability Indicator

Indicator	Average	Presses
Provide a simple explanation	2,40	60%
Build basic skills	2,04	51%
Summing up	2,63	66%
Provide further explanation	2,29	57%
Setting up strategies and techniques	2,28	57%

Source: Primary data processed, 2025

Based on Table 4, the achievement of the indicators of students' critical thinking ability shows differences. The indicator with the highest achievement is concluding, which is 66% with an average of 2.63. These results indicate that students are relatively more capable of drawing the right conclusions based on the information available in the questions. Furthermore, the indicator providing a simple explanation obtained an average of 2.40 (60%), followed by the indicator providing further explanations and regulating strategies and techniques that showed relatively similar achievements, respectively by 57% with an average of 2.29 and 2.28. The indicator with the lowest achievement is building basic skills, which is only 51% with an average of 2.04. The low score on this point shows that students still have difficulty in including strong scientific reasons and supporting their answers with logical and in-depth arguments.

The findings in this study show different results from the research of Laeni & Retno (2025). In the study, the ability to draw conclusions from prospective teacher students actually had the lowest score (28.66), while in this study it showed the highest percentage. These differences in results are likely influenced by differences in the characteristics of the material being tested and the form of the evaluation instrument used.

The temperature and heat material researched by Laeni & Retno (2025) is more abstract and mathematical, so that students have difficulty in constructing conclusions from their physical concepts. On the contrary, the material of the human digestive system in this study is much more contextual and closer to the daily experiences of students. This makes it easier for students to visualize the biological processes that occur, so that they are more courageous in drawing conclusions. The use of essay test instruments in this study also provides space for students to explore answers based on real observations, in contrast to physics material where the answers are more rigid and definite. However, despite excelling in concluding, the low achievement in the indicator of "building basic skills" shows that students still need guidance to relate these conclusions to deeper scientific arguments.

The difference in achievement in each indicator shows that students' critical thinking skills have not developed evenly. This indicates that students have different levels of mastery in each critical thinking indicator measured. Further explanation based on each indicator of students' critical thinking ability is described as follows.

Provide a Simple Explanation

In this indicator, students were given two main questions: (1) the difference in processes between mechanical digestion in the mouth and chemical digestion in the stomach, and (2) the

reason why the small intestine has multiple intestinal junctures (villi) and the impact caused if the surface of the small intestine is flat. This indicator obtained an average of 2.40 with a percentage of 60%. These results show that students have been able to identify important information and explain basic concepts related to the human digestive system. Most college students were able to explain that mechanical digestion involves the physical destruction of food, while chemical digestion involves the role of enzymes and stomach acid (HCl). Students also generally understand that the structure of the villi functions to expand the surface area of the intestine so that the absorption of nutrients takes place optimally. However, answers are still found that tend to be short and do not show a complete explanation. Some students only mention organ function in general without associating it with the biochemical mechanism of absorption of food substances in depth. These limitations show that even if students' basic understanding is formed, they still need to be trained to compose a more comprehensive explanation. The skill of providing simple explanations is the main foundation in the structure of critical thinking (Sundari et al., 2018). Therefore, reinforcement in this aspect is very important because it will be the basis for students to develop critical thinking skills at a more complex level.

Building Basic Skills

Indicators of building basic skills are measured through questions number 3 and 4. In question number 3, students were asked to analyze the impact of low HCl production on food sterilization and protease enzyme activity. In question number 4, students were asked to provide scientific reasons about the importance of fiber for the health of the digestive system. Based on the results in Table 4, this indicator obtained an average of 2.04 with a percentage of 51%, and became the indicator with the lowest achievement. These results show that students still have difficulty in determining relevant, trustworthy, and supportive information with scientifically sound reasons.

Some students have been able to explain that stomach acid functions to help digestion and kill germs. However, there are still many students who have not been able to explain in a more scientific way the role of HCl in creating the acidic atmosphere needed to activate protease enzymes. Similarly, in the question about fiber, some students only answered that fiber is useful for improving digestion, without explaining the biological mechanisms underlying these benefits. The low achievement in this indicator shows that students tend to know the answers in general, but are not used to building arguments based on scientific concepts. This shows that students' ability to build basic skills still needs to be improved, especially in terms of connecting biological knowledge with logical and scientific reasons. This finding is in line with Hasnawati et al. (2023) who stated that the in-depth mastery of concepts in prospective elementary school teachers is directly proportional to their low ability to provide critical arguments.

Summing up

The concluding indicator is measured through questions number 5 and 6. In question number 5, students were asked to conclude the impact of the habit of postponing bowel movements on the processes that occur in the colon and the risk of health problems that may

arise. In question number 6, students were asked to conclude the relationship between poor dental health and the efficiency of gastric work in the long term. Based on the results in Table 4, this indicator obtained the highest average, which was 2.63 with a percentage of 66%. These results show that students are relatively more able to connect the available information and draw appropriate conclusions.

Most college students were able to conclude that delaying bowel movements can lead to excessive water absorption in the colon, making the stool harder and at risk of constipation. Students are also quite able to conclude that poor dental health can cause the process of destroying food in the mouth to be suboptimal, thus burdening the work of the stomach. The higher achievement in this indicator is suspected to be because the questions given are more contextual and closer to the students' daily experiences. Thus, it is easier for students to connect the available information with real conditions to then draw conclusions. However, some students still give brief conclusions and have not explained the biological processes behind them in more detail.

Provide Further Explanation

The indicator provides further explanations measured through questions number 7 and 8. In question number 7, students were asked to define peristaltic motion and explain why food can still move towards the stomach even if a person eats in a lying position. In question number 8, students were asked to explain the reason why rice that has been chewed for a long time in the mouth tastes sweet. Based on the results in Table 4, this indicator obtained an average of 2.29 with a percentage of 57%. These results show that students are quite able to explain the phenomenon that occurs, but are not entirely able to elaborate on the underlying concepts or assumptions in more depth.

Most students have been able to explain that peristaltic motion is a movement of the muscles of the digestive tract that pushes food towards the stomach. Quite a lot of students also understand that rice tastes sweet because of the activity of the amylase enzyme in saliva. However, some of the students' answers are still short and do not show a strong elaboration of concepts. These results show that students already have an initial understanding of the concepts in question, but still need to be trained to develop more analytical, systematic, and scientific-based explanations.

Setting Strategies and Techniques

Indicators of managing strategies and techniques are measured through questions numbers 9 and 10. In question number 9, students were asked to develop the right dietary strategy for people with chronic ulcers. In question number 10, students were asked to determine the most logical and quick action to overcome severe dehydration due to acute diarrhea. Based on the results in Table 4, this indicator obtained an average of 2.28 with a percentage of 57%. These results show that students are quite capable of determining solutions or actions to the given problems, but the quality of the strategies prepared is not fully in-depth and systematic.

Some students have been able to provide appropriate solutions, such as suggesting a regular diet, avoiding foods that trigger stomach irritation, increasing fluid intake, or taking patients to health facilities. However, many of the students' answers are still general, such as simply writing "eat regularly", "avoid spicy", "drink water", or "take to the doctor", without explaining the scientific reasons or the exact sequence of actions.

This shows that students actually have the initial ability to determine solutions, but are not fully able to formulate a complete, logical, and case-specific strategy. Therefore, this indicator still needs to be strengthened through learning that emphasizes scientific decision-making and problem-solving exercises.

Naturally, this is a complete version that combines all the drafts that we have discussed systematically. This section starts with the closing of the discussion that connects the findings to the solution (learning model), followed by a comprehensive conclusion.

Overall, the results of the study show that the critical thinking skills of prospective elementary school teachers on the concept of the human digestive system are in the medium category. Students tend to be better at concluding indicators, while indicators of building basic skills are the weakest aspect. These findings show that students are relatively easier to answer questions related to cause-and-effect relationships and situations that are close to daily life, but still have difficulty when they are required to develop scientific arguments, explain reasons in depth, and determine relevant information.

As a prospective elementary school teacher, critical thinking skills are very important to support the understanding of science concepts in a more meaningful and applicable way. Therefore, learning for students needs to be directed to activities that emphasize more case analysis, scientific discussion, argumentation exercises, and concept-based problem solving. This is in line with the need to implement innovative learning models that are able to actively stimulate students' critical reasoning. Learning models such as *Problem Based Learning* (PBL) and *Project Based Learning* (PjBL) have proven to be effective in improving critical thinking skills because they expose students to real problems that require in-depth analysis and collaboration (Arsanti et al., 2021). In addition, the use of *the Inquiry* model can also help students in constructing their understanding of biological concepts independently through scientific proof (Rahmawati & Annita, 2020). The integration of these models in Science Literacy lectures is expected to be able to bridge the gap between academic theory and students' logical argumentation skills, so that they are ready to implement these skills in the future learning process (Simarmata et al., 2020).

CONCLUSION

The critical thinking ability of prospective elementary school teachers regarding the concept of the human digestive system was categorized as moderate (62%), with the highest performance in the concluding indicator (66%), reflecting students' ability to connect contextual information. In contrast, the lowest performance was observed in the basic skills building indicator (51%), indicating weaknesses in constructing in-depth scientific arguments. These findings suggest the need to strengthen science literacy through active learning models and case-based exercises to better develop professional critical thinking skills among prospective teachers. Future research is recommended to explore the effectiveness of specific

instructional interventions, such as inquiry-based or problem-based learning approaches, in improving critical thinking across different science topics and educational contexts.

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