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Learning Experience on Digestive System: Does it Underlie Students' Eating Habits?

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ABSTRACT

This study aimed to explore how biology education, particularly the topic of the digestive system, can serve as a basis for students to regulate their eating habits. The approach used in this research is a mixed-method approach, combining both quantitative and qualitative methods. The participants in this study comprised 69 twelfth-grade high school students. Data were collected using a questionnaire that included tests on digestive system content and eating habits, along with an open-ended section that required students to explain the eating patterns they adopted in their lives after studying the digestive system. The data collected were analyzed using Concurrent Triangulation. Students' understanding of the digestive system content remains relatively low, with an overall score percentage of 37.54%. Nevertheless, learning about the digestive system has positively impacted on the eating habits of most students, who have begun adopting healthier eating patterns. On the other hand, a small minority of students still neglect and have low awareness of maintaining healthy eating habits, indicating that further efforts are needed to enhance awareness and healthy habits among students. Support from parents, teachers, and the surrounding environment is crucial to ensure a balanced and nutritious diet for adolescents.

Keywords: biology, health, eating habits, digestive system, high school students.

INTRODUCTION

In modern era, scientific literacy is no longer a foreign concept among students. Students are required to compete in enhancing their scientific literacy skills (Yasir et al., 2024). A student is considered scientifically literate if they can connect the concepts or data learned in school with real-world (Reiss & Winterbottom, 2021). Students are expected not only to master science content but also to apply what they have learned in school to their daily lives. Biology, which studies life and living organisms, not only provides an understanding of these subjects but also emphasizes the importance of applying this knowledge in daily life (Reiss & Winterbottom, 2021; Rizqah et al., 2019).

However, few students show an interest in biology. Preliminary observation indicates that only 15 out of 69 students selected biology as their favorite subject. The difficulty rating of biology, on a scale from 1 (very easy) to 10 (very difficult), revealed that most students rated it between 5 and 8, indicating that biology is perceived as 'moderately difficult' to 'difficult.' Previous research has shown that for some students, biology are both challenging to understand and boring subject to learn (D. H. Putri & Pranata, 2023). This is attributed to the limited time available and the extensive number of topics that must be

covered (Berutu & Tambunan, 2018; Yolanda & Pranata, 2024).

Biology encompasses various aspects of life, from the human body systems to the importance of maintaining ecological balance, providing students with deep insights into the significance of health and good living habits. Students must be able to comprehend the concepts presented by the teacher during the learning process to be successful and achieve its goals (Kurniawan, 2013). Learning is effective when students can apply the knowledge or concepts acquired from their lessons to their daily lives. Therefore, the knowledge they gain will help them make informed decisions about how to maintain their health (Surata et al., 2018). For example, in maintaining digestive health and choosing healthy eating habits.

The experience of learning biology plays a crucial role in shaping healthy lifestyles in high school students. The scientific aspects of biology are closely related to healthy living awareness (Galuh Puspita & Subiantoro, 2022). Essentially, leading a healthy lifestyle involves several key aspects, such as regular exercise, assessing food and beverage choices, ensuring proper nutrition, and maintaining healthy eating habits (Sufa et al., 2017). Therefore, students are expected to apply the biology lessons learned at school to their daily lives, particularly those related to the digestive system, to promote healthy lifestyles and eating habits.

The digestive system is a crucial area of biology, with significant importance in human life. The digestive system consists of all the organs involved in food digestion, from the mouth to the anus, forming an interconnected system that cannot be separated (Khamim, 2019). Understanding the digestive system is considered crucial because it is widely applicable and closely related to everyday life (Ulfa & Rozalina, 2019). The digestive system material can assist in daily life. For instance, students can gain a better understanding of various digestive disorders, such as how gastritis (stomach ulcers) develops and how to prevent or treat it. This knowledge can also raise their awareness of the importance of a healthy diet for long-term health.

The health status of an individual is significantly shaped by their dietary habits. When these habits are unhealthy, they can lead to issues such as obesity, more severe illnesses, and even intellectual impairment (Sambo et al., 2020). Given its impact on long-term health, eating behavior becomes a crucial aspect of daily life. Unhealthy practices, like consuming nutrient-poor foods, skipping meals, and irregular eating, are well-documented to cause various digestive problems and contribute to malnutrition (R. A. Putri et al., 2020).

Unfortunately, despite these needs, unbalanced eating habits are increasingly prevalent among teenagers. Many adopt unhealthy eating patterns, or even develop eating disorders, which can lead to various digestive issues (Pratama et al., 2022). This trend is further fueled by the popularity of fast food, overly spicy foods, snacks rich in flavor enhancers, and a lack of fruit and vegetable consumption. Research indicates that 66.7% of teenagers purchase fast food more than three times a week (Asthiningsih & Lestari, 2020). Such habits are concerning, as fast food has been linked to a higher risk of obesity, depression, heart disease, cancer, dental problems, reduced concentration levels, chronic fatigue, long-term illnesses, and even premature death (Dahiya & Sheena, 2020). Compounding this issue, many students neglect regular meals, often prioritizing other activities or engaging in strict unhealthy dieting, which can trigger stomach disorders. This behavior is especially common among female teenagers who feel dissatisfied with their body image.

High school students generally do not pay attention to their eating habits. They often neglect to eat at mealtimes due to their busy schedules, may overeat in terms of portion and variety, and follow trends by consuming fast food without considering the negative impact on their digestive health (Amaliyah et al., 2021). Therefore, the researchers aim to investigate how the

understanding and learning of Biology, particularly on the topic of the digestive system, influence the eating habits that high school students apply in their daily lives.

RESEARCH METHODS

The study uses a mixed-method approach with an explanatory model. Explanatory sequential mixed methods involve conducting quantitative research first, analyzing the results, and then using qualitative research to provide a more detailed explanation of these results. This approach is termed 'explanatory' because the initial quantitative findings are further elucidated with qualitative data. It is called 'sequential' because the qualitative phase follows the quantitative phase. This design is commonly used in fields with a strong quantitative focus (which is why the project starts with quantitative research), but it poses challenges such as determining which quantitative results to explore further and managing unequal sample sizes across the different phases of the study (Creswell & Creswell, 2021)

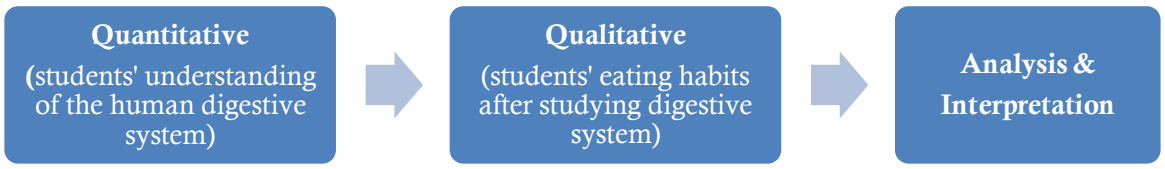


Figure 1. Explanatory Sequential Design

This method allows for the integration of complementary quantitative and qualitative data. Quantitative data provides an overall perspective and objective measurement of students' understanding of the human digestive system, while qualitative data offers deeper insights and context regarding students' eating habits after studying Biology, particularly the digestive system. The explanatory model was selected because it offers the flexibility needed to explore and clarify quantitative results through a qualitative lens. Starting with quantitative analysis enables the researcher to identify patterns and statistically significant relationships between variables. Subsequently, qualitative analysis allows for a deeper exploration of the context and underlying reasons behind the research findings, leading to a more comprehensive interpretation.

The research participants are 69 students who have studied Biology, specifically the topic of the digestive system. Data collection will be carried out using a questionnaire with two types of questions: (1) 10 multiple-choice questions regarding students' understanding of the human digestive system developed by Anwar et al. (2023), which had already been tested for validity and showed a reliability coefficient of 0.88 (Anwar et al., 2021). Each correct answer was scored as 1 point, while each incorrect answer was scored as 0. (2) An open-ended questionnaire with 5 essay questions about the eating habits students practice in their daily lives, which must be explained in writing. For the open-ended questionnaire, it was reviewed by two experts to ensure that the content and purpose of the questions were appropriate.

Quantitative data is obtained from the scores students achieve on multiple-choice questions, to ensure that students have indeed studied Biology concerning the digestive system. Qualitative data is obtained from students' statements and opinions regarding the eating habits they apply in their daily lives, as answered in the open-ended questions of the distributed questionnaire.In this study, the researcher will link students' understanding of the digestive system material through the scores obtained from the questionnaire containing multiple-choice questions about the digestive system with the application of

students' eating habits in daily life, as revealed through the open-ended questionnaire containing questions about their dietary practices.

Based on the above description, the issues to be discussed in this study are as follows: (1) high school students' understanding of human digestive system material in Biology, and (2) high school students' eating habits after learning about the digestive system in Biology. To address these issues, quantitative data from multiple-choice questions were analyzed using descriptive statistics (minimum, maximum, mean, percentage, and standard deviation). Meanwhile, qualitative data from open-ended responses were analyzed using content analysis by coding students' answers into thematic categories and calculating their frequencies. The findings from both analyses were then integrated through triangulation to provide a comprehensive interpretation.

RESULTS AND DISCUSSION

The difficulty rating for learning Biology from 1 (very easy) to 10 (very difficult) is shown in Figure 2.

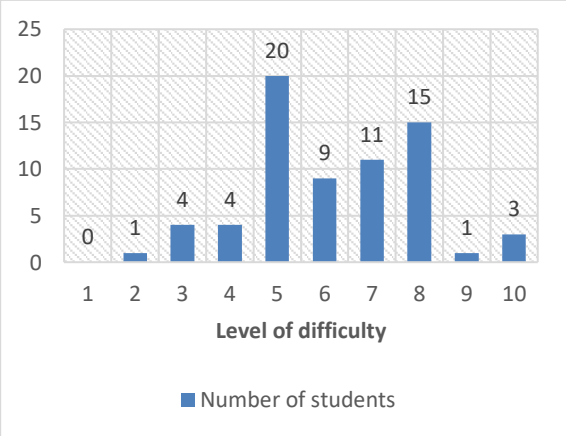


Figure 2. Histogram of the Difficulty Level in Learning Biology.

It was found that the difficulty level of learning Biology according to the majority of students is 5-8, indicating that learning Biology is of 'moderate' to 'difficult' difficulty. Previous research has stated that students find Biology hard to understand and easy to forget after studying it. This is due to limited time and the numerous topics that need to be covered (Berutu & Tambunan, 2018). One student mentioned that Biology is a subject that relies on memorization, which requires a lot of effort to learn, making it difficult for students to absorb and understand. Additionally, some students find Biology challenging because it is associated with tedious Latin terminology (Aprilia et al., 2023; Rijal & Bachtiar, 2015). Furthermore, one factor contributing to learning difficulties is internal factors, such as personal interest and motivation (Mardiah et al., 2021). The research shows that students who dislike Biology generally prefer subjects involving calculations rather than memorization. The low interest of students in Biology makes it challenging for them to grasp the material being taught.

Figure 3 shows that, based on the difficulty level of learning Biology (in Figure 2), the highest score achieved by students is 70, which was obtained by only 8 out of 69 students. This indicates that the level of understanding of the digestive system material among most students is still relatively low. The lack of interest and engagement in the subject of biology by students also makes the situation worse. Interest has a significant impact on learning outcomes (Ulandari et al., 2024). If the subject matter does not align with students' interests, they will not learn effectively and will not find satisfaction in the lesson (Febrianti & Ferazona, 2024).

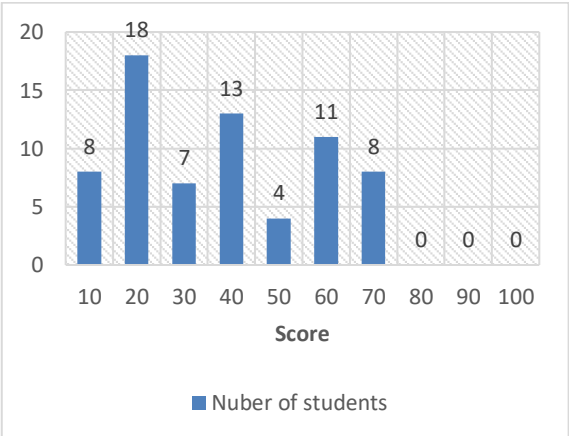


Figure 3. Histogram of Students' Understanding of the Digestive System Material

Understanding concepts is crucial for the teaching and learning process and is key to successful learning. If students do not understand concepts correctly, they may develop misconceptions or fail to grasp the concepts altogether (Adhani & Rupa, 2020). A teacher should connect lesson ideas to the real world by relating them to students' environments and daily lives, cognizing that human life is deeply intertwined with the environment and cannot exist apart from it (Afifah et al., 2022). This can enhance students' thinking abilities and improve their understanding of concepts related to the material being taught.

Table 1. Students' Understanding Scores on Digestive System Material

	Min	Max	Mean		Std. Deviation
			Statistic	Std. Error	
Question 1	0.00	1.00	0.54	0.06	0.50
Question 2	0.00	1.00	0.29	0.06	0.46
Question 3	0.00	1.00	0.52	0.06	0.50
Question 4	0.00	1.00	0.22	0.05	0.42
Question 5	0.00	1.00	0.32	0.06	0.47
Question 6	0.00	1.00	0.55	0.06	0.50
Question 7	0.00	1.00	0.39	0.06	0.49
Question 8	0.00	1.00	0.22	0.05	0.42
Question 9	0.00	1.00	0.32	0.06	0.47
Question 10	0.00	1.00	0.39	0.06	0.49
All Questions	1.00	7.00	3.75	0.24	1.98
Percentage	10.00	70.00	37.54	2.38	19.81

Table 1 presents the results of students' scores on 10 multiple-choice questions. Each correct answer was worth 1 point, so in theory the total score could range from 0 to 10. However, in this study the lowest score obtained was 1 and the highest was 7, meaning no student answered all ten questions correctly. The average score was 3.75, or 37.54% when converted into a percentage. Thus, the maximum value of 7.0 shown in the table reflects the highest score achieved by the students, not the total number of items provided.

Among the 10 questions, question number 6 has the highest average score of 0.55, indicating that it was answered correctly by 37 out of 69 students. This suggests that question 6, which reflects a real-life situation related to the digestive system, was more comprehensible to students and allowed them to apply their knowledge effectively.

Conversely, question number 8 has the lowest average score of 0.22, with only 14 out of 69 students answering it correctly. This question deals with less commonly encountered situations, necessitating memorization and recall of the material. This method may be less effective as it restricts students' ability to analyze real-world scenarios. Previous research indicates that excessive memorization can impair critical thinking and conceptual understanding (Agnafia, 2019).

Based on the data obtained, it can be concluded that students have some experience with learning Biology, particularly about the human digestive system, though their level of understanding is still relatively low, with a total percentage score of 37.54%. The researcher aims to examine how this understanding is applied and its impact on students' eating habits in their daily lives.

According to the open-ended questionnaire, most students reported changes in their eating habits after studying the human digestive system. Their eating habits became healthier and more regular. This supports the theory that increased

knowledge about disease causes, such as digestive issues, can enhance health awareness among students (Rizqah et al., 2019). The finding that 48 out of 69 students reported adopting healthier eating habits was drawn from the open-ended questionnaire, where they described the eating patterns they practiced after learning about the digestive system. These responses provide valuable insight into students' self-reported behaviors on their eating habits.

1. **Managing and determining the appropriate caloric intake.** Students number 2, 11, and 67 reported that they actively count and manage their calorie intake to maintain an ideal body weight. This practice is important because, according to research, excessive daily calorie consumption can lead to obesity (Pamelia, 2018).
2. **Scheduling meals to avoid stomach issues.** Student number 60 mentioned that they manage their eating habits by avoiding late meals to prevent acid reflux and gastritis. However, this remains a significant challenge for students at SMA 1 Sungai Penuh due to their busy schedules. Approximately 36.23% of students stated that they skip meals because they are too busy with other activities, such as homework and school tasks, causing them to forget or miss mealtimes. Frequently skipping meals can trigger increased stomach acid (Waluyo & Solikah, 2023) which may cause pain and discomfort in the upper abdomen. Additionally, going without food for extended periods results in significant energy expenditure, which can adversely affect health (Lakmali et al., 2022).
3. **Reducing the consumption of unhealthy foods such as spicy foods and fast food.** Fast food is popular due to its speed, affordability, and convenience. Research indicates that adolescents often consume fast food for reasons such as peer influence, lack of knowledge and awareness, convenience, and low cost (Kumalasari et al., 2023). Fast food consumption is widely promoted, and in the U.S., the percentage of energy consumed from home-cooked meals by adolescents aged 12 to 18 has decreased, while consumption from restaurants and fast food has increased over time (Hamish & Angus, 2019). However, the data suggests that after studying the biology of the digestive system, students are making efforts to reduce and eliminate these habits. For example, student number 63 reported that they now consider the impact of the foods they eat more carefully after learning about the digestive system.
4. **Paying attention to nutrition, protein, and vitamins in food.** Student number 1 stated that after learning about the digestive system, they have become more conscious of their diet by choosing healthier foods. This shift not only helps maintain digestive health but also supports overall bodily health. Consuming nutritious foods can reduce the risk of diabetes, high blood pressure, cancer, and heart disease, and enhance the body's resistance to infections and other illnesses (Kumalasari et al., 2023). For example, students might start incorporating more fruits, vegetables, and lean proteins into their diet. After understanding the impact of nutrition on the digestive system, students' self-awareness has increased, leading them to actively reduce and eliminate unhealthy eating habits.
5. **Starting to regularly eat vegetables and fruits.** Fiber-rich foods, such as leafy greens and apples, are highly beneficial for the digestive system. The amount of fiber consumed can significantly impact bowel movement patterns, helping to prevent constipation. For instance, students number 52 and 56 mentioned that they have started eating more fruits, like apples and bananas, to improve digestion and prevent constipation. A lack of fiber can lead to digestive issues, such as constipation

(Fahri et al., 2023). This change in their eating habits reflects a deeper understanding of the importance of fiber, which they learned through their biology lessons on the digestive system.

6. **Drinking enough water.** Water is one of the basic needs of the human body that is often overlooked. However, water is crucial for maintaining fluid balance in the body, supporting the proper functioning of vital organs, and promoting overall health (Purnama Teduh et al., 2024). Dehydration can lead to a variety of health issues, including digestive problems, skin conditions, and fatigue. Water helps digestive enzymes break down food more effectively, making the digestion process more efficient, and it also facilitates nutrient absorption and waste elimination. It is recommended to drink at least 8 glasses of water a day, especially during physical activities or in hot weather, to ensure that the body functions optimally.

All of this is done to maintain the health of their digestive system. This indicates that by studying the digestive system, they have heightened their self-awareness in maintaining a proper diet and ensuring the health of their digestive system.

However, it was also observed that a small portion of students remain indifferent to digestive health issues despite having studied the digestive system. This could be influenced by several factors. Besides external factors, such as the level of education or knowledge students have about the digestive system, internal factors also play a role in influencing the diet choices students make. Internal factors are those originating from within an individual, such as self-awareness regarding health and physical changes. For example, when adolescents undergo physical changes, particularly in terms of weight and body shape, their anxiety about weight often increases (Tirza, 2019). A lack of self-awareness regarding personal health leads some students to neglect the health of their digestive system, causing them to continue following unhealthy eating habits, such as:

1. **Students often do not pay attention to the nutritional content of the food they consume.** Students number 6, 7, and 9 stated that they had no specific preferences in choosing food, if their dietary needs were met. This statement indicates that they prioritize the quantity of food overpaying attention to the nutritional value of the food consumed.
2. **Students prioritize satisfaction in consuming food and disregard its impact on digestive health.** They mentioned that they eat whatever tastes good without considering how it affects their digestive system.
3. **Frequently skipping meals due to busyness, laziness, or lack of appetite.** The majority of students with poor eating habits admit that they often skip meals due to their busy schedules, exhaustion, or even lack of appetite. Many of them feel too busy or too tired after their activities to remember or prioritize eating. According to research, breakfast is the most frequently skipped meal, followed by lunch and dinner. A hectic schedule, particularly academic and extracurricular activities, is the main factor driving this behavior. Additionally, academic stress, family issues, and other factors also contribute, though to a lesser extent, to this habit of skipping meals (Chahine et al., 2023). This habit can have negative impacts on students' health, particularly their digestive systems. Regularly skipping meals can lead to metabolic disorders, reduced energy, and an increased risk of health issues such as gastritis and nutritional imbalances. an increased risk of health issues such as gastritis and nutritional imbalances.

Based on the findings, it was discovered that despite having an understanding and learning experience of the digestive system, a significant proportion of students still engage in poor eating habits. This indicates that eating

patterns are not solely influenced by students' knowledge or understanding of the human digestive system but are also affected by various external and internal factors. Previous research has shown that the environment significantly impacts the formation of eating behaviors, with peer influence being a prominent aspect (Rahman et al., 2016). Peers shape the food preferences and eating patterns of children and adolescents, serving as crucial sources of information on socially acceptable behaviors during this developmental stage (Ragelienė & Grønhøj, 2020).

Additionally, preferences factors such as trendy foods, media exposure, cultural norms, financial, and family policies play significant roles in shaping their eating habits. Given these multifaceted influences, it is recommended that a collaborative approach be adopted to address the issue. Parents should pay attention to teenagers' eating patterns by ensuring a balanced and nutritious food intake (Olarewaju et al., 2022). Schools can incorporate comprehensive nutritional education programs that not only provide knowledge but also foster practical skills and self-efficacy in making healthy food choices. Community initiatives and policies that increase access to nutritious foods, especially in underserved areas, can further support these efforts. By acknowledging and addressing the diverse factors influencing students' eating behaviors, more effective strategies can be developed to promote healthier dietary habits among adolescent.

CONCLUSION

This study reveals that while most students have a basic understanding of the digestive system, their comprehension is relatively low. Additionally, there is a noticeable lack of interest in the subject. Despite this, many students demonstrated positive changes in their eating habits after learning about the human digestive system. Specifically, these changes include better management of calorie, meal schedules, reduced consumption of unhealthy foods, increased attention to nutritional content, and greater consumption of vegetables, fruits, and water. Conversely, a small portion of students continue to exhibit poor eating habits, even after studying the digestive system. This persistence of unhealthy behaviors is likely due to limited self-awareness regarding health and the influence of external factors, such as peer pressure and environmental conditions.

Therefore, it can be concluded that understanding and learning about the digestive system have a noticeable impact on students' eating habits. However, there is still a need for additional efforts to enhance awareness and promote healthier eating practices. Support from parents, teachers, and the surrounding environment is crucial in ensuring that adolescents maintain a balanced and nutritious diet. Future research should explore other factors influencing students' eating habits, including the effectiveness of educational interventions and the role of school-based programs in fostering healthy dietary behaviors. Finally, to strengthen future research, it would be beneficial to use a pre–post questionnaire or structured interviews to obtain stronger evidence of how learning influences the implementation of healthy living habits.

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