

Exploring the Effectiveness of a Gameboard in Enhancing Understanding of the Digestive System

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ABSTRACT

The digestive system is a vital area of study in biology, yet students often find it challenging to understand due to its complexity. This study explores the effectiveness of using a gameboard to enhance students' understanding of the human digestive system. The gameboard was designed to illustrate the journey of food through the digestive system, incorporating tasks, challenges, and questions at each stage. The research involved 27 students who were assessed using a pretest before engaging with the gameboard and a posttest after using the gameboard. The purpose of this study was to evaluate the improvement in student knowledge of the digestive system by comparing the results of the pretest and posttest. The findings revealed significant improvement in the students' understanding of the digestive system after using the gameboard. The results suggest that interactive learning tools like the gameboard can help students better grasp complex biological concepts. This research underscores the potential of game-based learning in science education as an engaging and effective method for enhancing subject comprehension.

Keyword: *Gameboard, Digestive System, Interactive Learning, Education, Knowledge Retention*

1. INTRODUCTION

The digestive system is an essential aspect of human biology, responsible for breaking down food, absorbing nutrients, and eliminating waste. It involves a series of complex physiological processes that occur across various organs, including the mouth, esophagus, stomach, small intestine, large intestine, liver, pancreas, and rectum. The digestive process is dynamic and requires the coordinated functioning of multiple organs to ensure proper nutrient absorption and waste elimination. Despite its importance, the intricate and often abstract nature of these processes can make it challenging for students to fully comprehend the system and its functions. Many students struggle to visualize how the organs interact during digestion and find it difficult to understand the role each plays in maintaining overall health.

The complexity of the digestive system presents a significant challenge for educators in the field of biology. Traditional teaching methods, which often rely on lectures, textbooks, and static visuals, may not be sufficient to help students grasp the full scope of the digestive process. As such, there has been a growing interest in exploring alternative teaching methods that promote deeper understanding and active engagement. One such method that has gained attention is the use of interactive educational tools, which encourage students to engage with the material in a more hands-on and meaningful way. Among these tools, game-based learning has emerged as a promising approach. Game-based learning incorporates elements of play and problem-solving, offering a unique opportunity for students to actively engage with the subject matter, collaborate with peers, and reinforce key concepts through repeated practice.

This study investigates the effectiveness of a gameboard as an educational tool for enhancing students' understanding of the digestive system. The gameboard was designed to represent the journey of food through the digestive system, with each stage of digestion clearly depicted on the board. Tasks and questions related to digestion

were integrated into the game to challenge students' knowledge and encourage them to think critically about the processes involved. By navigating through the game, students were able to simulate the experience of food traveling through the digestive system, providing them with a tangible representation of a process that might otherwise seem abstract. The goal of the gameboard was to foster an interactive learning environment that would not only engage students but also improve their retention of key concepts related to the digestive system.

The study involved 27 elementary students, who were assessed before and after using the gameboard to measure changes in their understanding of the digestive system. A pretest was administered to assess the students' baseline knowledge, followed by an interactive session where students engaged with the gameboard. After the session, a posttest was given to evaluate any improvements in the students' comprehension of the material. By comparing pretest and posttest scores, the study aimed to determine whether the use of the gameboard resulted in significant improvements in students' knowledge of the digestive system.

The results of this study may contribute valuable insights into the potential benefits of incorporating interactive educational tools, such as game-based learning, into biology instruction. If the gameboard proves to be an effective tool for enhancing students' understanding of the digestive system, it could serve as a model for similar approaches in teaching other complex scientific concepts. The findings of this research may also inform future educational practices, suggesting that game-based learning can play a key role in making science education more engaging, interactive, and effective.

1.1 Statement of the Problem

This research study aims to explore the effectiveness of a gameboard in enhancing students' understanding of the digestive system. The research is designed to address the following questions:

1. What is the current level of students' understanding of the digestive system prior to using the gameboard?
2. How do interactive science activities, such as the gameboard, influence students' ability to understand and retain information about the digestive system?
3. How does the use of a game-based activity impact students' understanding of the digestive system compared to traditional learning methods?
4. Is there a significant improvement in students' understanding of the digestive system after participating in the gameboard activity, as measured by pretest and posttest scores?

1.2 Scope and Limitation

This study explores the use of a gameboard as an educational tool to enhance elementary students' understanding of the digestive system. It involves 27 students who engage with the gameboard, and their knowledge is assessed before and after the activity through pretest and posttest measurements.

The study aims to determine if the gameboard improves students' comprehension compared to traditional learning methods. The findings could offer insights into the potential of game-based learning to make complex scientific concepts more engaging and effective. However, the study's limitations include a small sample size, short-term assessment, and a narrow focus on only the digestive system. Further research is needed to confirm and expand on these findings.

2. REVIEW OF RELATED LITERATURE

The digestive system is a complex and essential aspect of human biology, with a series of physiological processes that help break down food, absorb nutrients, and eliminate waste. Understanding the function of this system is a fundamental aspect of biology education, particularly in the elementary and secondary school curriculum. However, research has consistently shown that students often struggle to grasp the abstract nature of these biological processes (Peacock & Stanley, 2014). Considering these challenges, educators have been increasingly turning to innovative teaching methods to improve student engagement and comprehension. Among these methods, interactive tools and game-based learning have gained prominence in recent years.

2.1 The Challenge of Teaching the Digestive System

Traditional educational methods, such as lectures, textbooks, and static visuals, are often insufficient in helping students understand the dynamic processes involved in digestion (Miller et al., 2015). The difficulty in understanding the digestive system is compounded by its abstract nature and the interplay between various organs. As noted by McGrath et al. (2016), students frequently face difficulty in visualizing how different organs function together to achieve digestion and nutrient absorption. This issue becomes more pronounced when students are required to comprehend a series of biochemical and physiological processes that occur over time and within different anatomical regions.

2.2 The Role of Gameboards in Learning

Gameboards as an educational tool provide students with an engaging way to learn about complex topics. Research on gameboards, specifically in the context of science education, shows that such tools can help students connect abstract ideas to real-world applications. A study by Hamilton et al. (2018) found that students using a gameboard to simulate the digestive system were more able to explain the sequence of events in digestion compared to students who learned the same material through traditional methods.

Gameboards foster an environment of active learning, where students are not passive recipients of information but instead actively engage with the material through hands-on activities and critical thinking exercises. The interactive nature of gameboards encourages students to participate in problem-solving, make decisions, and test their knowledge, all of which contribute to a deeper understanding of the subject matter (Caldwell & Miller, 2011).

2.3 Educational Outcomes of Game-Based Learning

The effectiveness of game-based learning in improving students' understanding has been widely documented. Research has shown that students who participate in interactive game-based activities often experience increased engagement, higher motivation, and better retention of knowledge (Steinkuehler & Duncan, 2008). Additionally, game-based learning has been found to promote collaboration and social interaction, allowing students to discuss and reinforce their understanding of concepts with peers (Burke et al., 2010). These social interactions are crucial in reinforcing the material and providing students with opportunities to clarify their misconceptions.

In the context of the digestive system, the interactive nature of game-based learning is particularly beneficial because it allows students to simulate and experience the various stages of digestion, which can be difficult to conceptualize through traditional instruction. Game-based learning tools such as gameboards provide a visual and hands-on approach to understanding the digestive system, which can significantly enhance students' learning outcomes.

3. GAMEBOARD DESIGN AND METHODOLOGY

3.1 Gameboard design overview

Gameboard: Journey Through the Digestive System is an educational and fun board game where players navigate through the digestive system, collecting nutrients and avoiding obstacles, while answering trivia questions about digestion. The gameboard features a winding path divided into segments representing key parts of the digestive system, such as the mouth, esophagus, stomach, and small intestine, with spaces for nutrient cards, obstacles, trivia checkpoints, and bonus rewards. Players roll a dice to move forward, drawing cards for nutrients or obstacles, and answering trivia questions to earn bonuses or extra moves. The goal is to reach the end of the digestive system first with the most nutrient cards. The game is designed to educate players about human biology in an interactive and engaging way, suitable for ages 8 and up, and can be played individually or in teams.

3.2 Representation of the Digestive System on the Gameboard

A visual representation of the gameboard illustrating the stages of digestion, including the mouth, stomach, small intestine, and large intestine.

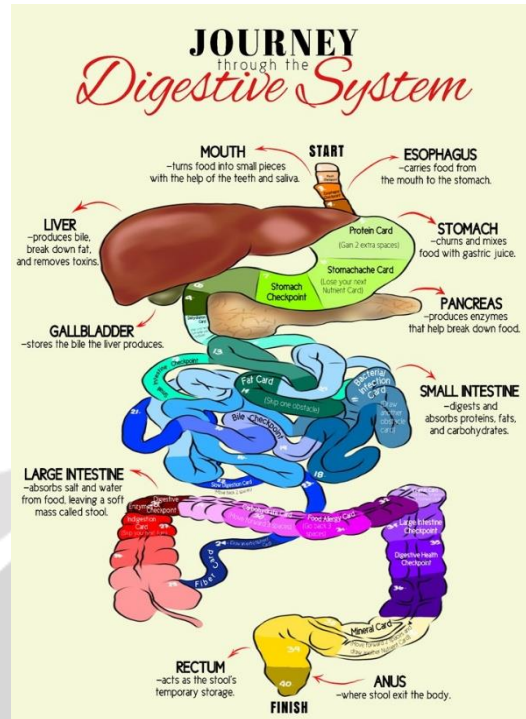


Fig -1: Journey through the Digestive System Gameboard

3.3 Research Locale and Duration

The researcher conducted this study at La Purisima Elementary School, situated in La Purisima, Cagwait, Surigao del Sur. The research took place over a period of one week, starting in the first week of December and concluding in the middle of the second week of December 2024. The study involved a total of 27 elementary students who were selected to participate in the evaluation process. The students underwent a pre-test at the beginning of the study to assess their baseline knowledge of the digestive system, followed by an interactive session using the gameboard to enhance their understanding. After the session, a post-test was administered to measure any improvements in their comprehension of the digestive system. This study aimed to compare the students' pre-test and post-test scores to determine the effectiveness of the gameboard as an educational tool.

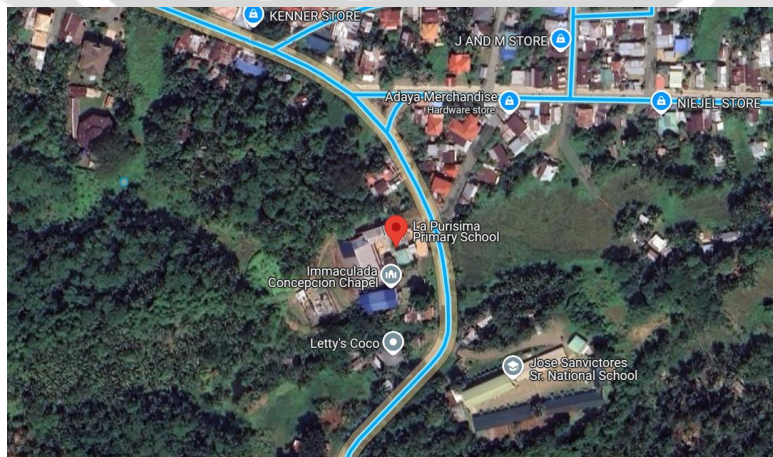


Fig -2: Map of La Purisima Elementary School

3.4 Research Design

This study employed a quantitative research design with a pretest-posttest approach, which allowed for the measurement of knowledge improvement before and after the intervention. The pretest-posttest design was ideal for assessing the impact of the gameboard on students' learning, as it enabled a direct comparison of students' knowledge of the digestive system prior to and after engaging with the gameboard activity.

The design was quasi-experimental since only one group of students was tested without random assignment to experimental and control groups. This approach allowed the researcher to observe the changes in understanding due to the specific intervention.

3.5 Participants and Sampling Procedure

The participants were selected using convenience sampling, a non-probability sampling method, as they were readily accessible, and part of the class involved in the study. Since the study aimed to assess the effectiveness of the gameboard in teaching the digestive system to elementary students, all 27 students in the class were included, ensuring a manageable sample size. Due to the small class size, random sampling was not necessary, as the entire group was available for the study.

3.6 Research Instrument

The instrument used in this study was adapted from the book *Science Beyond Borders*, authored by Evelyn T. Sarte and other licensed contributors. This book was specifically designed for 6th-grade students, containing relevant lessons, details, and activities tailored to their curriculum. A total of thirty questions were selected from the book, which were then administered to the respondents. The researcher utilized the same instrument to assess the students' knowledge through both a pre-test and a post-test.

4. RESULTS AND DISCUSSION

4.1 Comparison of Pre-test and post-test Scores

A pretest consisting of 30 items was administered to assess Grade 8 students' understanding before implementing a specific educational intervention. This pretest aimed to evaluate students' initial grasp of the subject matter. After the instruction period, a posttest was given to measure any changes in students' knowledge. Table 1 summarizes the results of both the pretest and posttest assessments, highlighting the impact of the instructional intervention.

Table 1. Level of Pre-Test and Post-Test Scores

Type of Assessment	Total Score	Standard Deviation	Mean	Grade Percentage	Remarks
Pretest	30	4.75	10.3	49.0	Limited Grasp
Posttest	30	4.99	17.4	66.8	With Considerable Improvement

The data presented in Table 1 illustrates a notable improvement in students' understanding after the instructional intervention. The pretest results show a mean score of 10.3 out of 30, corresponding to a grade percentage of 49.0%, categorized as "Limited Grasp." This suggests that students initially had a partial understanding of the subject matter, which is often observed when learning abstract concepts without engaging teaching methods or interventions.

After the instructional period, the posttest results show a marked increase in the mean score to 17.4, which corresponds to a grade percentage of 66.8%. This improvement is classified as "With Considerable Improvement." The increase in scores indicates that the intervention helped students grasp the concepts more effectively. This supports the notion that targeted instructional strategies, or educational tools can foster significant improvement in students' learning outcomes by addressing areas of difficulty and promoting deeper understanding.

The findings underline the importance of active learning strategies or interventions in enhancing student performance. The considerable improvement observed in the posttest highlights the effectiveness of the instructional approach in aiding students' comprehension. This aligns with research indicating that interactive and engaging methods improve retention and understanding of challenging concepts. Moreover, the increase in the standard deviation from the pretest to the posttest (4.75 to 4.99) suggests that while most students showed improvement, there was some variation in the level of progress among individuals. This points to the need for differentiated approaches to address varying learning needs within the student group.

4.2 Student Perspectives on Traditional vs. Gameboard-Based Learning

In addition to the pretest and posttest assessments, individual interviews were conducted with the Grade 6 students to gather deeper, qualitative insights into their experiences with traditional teaching methods versus the gameboard-based approach. The interviews provided students with the opportunity to share their thoughts on both teaching methods, offering a comprehensive view of how each influenced their learning.

Students expressed that traditional teaching methods often felt passive and disengaging, making it difficult for them to connect with the material and understand it deeply. These methods were frequently associated with rote memorization rather than meaningful comprehension. In contrast, the gameboard approach was praised for stimulating active participation, collaboration, and engagement, all of which contributed to improved understanding and knowledge retention. The interactive nature of the gameboard method was particularly appreciated, as it allowed students to learn through experience and teamwork. This finding aligns with research showing that active, collaborative learning fosters better engagement and deeper understanding.

Students particularly valued the enjoyment and fun elements of the gameboard method, which they felt made learning more dynamic and effective. This approach encouraged critical thinking and hands-on problem solving, which led to improved comprehension of the material. Furthermore, students noted that the competitive aspect of the gameboard method added excitement, motivating them to participate more actively in class. This supports existing research suggesting that game-based learning can improve student motivation and engagement.

Despite the overwhelmingly positive feedback, some students pointed out challenges related to time management and the initial complexity of understanding the game rules. However, these challenges were overcome through peer collaboration, demonstrating that students were able to problem-solve and learn from each other. This finding reflects the importance of peer interaction in fostering a supportive learning environment. Additionally, some students suggested that the gameboard method could be improved by incorporating more varied activities and providing clearer instructions. This iterative feedback highlights the potential for refining instructional strategies to meet students' diverse needs.

4.3 Relationship Between the Gameboard Activity and Students Understanding

To evaluate the effectiveness of the gameboard activity in enhancing students' understanding, a comparison of the pretest and posttest mean scores was conducted. Table 1 presents the statistical analysis of the results, including the t-value and p-value, which indicate the significance of the observed differences.

Table 2. Mean Comparison of Pre-test and Post-test

Type of Assessment	Mean	Standard Deviation	t-value	p-value	Interpretation
Pretest	10.3	4.75	8.0	.0001	There is a statistically significant relationship
Posttest	17.4	4.99			

The results in Table 1 demonstrate a significant improvement in students' performance, with the mean score increasing from 10.3 (SD = 4.75) in the pretest to 17.4 (SD = 4.99) in the posttest. The t-value of 8.0 and the p-value of 0.0001 confirm that the difference between the pretest and posttest scores is statistically significant. These findings indicate that the gameboard activity had a notable impact on enhancing students' understanding of the subject matter.

The observed improvement in posttest scores highlights the effectiveness of the gameboard activity in promoting student engagement and comprehension. Game-based learning has been shown to foster active participation, critical thinking, and collaboration, all of which are essential for deeper learning. The results suggest that the gameboard method encouraged students to apply concepts in a hands-on, interactive environment, which likely contributed to better retention and understanding compared to traditional passive learning methods.

Furthermore, the significant difference between the pretest and posttest scores suggests that the gameboard activity helped address gaps in students' initial understanding, offering an effective alternative to conventional teaching methods. This aligns with research emphasizing the value of interactive learning tools in improving students' academic performance and knowledge retention.

5. Conclusion

The findings of this study demonstrate that using a gameboard as an educational tool significantly enhances elementary students' understanding of the digestive system. By comparing pretest and posttest scores, the results show a clear improvement in students' knowledge after engaging with the gameboard. The pretest indicated a limited grasp of the material, with students scoring an average of 49%, whereas the posttest showed a notable increase, with an average score of 66.8%. This improvement is statistically significant, as indicated by the t-value and p-value, confirming that the gameboard activity effectively contributed to the students' learning.

In addition to quantitative improvements, qualitative feedback from students highlighted the advantages of the gameboard approach over traditional teaching methods. Students found the interactive, hands-on nature of the gameboard to be engaging and motivating. They appreciated the active participation, collaboration, and critical thinking that the gameboard encouraged, which led to better comprehension and knowledge retention. The competitive and fun elements of the game further enhanced student engagement, making learning more dynamic and enjoyable.

Despite some challenges, such as time management and initial difficulties with understanding the rules, the gameboard activity facilitated peer collaboration, enabling students to overcome these obstacles together. This suggests that the social aspects of game-based learning, including teamwork and problem-solving, play an important role in supporting student learning.

Overall, this study supports the potential of game-based learning as an effective and engaging method for teaching complex concepts, such as the digestive system, in elementary education. The findings suggest that interactive educational tools like gameboards can significantly improve students' comprehension and retention of scientific concepts, providing a valuable alternative to traditional teaching methods. Further research with larger sample sizes and broader content coverage is needed to confirm and extend these findings, potentially offering insights into broader applications of game-based learning in science education.

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