NEEDS ANALYSIS OF GAMIFICATION MODELS IN THE DIGESTIVE SYSTEM LESSON TO IMPROVE STUDENTS' CRITICAL THINKING SKILLS AND SCIENCE PROCESS SKILL

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Abstract: The human digestive system is one of the essential Biology learning materials so that in understanding it requires high-level skills and in-depth thinking. In general, current learning still often uses conventional learning methods and media so that it is considered less effective in improving students' critical thinking skills and science process skills. Gamification is considered as one of the innovative learning media that can be a solution to improve high-level skills because gamification involves students actively and can increase student motivation in learning Biology This study aims to analyze the needs of gamification learning media for MTS Al-Inayah Bogor schools on human digestive system material which is designed in such a way as to improve students' science process skills and critical thinking skills. This research uses the development research model (R&D) with the ADDIE approach, this research focuses on the analysis stage. The purpose of this study was to analyze the needs of gamification media on human digestive system material to improve students' critical thinking skills and science process skills. Data collection techniques use purpose sampling techniques using student needs instruments using a Likert scale (5 points) through a survey of 72 students in class VIII MTS and 10 Biology teachers. While qualitative data was obtained through interviews with 10 teachers. The results of this study show 91% of classroom learning still uses conventional methods. Learning media that uses game elements is only about 9%, but respondents stated that this media is not enough to improve critical thinking skills. Only 8% have just used gamification, especially in human digestive system material. About 82% stated that they really need gamification learning media to improve students' critical thinking skills and science process skills. This research can be a strong basis for developing gamification media according to the needs of science learning in schools.

Keywords: Critical thinking skills; digestive system; gamification; science process skills

INTRODUCTION

Human digestive system material is material at the junior high school level that is complex so that in learning it requires deep thinking. Often students find it difficult to learn biology because this subject has abstract concepts that are difficult for students to visualize (Abobaker et al., 2023). In the digital era, critical thinking skills and science process skills are categorized as very important skills to build students' future success and professionalism (Fadel & Trilling, 2022). Conventional methods that are often used have proven to be less effective in improving critical thinking skills and science process skills, especially in the material of the human digestive system (Hofstein et al., 2021). Gamification as an innovative method and media shows good significance in improving high thinking skills with student engagement and student learning outcomes in its game elements. Huang et al. (2020) in their research stated that gamification is effective in increasing student motivation, cognition, and learning performance. According to Lamrani et al. (2022) in learning Biology, gamification can increase students' critical thinking skills and students' science process skills because the gamification game elements contain narratives, provide challenges for students to complete the material in the game, and provide feedback to students.

Gamification is an innovative learning media that can provide problem-solving solutions in improving students' critical thinking skills and students' science process skills so that this media is very important to develop (Díaz-Lauzurica & Moreno-Ger, 2022). Therefore, this study aims to conduct a needs analysis to develop gamification media in human digestive system material. This media development design focuses on improving students' critical thinking skills and science process skills. The results of this needs analysis will provide strong empirical results as an innovative media to improve the quality of learning at the MTS level. When building quality science education, educators need to examine the quality of the literacy. Indonesia's low scientific literacy, as noted by Triantoro (2019), presents challenges in the management of these resources and hinders Indonesians from keeping up with global advancements via scientific ESD.

Several factors contribute to Indonesia's low literacy, and according to Revina (2019), the first is the country's low education system, which is due to the partial curriculum implemented in Indonesian schools; some use the national curriculum, and some use the independent curriculum, causing numerous approaches to learning. This unique challenge, as Al Machmudi (2023) stated and PISA data indicates, is that Indonesia's curriculums, which undergo regular revisions, are unable to achieve their full potential due to the difficulties posed by these frequent changes for both students and teachers in following each curriculum's flow.

The second factor involves the teaching-learning process. Alexander (2019) and Girsang et al. (2022) observed that Indonesian educators often need more professionalism, frequently employing traditional lecturing methods. Hence, this teaching approach leaves students unengaged without the critical thinking skills they

need. Moreover, based on Yulianti's (2023) finding, students attend classes out of obligation, mainly due to inadequate learning methods, strategies, and media. Therefore, Indonesian students are unenthusiastic about participating in lessons.

In regards to the concern upon these situations, researchers who are involved in this paper propose gamification media to be more easily made and implemented in various Indonesian schools to promote quality education in the country, To promote quality education, it is essential to integrate science literacy into scientific research, which helps shape students' thinking processes (Mo'tasim, 2019), where the character of a researcher who can think critically and creatively is built. Developing critical thinking skills from an early age is vital for students, as they are fundamental to the scientific approach during their academic years. As Putri et al. (2022) argued, with these skills, students do not merely accept information but instead process it thoroughly. Moreover, critical thinking skills are essential for students to navigate the digital era, where information explosions occur rapidly (Alfhandy, 2023). Without these skills, students will easily accept hoaxes and struggle to distinguish between facts and opinions. Gamification media has been quite popular in the field of education to improve higher order thinking skills by actively engaging students and boosting student motivation. In its application, gamification shows a significant increase in student interest and active participation in school learning Atmajaya and Saputra (2021). Elements in gamification media such as badges, points, leaderboards can make students more active in learning because they are challenged to compete.

According to Widyastuti et al. (2022) students' understanding in learning digestive system material successfully increased after using gamification learning media. This is because using gamification media makes complex learning more interesting and interactive. Critical thinking skills are so important in science learning that these skills must be possessed by every student. Gamification media can stimulate students' critical thinking through games that contain challenges and problem solving (Nugroho & Susilowati, 2021). With student involvement in gamification games, students' analysis and evaluation skills are better than learning using conventional media. In addition to critical thinking skills, science process skills are also very important in learning the human digestive system because it involves a lot of practicum activities in it. According to Pratiwi et al. (2023) gamification can make students' science process skills better because this media can improve the ability to design and conduct experiments better through its game elements that successfully improve students' critical thinking skills indicators such as observation, classification, and interpretation.

Rahmat and Suryani (2020) reminded that before implementing gamification media, several things must be considered so that this media runs effectively. The considerations are adjusted to the characteristics of the students and the learning objectives to be achieved. Need analysis activities are very important to obtain these data. Some aspects that need to be analyzed in this gamification media framework are aspects of analyzing student characteristics, identifying learning objectives, and mapping appropriate game elements (Purwanto et al., 2022). Based on some of these

literature reviews, the needs analysis activities for this gamification media have great potential in improving students' critical thinking skills and science process skills, but further research is needed to develop this media to be more effective and in accordance with the learning needs of the digestive system material at school.

METHODS

The research design involves collecting data through a small sample (a small sample allows researchers to collect data more quickly and with fewer resources), focusing on field observations, and completing questionnaires by both teachers and students. For students, the Gutman scale is used to gather information, while teachers provide responses in a descriptive format. This methodology allows for a comprehensive understanding of the gamification implementation and its effects on student and teacher perspectives.

This gamification study focuses on MTS Al-Inayah, a Madrasah Tsanawiyah in Ciomas, Bogor, under the Indonesian Ministry of Religious Affairs. Using grade VIII as a sample, the research aims to analyze gamification needs in this high-demand school, emphasizing the importance of adopting modern educational approaches.

In the process, the research method chosen to analyze the needs of gamification uses descriptive qualitative methods, namely by collecting information in the field through observation and filling out teacher and student questionnaires. The subjects studied consisted of a single science subject teacher, 11 teachers of other subjects as supporting information on reality in the field, and 72 class VIII grade students of MTS Al-Inayah as the core respondents to determine how vital gamification media is in this school. Data collection involved manual interview forms and student questionnaires. Using a Gutman scale (Yes/No), the student questionnaire assessed critical thinking skills and scientific procedures while also gauging the need for gamification media. The primary aim was to determine gamification requirements and guide product development to enhance students' critical thinking.

The teacher questionnaire, comprising 19 questions, explored current teaching methods, gamification usage, and barriers to innovative media adoption. Teacher interview data underwent descriptive interpretation, while student questionnaire data was analyzed quantitatively and descriptively. All data was subject to credibility testing through a triangulation approach to ensure validity and trustworthiness.

RESULTS AND DISCUSSION

The research plan involves a comprehensive analysis of both qualitative and quantitative data to assess the effectiveness of gamification in enhancing critical thinking and practical task engagement among students. For the qualitative analysis, responses from 19-question teacher interviews will be transcribed and organized. Thematic analysis will be conducted to identify common themes and patterns related

to current teaching methods, the use of gamification, and barriers to implementing innovative media. The findings will be presented in descriptive form, possibly using quotes to illustrate key points.

In contrast, the quantitative analysis will involve tabulating responses from 72 Grade VIII students using a Gutman scale, calculating frequencies and percentages for 'Yes' and 'No' responses, and analyzing data to assess students' critical thinking skills and engagement with scientific procedures. Finally, visual representations such as bar charts and pie charts will be created to display results. The descriptive analysis will descriptively interpret these quantitative results, discussing trends and patterns observed in students' responses and relating them to the need for gamification in enhancing critical thinking and practical task engagement. To ensure the validity and reliability of the findings, triangulation will be employed by comparing and contrasting results from teacher interviews and student questionnaires, identifying areas of convergence and divergence between teacher and student perspectives. Finally, all data will be synthesized to conclude the extent of gamification needs in the school, identifying specific areas where gamification could be recommended to address current educational challenges.

Table 1. Teacher Needs Analysis (TNA) of the gamification media

Question	Response	Percentage (%)
Learning media that are often used in class	Discussion	36
	Presentation	55
	Gamification	9
Frequently use learning media	Yes	36
	No	19
	Sometimes	55
Frequently used media other than gamification.	PowerPoint	27
	Worksheet	73
Learning media that are often used at school today are enough to improve students' critical thinking skills	Yes	18
	No	36
	Sometimes	46
Learning media that are often used at school already have game elements	Yes	18
	No	27
	Sometimes	55
Frequent practicum at school	Yes	36
	No	9
	Sometimes	55
Students look enthusiastic about participating in practicum activities	Yes	91
	No	0
	Sometimes	9
Make own learning media	Yes	45.5
	No	9
	Sometimes	45.5
Have made gamification media	Yes	27
	No	73
	Sometimes	0

The data analysis reveals several key findings regarding the current state of learning media and teaching methods in the context of improving students' critical thinking skills and science process skills, particularly in the digestive system lesson. The use of learning media is dominated by presentations (55%), followed by discussions (36%), and gamification (9%), indicating a strong reliance on traditional teaching methods with limited integration of innovative approaches like gamification. The frequency of learning media usage varies, with 36% of respondents using them frequently, 19% not using them, and 55% using them sometimes, suggesting inconsistent utilization of learning media across classrooms.

The most common types of media used besides gamification are PowerPoint presentations (27%) and worksheets (73%), further emphasizing the prevalence of conventional teaching tools. Only 18% of respondents believe that current learning media are sufficient to improve students' critical thinking skills, while 27% disagree, and 55% think they are sometimes effective. This highlights a perceived inadequacy in existing learning media for developing critical thinking skills. Regarding game elements in current learning media, 18% of respondents report that their learning media incorporate game elements, 36% say they do not, and 46% indicate occasional inclusion. This suggests limited gamification in existing teaching materials. The frequency of practical activities also varies, with 36% of respondents conducting them frequently, 9% not conducting them, and 55% doing so sometimes, indicating a moderate level of hands-on learning experiences.

Interestingly, 91% of respondents observe that students are enthusiastic about participating in practicum activities, with only 9% reporting occasional enthusiasm. This strongly suggests that practical, hands-on learning experiences are highly engaging for students. In terms of creating learning media, 45.5% of respondents create their own learning media, 9% do not, and 45.5% do so sometimes, showing a balanced mix of educators who develop custom materials and those who rely on pre-existing resources.

Finally, only 27% of respondents have experience in creating gamification media, while 73% have not. This indicates a significant opportunity for growth in the development and implementation of gamified learning experiences. These findings suggest a need for more diverse and innovative learning media, particularly those incorporating gamification elements, to enhance students' critical thinking skills and science process skills in the digestive system lesson. The high enthusiasm for practicum activities indicates that interactive, hands-on approaches are likely to be well-received by students.

Based on the results of the analysis data collected on the needs of teachers at MTs Al Inayah Parakan Ciomas Regency, Figure 1 shows that 55% of teachers stated that in their daily teaching, they still use old media and methods such as discussions and presentations and still often focus on lecture-based methods. This shows that this school still lacks innovative learning media usage. This finding aligns with recent studies highlighting the persistent challenges in transitioning from

traditional to more innovative teaching methods in Indonesian schools (Prasetyo et al., 2022).

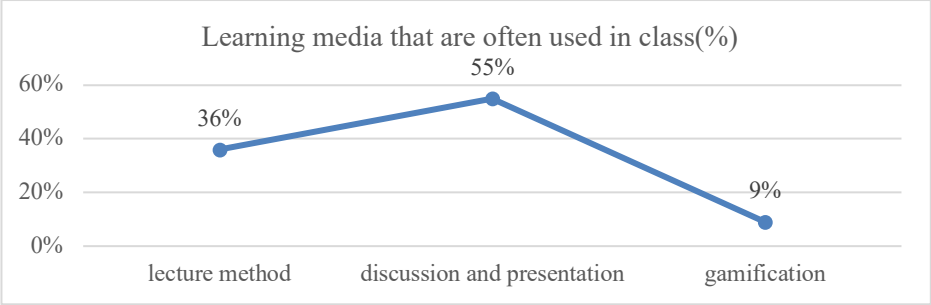

Figure 1. Diagram of daily teachers' media usage in the classroom

Figure 2 reveals that 64% of teachers sometimes use media to enhance their lecture-based daily teaching, the nature of this media is limited.

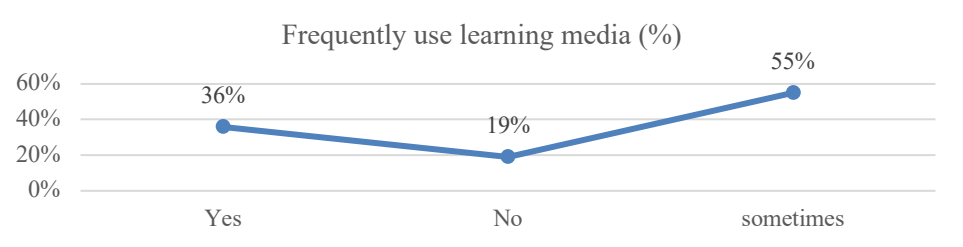

Figure 2. Diagram of the analysis of whether or not to use media in class

Figure 3 shows that only *Lembar Kerja Siswa (LKS),* a monochromatic, paper-based workbook, is used among the media to enhance lecture-based teaching. Hence, students rarely see moving image displays in class. This limited range of media resources suggests a significant opportunity for introducing more diverse and engaging learning tools, particularly those that incorporate visual and interactive elements.

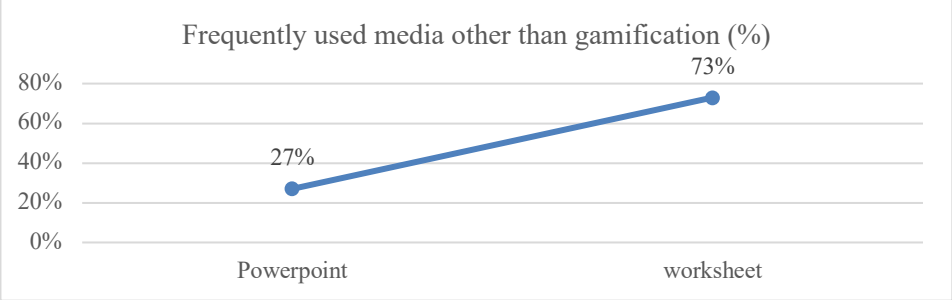

Figure 3. Diagram of the analysis of media items used in class

As shown in Figure 4, 36% of teachers responded affirmatively, and 46% expressed doubt. This finding suggests that teachers' ability to use media to foster

critical thinking remains challenging.This hesitation underscores the need for targeted professional development in leveraging media for higher-order thinking skills, a crucial aspect of 21st-century learning (Wijaya et al., 2023).

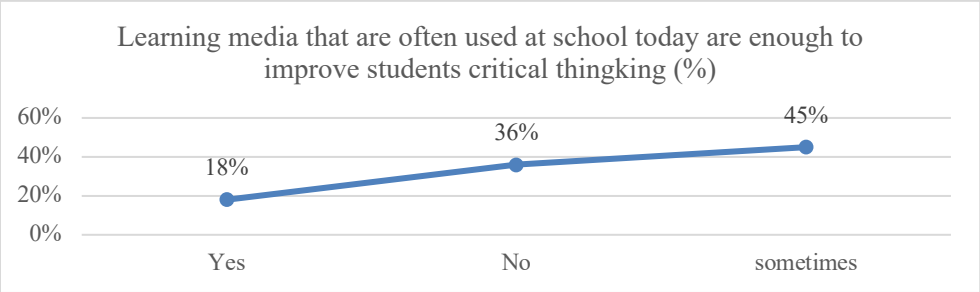

Figure 4. Diagram of the results of the use of media to improve student's critical thinking skills

Moreover, Figure 5 shows that 55% of teachers only sometimes use game elements in learning. It means that gamification is rarely done in the classroom. This infrequent use of gamification strategies represents a missed opportunity, given the growing body of evidence supporting gamification's positive impact on student engagement and learning outcomes, particularly in science education (Nurwanto & Mustika, 2023).

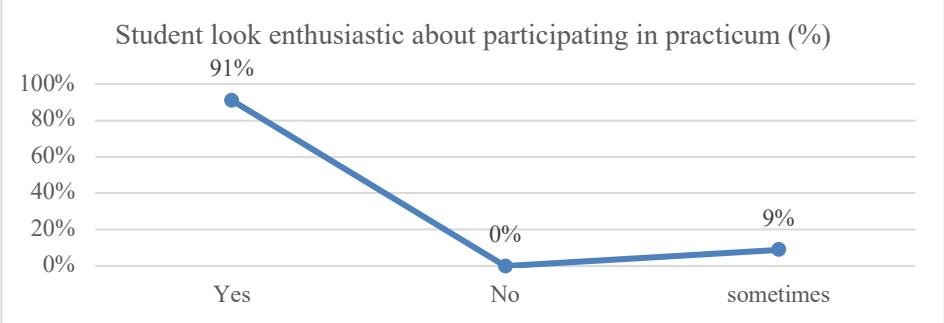

Figure 5. Diagram of the results of the presence or absence of game elements in learning media used daily

As shown in Figure 6, practical activities are only sometimes conducted at school, at 55% of the time. The data indicate that, despite teachers realizing that practicums for hands-on practices are needed, the practice is less often. This finding is particularly relevant to science education, where hands-on experiences are crucial for developing science process skills (Sari et al., 2024).

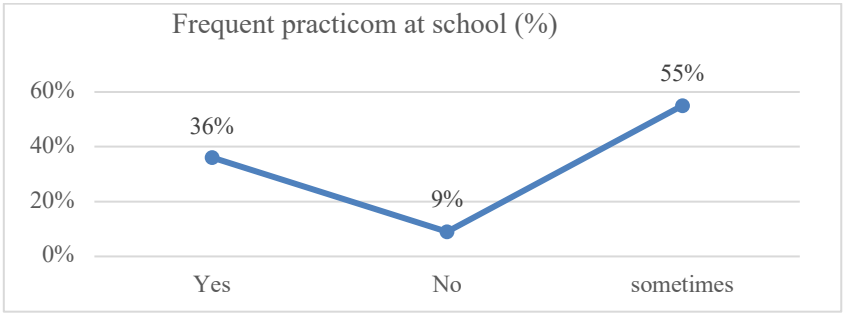

Figure 6. Diagram of the frequency of practicum activities done at school

Figure 7 further showed that 82% of teachers believed students were enthusiastic about participating in the practicum. This perceived student interest in hands-on learning presents a compelling argument for increasing the frequency and quality of practical activities, potentially through gamified approaches that can simulate real-world scenarios (Putri & Suparman, 2023).

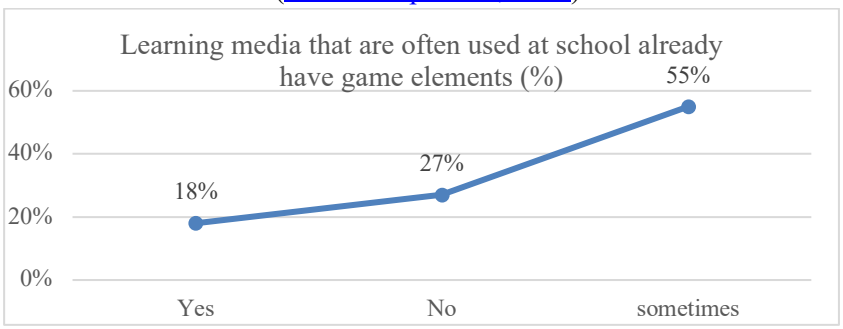

Figure 7. Diagram of teachers' prediction on students' motivation to participate

The data in Figure 8 shows whether teachers often create learning media. 45,5% answered yes, 45,5% answered sometimes, and 9% answered never. However, as aforementioned, the media they created is mainly monochromatic text-based and paper-based, not gamified multimedia-based. The predominance of monochromatic, text-based resources suggests a need for support in developing more engaging, multimedia-based learning materials.

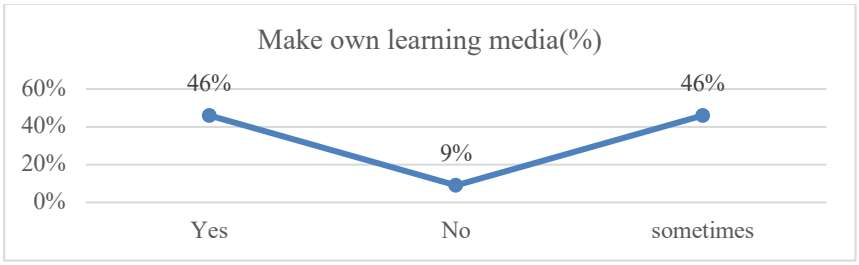

Figure 8. Diagram of the frequency of teachers making learning media

As shown in Figure 9, most teachers, 73%, had never used gamification media before. This finding explains their hesitation in implementing the gamification process in their classrooms.

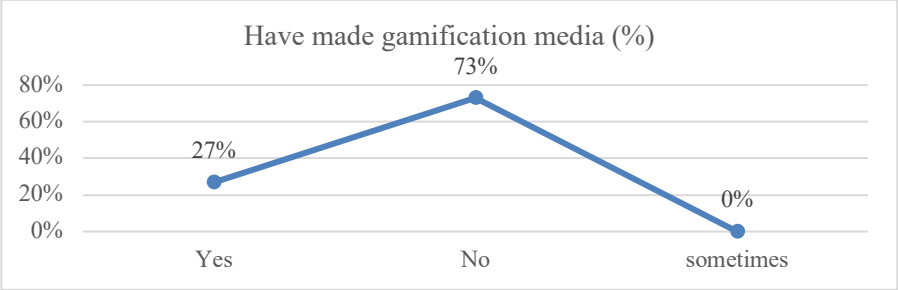

Figure 9. Diagram of whether the teacher has ever made gamification media

The analysis of student needs data revealed significant insights into students' attitudes towards science education and their learning experiences, particularly in the context of the human digestive system. A substantial majority of students (82%) demonstrated enthusiasm for science, as evidenced by their positive responses. This high level of interest provides a solid foundation for engaging students in scientific subjects. However, despite this general enthusiasm, a considerable proportion of students (60%) reported difficulties in learning about the human digestive system. This discrepancy suggests that while students are intrinsically motivated to study science, they face challenges in grasping specific complex topics, particularly without adequate explanatory tools.

Interestingly, an overwhelming majority (95%) of grade VIII students expressed interest in using game-based media to learn about the human digestive system. This strong preference for gamified learning approaches indicates a potential avenue for addressing the learning difficulties identified earlier. Furthermore, 78% of students acknowledged needing assistance in presenting the human digestive system lesson, citing challenges in explaining their understanding due to incomplete grasp of the content, which they perceived as less engaging and uninteresting.

Contrary to teachers' expectations, 56% of students reported feeling bored with traditional practicum approaches. This finding underscores the need for more engaging and interactive learning methods. Aligned with this, an almost unanimous 99% of students showed interest in incorporating gamification into their learning sessions, demonstrating a strong desire for more interactive and enjoyable educational experiences.

Despite the clear student preference for gamified learning, 71% reported that their school rarely implements gamification activities in daily lessons. This discrepancy between student interest and current educational practices highlights a significant opportunity for improvement in teaching methodologies. Additionally, 67% of students agreed that practicum activities infused with gamification elements could enhance their learning motivation. These findings collectively suggest a pressing need for the integration of gamification in science education, particularly

for complex topics like the human digestive system, to bridge the gap between student interest and effective learning outcomes.

The data presented reveals a complex landscape surrounding the implementation of gamification in educational settings, highlighting a significant disconnect between teacher and student perceptions of its importance. This phenomenon, where teachers underestimate the value of gamification despite students emphasizing its positive impact on engagement and performance, can be attributed to several factors. First and foremost, the lack of innovative media training in schools, acknowledged by 82% of respondents, suggests that educators may not be fully aware of or equipped to leverage the potential of gamification in their teaching practices. This knowledge gap likely contributes to the undervaluation of gamification's importance. Additionally, the equal percentage (82%) indicating that gamification media is not very popular further underscores the lack of awareness and adoption in educational circles.

The challenges in implementing gamification are further compounded by the lack of supporting facilities for its development, as reported by 73% of respondents. This infrastructural deficit not only hinders the practical application of gamification but also potentially reinforces the perception among teachers that it is not a viable or essential educational tool. Interestingly, the data shows a more balanced perspective on the creativity aspect, with 55% agreeing that there is no idea to develop gamification media, while 45% disagree. This split suggests that while creativity isn't the primary barrier, there's still a significant need for inspiration and innovation in this area.

The disconnect between teacher and student perceptions aligns with findings from several credible sources. For instance, a study by Dicheva et al. (2015) in the International Journal of Educational Technology in Higher Education found that while gamification shows promise in education, its effective implementation is hindered by a lack of understanding among educators about how to integrate game elements into instructional designs. Furthermore, research by Alsawaier (2018) in the Journal of Education for Business highlights the positive impact of gamification on student motivation and engagement, corroborating the student perspective in our data.

The reasons behind this phenomenon are multifaceted. Firstly, the rapid evolution of educational technology often outpaces professional development programs, leaving teachers struggling to keep up with innovative practices like gamification. Secondly, the lack of supporting infrastructure creates a practical barrier to implementation, potentially leading teachers to dismiss gamification as impractical or unnecessary. Lastly, the general unpopularity of gamification media in educational settings may create a self-reinforcing cycle where lack of exposure leads to lack of interest, and vice versa.

To address these issues, a comprehensive approach is needed. This should include targeted professional development programs to bridge the knowledge gap, investment in technological infrastructure to support gamification implementation,

and initiatives to showcase successful gamification projects in education. By addressing these barriers and aligning teacher perceptions with student experiences, educational institutions can harness the full potential of gamification to enhance learning outcomes and student engagement.

Table 2. Gamification Barrier Factors

Statement	Yes (%)	No (%)
Lack of innovative media training at school	82	18
Lack of supporting facilities for Gamification media development	73	27
There is no idea to develop Gamification media	55	45
Gamification media is not very popular	82	18

CONCLUSION

This study highlights the pressing need for innovative learning approaches in Biology education, particularly for complex topics like the human digestive system. The analysis reveals a significant gap between current teaching practices and student learning needs. While conventional methods still dominate classroom instruction, there is a clear demand for more engaging and interactive learning experiences. The limited use of gamification elements in current learning media, despite their potential to enhance critical thinking and science process skills, underscores the opportunity for educational improvement. The overwhelming majority of respondents expressing a need for gamification-based learning media indicates a strong foundation for future development in this area. This research not only identifies the current limitations in Biology education but also paves the way for the development of gamification media tailored to the specific needs of science learning in schools. By addressing this gap, educators can potentially enhance students' engagement, motivation, and ultimately, their mastery of complex biological concepts, thereby improving both critical thinking skills and science process skills.

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