Jurnal Pembelajaran Dan Biologi Nukleus p-ISSN: 2442-9481
Vol 11 (2): 657 - 676, June 2025 e-ISSN: 2685-7332

Development of '*Truth or Dare*' Team Games Tournament-Based Biology Media for Teaching Digestive System in Senior High School

Aulia Andin Kinanti(*), Kartika Manalu

Biology Education Study Program, Faculty of Tarbiyah and Teacher Training,
Universitas Negeri Islam Sumatera Utara,
Jl. William Iskandar Pasar V, Medan Estate, North Sumatera, 20371 Indonesia

***Corresponding author:** auliaandinkinanti@uinsu.ac.id

Submitted February 25Th 2025 and Accepted May 23 Th 2025

Abstract

Background: *Low student engagement and learning outcomes in biology, particularly in abstract topics such as the human digestive system, are often caused by the use of monotonous learning media that do not actively involve students. This research aims to create Truth or Dare learning media integrated with the Team Games Tournament (TGT) model to enhance the learning outcomes of eleventh-grade high school students on the topic of the digestive system.* **Methodology:** *This study uses the Research and Development (R&D) method with the 4D model (Define, Design, Develop, Disseminate). Validation was conducted by subject matter experts and media experts, while practicality and effectiveness were tested through student and teacher response questionnaires, as well as pre- and post-tests.* **Findings:** *Validation results indicated that the media was highly valid, with a score of 98% for the subject matter and 82,1% for the media. Teacher and student responses indicated that the media was highly practical, with scores of 95,5% and 90,4%, respectively. The N-Gain analysis showed a high level of effectiveness, with a score of 0,76. This media has proven capable of improving student learning outcomes while fostering active, collaborative, and enjoyable engagement in learning. Thus, the Truth or Dare-based TGT learning media is suitable as an innovative alternative in Biology education to enhance student learning outcomes, particularly for abstract topics such as the human digestive system.* **Contribution:** *These results demonstrate the potential contribution of game-based learning in biology education as an alternative to foster student-centered and meaningful learning.*

Keywords: *Digestive System; Learning Media; Learning Outcomes; Team Games Tournament; Truth or Dare*

Jurnal Pembelajaran dan Biologi Nukleus (JPBN) by LPPM Universitas Labuhanbatu is under a Creative Commons Attribution-ShareAlike 4.0 International License (CC BY - SA 4.0)

https://doi.org/10.36987/jpbn.v11i2.7635

INTRODUCTION

One of the key elements in developing high-quality human resources is education (Faradilla, 2024). Essentially, education can develop students' potential to become people of faith (Sari & Adlini, 2024). Education plays a crucial role in human life, fostering creativity, innovation, independence, responsibility, knowledge, and good behavior (Nurindah et al., 2022). The world of education continuously adapts to technological advancements, which contribute to the success of learning (Daryanes et al., 2023).

One important aspect in education that determines learning success is student learning outcomes, which are the main indicator of learning success because they reflect students' level of understanding and skills. Learning outcomes describe the knowledge, skills, and understanding that students should acquire by the end of their learning experience (Catenazzi et al., 2025). Low student engagement in the learning process reflects low learning motivation, which affects student learning outcomes (Rahmi & Yogica, 2021). Teachers must manage learning in a creative, innovative, and motivating way to ensure that the learning process is not boring (Rahayu, 2019). Many factors influence learning outcomes in schools, one of which is the inappropriate use of learning models. The use of learning models plays an important role in achieving good learning outcomes. The process of learning is closely linked to the use of instructional media, strategies, and student achievement. Educational media serve as tools that help teachers convey learning content to students effectively (Karlina et al., 2023). Therefore, effective learning activities using effective learning models should be maximally pursued by teachers (Wicaksono & Iswan, 2019).

Even in effective learning environments, attaining optimal learning outcomes remains a challenge particularly in biology, where students must grasp abstract concepts like the human digestive system. Mastery of this topic is essential for students' understanding of biological processes (Permana & Nourmavita, 2017). Based on observations and interviews with biology teachers at SMAN 2 Percut Sei Tuan on February 4, 2025, students in class XI-F at SMAN 2 Percut Sei Tuan demonstrated low participation or activity levels during the learning process. Despite using media such as PowerPoint presentations, educational videos, and Quizizz, students still struggled to understand the digestive system material, particularly in connecting theoretical concepts with the biological processes occurring within the body. This difficulty has also been reported in previous studies, which found that the abstract nature of the digestive system, involving multiple organs, stages, and enzymatic processes, poses a challenge for students (Nurindah et al., 2022). Students often find it hard to visualize the dynamic processes and relate them to everyday experiences, resulting in low motivation and conceptual understanding. The teacher also tried a team-based learning model but without using any media, simply having Group 1 ask questions to Group 2, who then answered them. As a result, students lost interest because the learning process was too serious. Students' comprehension would be faster if they were directly involved in the learning process, for example through games.

In response to these problems, it is important to utilize learning media that is engaging and able to sustain students' interest throughout the learning process, and the material taught by teachers can be absorbed well by students (Rahayu, 2019). Referring

to the problems that have been described, this can be done by applying the Team Games Tournament (TGT)-based cooperative learning model (Lestari et al., 2023). According to Gunarta (2019), Cooperative learning using the TGT model consists of a set of instructional approaches in which students collaborate in teams to reach shared learning objectives. The TGT model engages all students in various activities that reflect religious values, nationalism, independence, and collaboration. It also emphasizes the role of students as peer tutors while incorporating elements of play into the learning process (Pada & Amir, 2022). The advantage of this learning model is that the learning process emphasizes a form of "tournament." This tournament prepares students of all levels to have the courage to compete, collaborate, and develop the skills needed to compete. As a result, students are motivated to become more active, creative, and independent in the learning process (Sofyan, 2022). Therefore, if implemented, this model can enhance students' motivation and creativity in participating in classroom learning and interacting with other group members (In'am & Sutrisno, 2020). One approach that can be used is to utilize Team Games Tournament (TGT)-based games combined with truth or dare elements. Truth or dare cards serve as a learning tool featuring questions that require honest responses and tasks that challenge students to act boldly. Using truth or dare cards can encourage students to play an active role in the learning process (Amelya & Arini, 2024). previous studies have indicated that the use of the Truth or Dare game in the learning process is highly appropriate, as it can enhance both student learning outcomes and engagement during classroom activities (Fanny & Sakti, 2021).

Previous studies have reported the effectiveness of Truth or Dare-based learning media in enhancing student learning outcomes. Pramesti (2024) reported that the development of Truth or Dare media integrated with the TGT model on respiratory system material produced a high effectiveness, with an N-Gain score of 0.71 and learning mastery of 86.67 %. Rahayu (2019) reported that implementing Truth or Dare media on the excretory system resulted in a significant learning gain, with an average N-Gain of 0,8 (high category), and posttest mastery reaching 93.33 %, showing a substantial increase compared to the pretest. Fanny & Sakti (2021) reported that using Truth or Dare game-based media in economics subjects led to an N-Gain score of 0.71, 100 % effectiveness, and 98.2 % positive student responses, indicating the media's strong practicality and appeal. These findings support the integration of Truth or Dare media with cooperative learning models like TGT as a valid, practical, and highly effective approach to improve students' understanding and engagement across various subjects. Risqiyono & Setyasto (2025) denclare the digestive system material is considered complex and abstract, involving various organs, processes, and terminologies that are often difficult for students to understand through conventional teaching methods. Students frequently struggle to visualize the dynamic flow of digestion and relate it to daily life.

Therefore, the use of a cooperative learning model such as Team Games Tournament (TGT) is considered appropriate, as it promotes active participation, peer interaction, and team-based competition that increases engagement. Additionally, integrating TGT with a game-based media like Truth or Dare can further enhance motivation and focus. Previous studies have not found any research that specifically discusses the development of truth or dare learning media focused on improving learning outcomes in human digestive system material. Therefore, this opens up

opportunities to develop truth or dare cards for human digestive system material. The digestive system is quite difficult to understand because it requires memorizing the names of organs and enzymes involved, understanding multiple stages, and connecting the material to everyday life. Therefore, the use of educational media, such as truth or dare cards, is necessary to help address these challenges.

The creation of truth or dare learning media using the Team Games Tournament (TGT) approach is intended to help enhance students' understanding and performance in learning about the digestive system. This research seeks to evaluate how valid, practical, and effective the TGT-based truth or dare cards are when used in the classroom setting. This research contributes theoretically by supporting the implementation of game-based and student-centered learning approaches in biology education. Practically, it provides innovative and validated learning media that teachers can apply to improve student engagement and understanding, especially in abstract topics such as the human digestive system.

METHOD

Type of Research

The development method used is a type of Research and Development (RnD) research. Sugiyono (2017) The Research and Development (R&D) approach refers to a method used to create a particular product and assess how effective that product is in practice. This research is development research that aims to develop truth or dare game media. This research follows the 4D model introduced by Thiagarajan et al., (1974) which includes four main stages: 1) *define*, 2) *design*, 3) *develop*, and 4) *disseminate* .

Development Procedure

The development research stages of the 4D development model are described as follows:

Define

At this stage, the determination and determination of the various needs required in the learning media development process are carried out. This process is adjusted to the conditions and needs of class XI students at SMA Negeri 2 Percut Sei Tuan, so that the media developed is truly relevant and useful for them. This stage is carried out in five steps, namely: a) Initial-final analysis: at this stage, the potential and problems for developing the desired product are identified. b) Student analysis: this stage is carried out by distributing a questionnaire in the form of a student needs analysis containing various questions relevant to student problems. c) Material/concept analysis: this stage is determined by conducting interviews with biology teachers regarding which biology materials pose challenges and determining the content of the learning media to be developed. d) Task analysis: this stage aims to identify the skills and stages of task completion that students must master. The development of this learning media refers to the Competency Standards (SK) and learning outcomes in the Merdeka Curriculum. e) Formulation of learning objectives: this stage determines the indicators of learning outcomes based on the Ministry of Education, Culture,

Research, and Technology's attachment regarding learning outcomes and the flow of learning objectives as a reference for biology subjects when designing learning media.

Design

The design phase is implemented following the definition stage and focuses on planning and developing the structure of the learning media. This stage is carried out in four steps, namely: a) Test standard development, which is done by collecting the data and media needed for the learning media product. The data collected consists of materials and images that will be compiled to form a complete learning media. b) Media selection: next, determine the most appropriate media or combination of media to use and that suits the needs. This media selection also helps students achieve learning outcomes and learning objectives. c) Format selection: the truth or dare cards are designed using the Canva application, with the truth or dare cards measuring 7x10 cm and made from art cartoon paper, while the game guide and answer key also measure 7 x 10 cm. The cards use a combination of fonts, including Kapsalon for the "truth" and "dare" text, Merriweather for the card content and clues. The game guide and answers use a combination of fonts, including Sports World, Gagalin, and Bree Serif. The card packaging uses a combination of Kapsalon, Open Sans, and Archivo Black fonts. The color combination is purple for truth cards, red for dare cards, colorful for the game guide and answer key, and purple for the card packaging. d) Creating the initial design: the design stage includes each card being equipped with questions on the truth cards, challenges on the dare cards, and images. This initial design is called a Draft.

Development

The development stage, which is the stage for producing the product to be developed (Damayanti & Jayanti, 2024). The develop stage is the primary phase in producing the Truth or Dare learning media based on the Team Games Tournament (TGT) model that is ready to be tested. In this stage, validation was carried out by two expert validators: one material expert and one media expert. The validation process used expert validation questionnaires and assessment sheets covering indicators such as content feasibility, language clarity, media appearance, and alignment with learning objectives. Following the validation, the researcher received feedback regarding the content and design of the cards. The suggestions included revising question phrasing that contained implicit answers, correcting unclear instructional wording, and adjusting supporting images to be more representative of the digestive system material.

The researcher then revised the media based on the validation results and refined the design according to the validators' recommendations. A limited trial was then conducted involving 30 students from class XI-F at SMAN 2 Percut Sei Tuan. This trial was held over two learning sessions. During the trial, students were given the Truth or Dare media and engaged in learning activities using the TGT model. After the sessions, both students and the teacher were asked to fill out response questionnaires to evaluate the practicality of the media in terms of ease of use, student engagement, and relevance to the learning objectives. In addition, pretest and posttest assessments were administered to measure the effectiveness

of the media. The tests consisted of 20 multiple-choice questions that had been previously validated and were designed to assess cognitive levels C1 to C4 according to Bloom's taxonomy. The pretest and posttest results were analyzed using the N-Gain formula to determine the improvement in student learning outcomes after using the developed media.

Disseminate

The dissemination stage involves spreading the use of the developed product. In this study, the researchers disseminated the product on a limited basis to biology teachers and students at SMAN 2 Percut Sei Tuan.

Research Subjects

The subjects of this research included one material expert, one media expert, one biology teacher, and thirty students from class XI-F at SMAN 2 Percut Sei Tuan. The sampling technique used was purposive sampling, selecting individuals who were considered competent and relevant to the objectives of the study.

Instrument

The instruments used in this study consisted of six components: (1) teacher interview and classroom observation sheets, which were used in the initial stage to collect information about the learning process and student needs; (2) media expert validation sheets, which assessed the visual appearance, technical features, and overall design of the learning media; (3) material expert validation sheets, which evaluated the accuracy, relevance, and appropriateness of the content; (4) student response questionnaires and (5) teacher response questionnaires, both used to assess the practicality and attractiveness of the media based on users' experiences; and (6) pretest and posttest questions, which were designed to measure the effectiveness of the media in improving student learning outcomes. The pretest and posttest consisted of 20 multiple-choice questions, developed based on learning indicators and designed to assess students' cognitive abilities at levels C1 to C4 in the digestive system topic.

Data Collection Techniques

Data were collected through several techniques. Validation data were obtained from the assessment sheets completed by the media and material experts. Practicality data were collected through student and teacher response questionnaires after using the media in class. Effectiveness data were obtained from the administration of pretest and posttest questions given to students before and after learning using the developed media.

Data Analysis Techniques

Data collection and analysis techniques are carried out by assessing the extent to which truth or dare media on human digestive system material is valid, practical, and effective. This study uses a Likert scale assessment method, the details of which can be seen in the table 1.

Table 1. Validator rating scale, Source: (Nanda & Ulfa, 2024)

Description	Score
Very good	4
Good	3
Less	2
Not good	1

The data obtained was in the form of scores on a 1-4 Likert scale, based on criteria ranging from poor to excellent, and calculated the average of the three validators. The average value of the validation results that have been obtained is then further analyzed to determine the validity level of the truth or dare game card media. This analysis process is carried out by calculating the percentage of validity using a certain formula refers to (Nanda & Ulfa, 2024), so that it can be seen whether the media meets the criteria that are suitable for use in the learning process.

$$\%\ Media\ validity/Material = \frac{\Sigma\ score\ obtained}{\Sigma\ maximum\ score} \text{ x } 100 \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

Table 2. Media and Material Score Interpretation Criteria, Source: (Sugiyono, 2017)

Percentage (%)	Criteria
81-100%	Very feasible
61-80%	Feasible
41-60%	Enough feasible
21-40%	Less feasible
0-20%	Not feasible

Analysis of the practicality of Truth Or Dare cards can be seen based on the results of teacher and student responses regarding the assessment of learning media refers to (Pramesti, 2024), which can be seen in table 3.

$$S = \frac{\Sigma p}{\Sigma n} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

Description:
S = Score per aspect
ΣP = Total score per aspect
Σn = Number of student

Testing the effectiveness of Truth or Dare cards is done using an instrument in the form of a learning outcome test, which consists of a number of questions to measure the extent to which students master the material after using the learning media that has been developed. The level of effectiveness is calculated using the N-Gain formula refers to (Nanda & Ulfa, 2024), and the calculation results are interpreted based on the reference in Table 4.

Table 3. Criteria for practicality level, Source: (Sugiyono, 2017)

Percentage (%)	Criteria
81-100%	Very practical
61-80%	Practical
41-60%	Quite practical
21-40%	Not practical

$$N\ Gain = \frac{pretest\ score - postest\ score}{maximum\ value - pretest\ score} \text{ x } 100\ \% \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{ (3)}$$

Table 4. Criteria N-Gain, Source: (Sugiyono, 2017)

N-Gain	Criteria
g > 0.7	High
0.3 > g < 0.7	Currently
g < 0.3	Low

RESULT AND DISCUSSION

The results of research on truth or dare game-based media using Team Games Tournament (TGT) on human digestive system material for grade XI. The development of this media used the 4D model, which consists of four steps, namely:

Define Stage

The first stage is the definition stage. Initial analysis revealed that students faced difficulties in understanding biology lessons, particularly the human digestive system material. When biology teachers used PowerPoint presentations, educational videos, Quizizz, and Kahoot as primary learning media, students often felt bored with the overly serious learning approach. This became the basis for the researcher in developing a truth or dare card game based on the Team Game Tournament (TGT) model. TGT is a model that involves all students in activities that include religious, nationalistic, independent, and cooperative elements, as well as involving students as peer tutors with game-like elements.

In the next stage, researchers conducted a conceptual analysis, namely curriculum analysis and student needs analysis. The curriculum analysis was linked to the 2022 Ministry of Education, Culture, Research, and Technology regulation. Student needs analysis was reviewed in relation to the appropriateness of the learning media to be used by distributing a questionnaire in the form of a student needs analysis containing various relevant questions in accordance with the card media used in accordance with the Ministry of Education, Culture, Research, and Technology regulations for phase F of grade XI, which are in line with learning outcomes and learning objectives. In this case, the researcher chose the topic of the human digestive system.

In the next stage, the researcher formulated and established learning objectives. The curriculum and concepts were analyzed in accordance with the learning achievement indicators based on the appendix of Ministry of Education, Culture, Research, and Technology Regulation No. 08 of 2022 regarding learning achievements in biology as the basis for designing learning media. In class XI digestive system material, the learning outcomes are in phase F, where students are expected to be able to explain the structure of cells and important processes that occur in them, such as transportation through membranes and cell division. In addition, students are also asked to analyze the relationship between the structure and function of organs in the body system, as well as recognize disorders or abnormalities that can occur. They also need to understand the role of enzymes and metabolic processes in the body, apply the concepts of inheritance of traits, growth, and development, and be able to evaluate ideas about evolution and various innovations in the field of biological technology. Therefore, the researcher formulates several learning objectives that must be achieved, namely: 1) Students are able to identify the organs of the human digestive system and their functions. 2) Students are able to analyze the mechanical and chemical processes of digestion. 3) Students are able to explain the role of enzymes in the digestive system. 4) Students are able to connect dietary patterns with digestive system health.

Design Stage

The next stage of the design process involves preparing truth or dare learning cards using the Canva application. The design process consists of four stages, namely: 1) Development of Reference Tests. At this stage, the researcher collects key material on the digestive system, including the structure and function of organs, digestive enzymes, the process of food digestion, and disorders of the digestive system. In addition, representative images of digestive organs are collected to support students' visual understanding. This data forms the basis for compiling the content of the cards for both the Truth and Dare categories. 2) Selection of media: The chosen learning medium is a truth or dare card game developed using the Canva graphic design application. This medium was selected for its high flexibility in visualization, allowing the integration of images, icons, and colors, as well as ease of access for editing. The use of Canva also supports the production of visually appealing media, thereby increasing students' interest and participation in learning. 3) Font selection and media format are tailored to the characteristics of the material and student needs. Truth or dare cards are designed in a 7 x 10 cm size. Card designs are differentiated by type: truth cards are purple and dare cards are red. There are 15 truth cards and 15 dare cards.

The cards use a combination of fonts consisting of Kapsalon font for the truth and dare text, Merriweather font for the card content and clues. The game guide and answers use a combination of fonts consisting of Sports World, Gagalin, and Bree Serif. The card packaging uses a combination of Kapsalon, Open Sans, and Archivo Black fonts. The color combination is purple for truth cards, red for dare cards, colorful for the guide and answer keys, and purple for the card packaging. 4) The initial design of the cards includes interactive visual and text elements. On truth cards, knowledge- and understanding-based questions (C1–C4) are listed, along with a lightbulb icon as a clue and supporting images related to the question. On dare cards, challenges such

as simulating the digestive process, creating an organ diagram, or giving a mini-presentation are listed. Each card is designed to encourage active student engagement and support improved learning outcomes through fun, competitive activities.

Development Stage

The next stage is the development stage, where truth or dare card products begin to be developed after going through a validation process by two experts, namely media experts and material experts. Before this media was tested on students, the two validators provided some input, especially regarding the quality of the questions in the card. A summary of the suggestions and improvements made to the truth or dare card media is presented in Table 5.

Table 5. Recap of Truth Or Dare Card Suggestions and Improvements

Card contents before revision	Advice	Card contents after revision
1. In the instructions for truth card number 5, "One involves enzymes, the other involves physical movement."	The instructions should not contain the answers directly.	Both processes occur in the mouth, but they work differently.
2. Section 10 of the truth card instructions: "This medicine neutralizes stomach acid."	Neutralizing stomach acid is indeed how antacids work. Try changing the instructions, for example, to "this medicine works in the stomach, where stomach acid is produced."	This medicine works in the stomach, where stomach acid production is high.
3. The clue on truth card number 12 is "this process involves the absorption of air."	Feces are formed due to the absorption of water, not air. Change the other instructions.	This organ is the last stop before food waste is discarded.
4. On card number 11, it says, "Congratulations, you are a good bacterium! Invite your friends to be bad bacteria and debate which one is more useful!"	Of course, good bacteria are more useful. Try replacing the word "useful" with	Congratulations, you are playing the role of bacteria in the intestines! You are a good bacterium, and choose one of your friends from another group who is a bad bacterium. Discuss each other's roles and how they can affect the digestive system!

Table 6 shows that the content of the media regarding the human digestive system obtained a minimum score of 87.5 % for the presentation aspect criterion. Meanwhile, two criteria obtained a maximum score of 100 %. Based on the results of the validation, the overall validity percentage of the content in the media was 98 %, which means that it is highly valid and suitable for testing. After that, media experts

assessed the truth or dare card media developed with the Team Games Tournament (TGT) approach to ensure that the media was suitable for use. This assessment aims to check whether the media is appropriate in terms of appearance and function. The results of validation from media experts and material experts are shown in Tables 6 and 7.

Table 6. Validation Test Results

No	Assessment Criteria	Score Obtained	Maximum Score	Percentage (%)	Criteria
1.	Suitability of material content on the card	20	20	100	Very valid
2.	Accuracy of the material	20	20	100	Very valid
3.	Linguistics	4	4	100	Very valid
4.	Presentation aspect	7	8	87.5	Very valid
	Score Obtained		**51**		
	Maximum Score		**52**		
	Percentage		**98 %**		
	Criteria		**Very valid**		

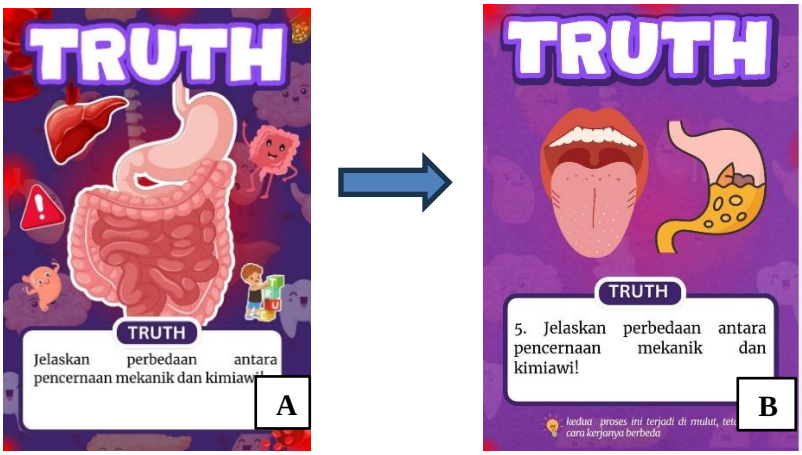

Figure 1. The appearance of the back of the truth card before (A) and after (B) revision in accordance with media expert advice.

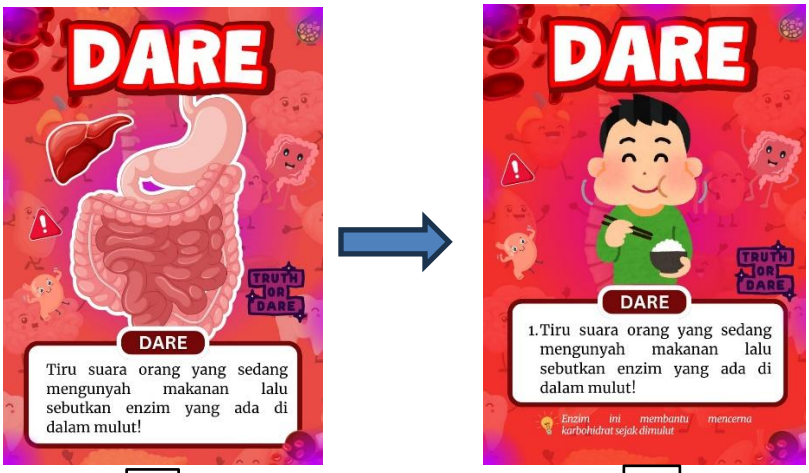

Figure 2. The appearance of the back of the dare card before (A) and after (B) revision in accordance with media expert advice.

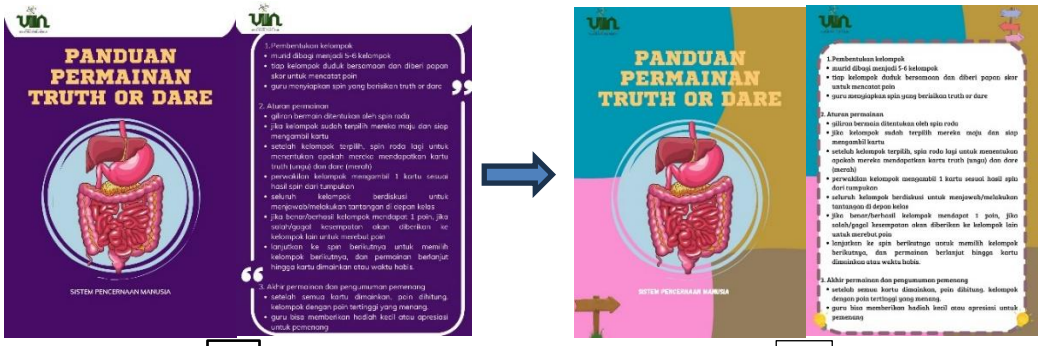

Figure 3. Display of part of the game guide before (A) and after (B) revision in accordance with media expert advice.

Figure 4. Display of part of the answer key before (A) and after (B) revision in accordance with media expert advice.

Figure 5. Appearance of the packaging before (A) and after (B) revision in accordance with media expert recommendations

Media experts revised the appearance of the truth and dare cards based on Figures 1(A), 1(B), 2(A), and 2(B) to add answer clues from the questions on the cards, and the images on the back of the cards were adjusted to match the content inside the cards so that students could get clues to answer the questions. In Figures 3(A) 3(B) and 4(A) 4(B), the font size and color of the answer keys were improved, as their appearance was too monotonous, resembling answer keys in textbooks. For the questions in the answer keys, there is no need to rewrite them, so the appearance is improved by using different colors for each number and adding a light symbol for the truth card answers. In Figure 5(A), the card packaging design does not include an institutional logo, and in Figure 5(B), the media expert suggests adding an institutional logo.

Table 7. Media Expert Validation Test Results

No.	Assessment criteria	Score Obtained	Maximum Score	Percentage (%)	Criteria
1.	Card size	4	4	100	Very valid
2.	Proportionality of design	18	20	90	Very valid
3.	Selection of fonts	35	48	72.9	Valid
4.	Presentation aspect	12	12	100	Very valid
Score Obtained			**69**		
Maximum Score			**84**		
Percentage			**82.1**		
Criteria			**Very valid**		

Based on table 7, the validation results from two expert validators, the Truth or Dare card media based on the TGT model was categorized as highly feasible, with an average score of 82.1 % from the media expert and 98 % from the material expert. The highest-rated aspects from the media expert were visual design and text readability, while the material expert emphasized content accuracy and alignment with the learning objectives. These results indicate that the media meets the criteria of both content and technical feasibility. This is in line with Arsyad (2019), who emphasized

that effective learning media should be visually engaging and supportive of conceptual understanding.

Table 8. Practicality Test Results Based on Teacher Response Questionnaire

No	Assessment Criteria	Score Obtained	Maximum Score	Percentase (%)	Criteria
1.	Content Appropriateness	28	28	100	Very practical
2.	Motivating Learners	10	12	83.3	Very practical
3.	Presentation	27	28	96.4	Very practical
	Score Obtained		**65**		
	Maximum Score		**68**		
	Percentage		**95.5**		
	Criteria		**Very practical**		

Table 9. Practicality Test Results Based on Students Response Questionnaire

Number of Respondents Obtained	Maximum Score	Percentage (%)	Criteria
1122	1240	90.4	**Very Practical**

The practicality of the truth or dare card learning media was obtained from the results of teacher response questionnaires and student response questionnaires with statements and responses to evaluate the developed truth or dare cards. This stage was carried out after expert validators validated the truth or dare cards. The data obtained from the Biology teacher at SMAN 2 Percut Sei Tuan, as shown in Table 8, teacher and student responses also indicated that the media was highly practical. The teacher practicality score averaged 95.5 %, while the student score was 90.4 %. Teachers stated that the media was easy to use, enjoyable, and aligned with the subject matter. Students felt more motivated and interested in learning through interactive and game-based activities. These findings are supported by Rahayu (2019), who state that game-based learning media increased student engagement and classroom participation.

Table 10. Effectiveness Test Results Based on N-Gain

Pretest average	Posttest average	N-Gain Score	Percentage (%)	Criteria
36.45	84.83	0.76	76	**High**

The effectiveness of the media was assessed through pretest and posttest scores. The average pretest score was 36.45, which increased to 84.83 in the posttest. The calculated N-Gain score was 0.76, categorized as high. This indicates that the use of the media significantly improved students' learning outcomes. This finding is consistent with Pramesti (2024), who also reported high learning gains through the use of TGT-based Truth or Dare media. This approach is also consistent with

constructivist learning theory, which highlights the significance of students' active participation during the learning process. This finding is in line with research conducted by Sya'adah et al., (2023), which found that the use of the Team Games Tournament model assisted by question cards was more effective in improving students' interest and learning outcomes than conventional learning models.The student-centered learning approach is considered capable of encouraging students to think more actively and explore ideas, so that their knowledge develops more optimally (Simanjuntak & Sudibjo, 2019).

In addition, the significant improvement in learning outcomes after the implementation of the Truth or Dare card-based TGT media shows that innovative and enjoyable learning methods can be a solution to classic problems in biology learning, such as lack of student interest, low classroom interaction, and difficulty in understanding abstract concepts. This finding is also supported by the study conducted by Erbil (2020), who emphasized that cooperative learning models such as TGT are closely related to Vygotsky's *Zone of Proximal Development* (ZPD) theory. In cooperative learning, students who have difficulty understanding content can benefit from social interaction and peer guidance. This process serves as *scaffolding*, a form of temporary support that enables students to move from their current level of ability to their potential development.

Therefore, collaboration in the TGT model fosters a social learning environment that enhances students' cognitive development. This media not only succeeded in improving students' absorption of digestive system material but also provided a more contextual and collaborative learning experience. Hui & Mahmud (2023) in his systematic review emphasizes that game-based learning strategies have a significant impact on students' cognitive and affective domains. This is highly relevant to the findings of this study, where students not only demonstrated improved academic performance but also showed greater enthusiasm, collaboration, and self-confidence in participating in the learning process. Thus, this medium contributes to holistic learning outcomes. In the context of the constructivist approach, Gui et al., (2023) state that appropriately designed educational games encourage students to actively engage in the learning process and train their critical thinking and problem-solving skills.

The TGT model implemented through Truth or Dare cards creates a learning environment rich in interaction and exploration, encouraging students to build their own knowledge through meaningful play experiences. From an affective perspective, Ling & Aziz (2022) state that the TGT strategy also has a positive impact on student motivation and retention. This aligns with the findings of this study, which show that students are more interested and engaged in learning when the Truth or Dare media is used compared to conventional media such as PowerPoint presentations or standard educational videos. Student participation in games and tournaments creates a fun and competitive learning atmosphere while remaining educational. Based on the integration of research findings and theory, it can be concluded that the use of Truth or Dare card-based TGT media is highly effective in improving learning outcomes as it simultaneously engages cognitive, affective, and social dimensions. These results align with global trends in educational innovation emphasizing the importance of active, collaborative, and game-based learning in creating relevant and enjoyable

learning experiences for 21st-century students.

The results of this study also reinforce Pramesti (2024) findings that game-based media can create a more active and conducive learning environment. With the elements of competition and collaboration in the TGT model, students are more motivated to prepare themselves, understand the material, and actively engage in learning activities. This is reflected in the significant increase in posttest scores compared to pretest scores, as well as N-Gain scores that fall into the high category. These scores indicate that the media has high effectiveness in enhancing students' meaningful mastery of concepts, not merely rote memorization. Beyond cognitive aspects, this media also contributes to the development of students' social and communication skills. When students work in groups and interact through games, they learn to listen, respect others' opinions, and make decisions together. Character values such as cooperation, sportsmanship, responsibility, and courage are also formed during the tournament process. This is an important point in strengthening the Pancasila Student Profile in 21st-century learning, which emphasizes the development of soft skills and positive attitudes in the educational process.

Furthermore, the use of this medium has also proven to assist teachers in managing the classroom more dynamically. Teachers no longer merely act as content deliverers but also as facilitators and guides in the process of student discussion and reflection. This aligns with the learning approach in the Merdeka Curriculum, which prioritizes differentiated and participatory learning. This study has certain limitations, as it was conducted in a single school and focused only on one biology topic, namely the digestive system. Therefore, the generalizability of the findings is limited to the specific context and characteristics of the sample used. Moreover, the implementation was restricted to one class with a relatively small number of participants. Future research is recommended to expand the scope to other schools and topics in biology to examine the consistency of the media's effectiveness across different learning contexts.

CONCLUSION

The results of this study not only show that TGT-based Truth or Dare card media are effective in improving student learning outcomes in the digestive system material, but also demonstrate that interactive and engaging learning models can serve as an effective strategy for fostering meaningful, student-centered learning aligned with current curriculum demands. This media was developed using the 4D model (Define, Design, Develop, Disseminate) and has undergone validation by both subject matter and media experts, with very high validity results of 98 % and 82,1 % respectively. In terms of practicality, it received highly positive responses from teachers (95,5 %) and students (90,4 %), indicating that the media is highly practical. The effectiveness test using the N-Gain formula showed a significant increase in learning outcomes, with a gain score of 0,76 (categorized as high). This suggests that the media can enhance students' conceptual understanding, especially in abstract topics such as the digestive system. Furthermore, this study contributes theoretically by strengthening the application of Vygotsky's social constructivist theory, particularly the *Zone of Proximal Development*, through cooperative, game-based learning models like TGT that promote

peer interaction and scaffolding. Practically, this research provides teachers with an innovative and enjoyable instructional alternative to improve student motivation and learning outcomes in biology. It also supports the realization of the Pancasila Student Profile by fostering collaboration, critical thinking, and joyful learning. Therefore, the TGT-based Truth or Dare card media is recommended for broader implementation in senior high school biology instruction.

ACKNOWLEDGMENTS

The author would like to express sincere gratitude to Miza Nina Adlini, M.Pd. as the material expert validator, Dini Anissha, M.Pd. as the media expert validator, and Dr. Mhd. Rafi'i Ma'arif Tarigan, M.Pd. as the learning outcomes test validator, for their contributions and suggestions during the validation process of the learning media. Special thanks are also extended to Ms. Andriani, S.Pd., the Biology teacher, and all students of class XI-F at SMAN 2 Percut Sei Tuan for their participation and support during the feasibility testing of the Truth or Dare card media. The author also appreciates all parties who have provided moral and technical support in the completion of this study.

REFERENCES

Amelya, R., & Arini, N. W. (2024). Development of Truth or Dare Card Media to Improve Student Understanding of 6th Grade Citizenship Education Learning Pancasila Material. *Jurnal Pendidikan dan Pembelajaran*, 22(2), 186–197

Arsyad, A. (2019). *Learning Media.* Revise Edition. Jakarta: PT Raja Grafindo Persada. **[*In Indonesian language*]**

Catenazzi, N., Sommaruga, L., De Angelis, K., & Caboni, S. (2025). Innovative Technologies In Applied Science Education. *Computers and Education Open*, 100248. https://doi.org/10.1016/j.caeo.2025.100248

Damayanti, A., & Dwi jayanti, U. N. A. (2024). Development of biology smart card learning media based on character education in immune system material. *BIO-INOVED : Jurnal Biologi-Inovasi Pendidikan*, *6*(2), 179. https://doi.org/10.20527/bino.v6i2.19155

Daryanes, F., Darmadi, D., Fikri, K., Sayuti, I., Rusandi, M. A., & Situmorang, D. D. B. (2023). The development of articulate storyline interactive learning media based on case methods to train student's problem-solving ability. *Heliyon*, *9*(4), e15082. https://doi.org/10.1016/j.heliyon.2023.e15082

Erbil, D. G. (2020). A Review of Flipped Classroom and Cooperative Learning Method Within the Context of Vygotsky Theory. *Frontiers in Psychology*, *11*(June), 1–9. https://doi.org/10.3389/fpsyg.2020.01157

Fanny, C. D. A., & Sakti, N. C. (2021). Development of Truth and Dare Game Learning Media to Improve Student Learning Outcomes. *Edunomic Jurnal Pendidikan Ekonomi*, *9*(2), 108-117. https://doi.org/10.33603/ejpe.v9i2.5074 **[*In*

Indonesian language]

Faradilla, M. (2024). Implementing The Teams Games Tournament Cooperative Learning Model To Enhance Student Learning Outcomes On Diversity Is Beautiful. *Jurnal Pendidikan dan Ilmu Sosial*, 1(2), 95–102.

Gui, Y., Cai, Z., Yang, Y., Kong, L., Fan, X., & Tai, R. H. (2023). Effectiveness of digital educational game and game design in STEM learning: a meta-analytic review. *International Journal of STEM Education*, *10*(1). https://doi.org/10.1186/s40594-023-00424-9

Gunarta, I. G. (2019). The Effect of the TGT Learning Model Assisted by Question Cards on Science Learning Outcomes. *Jurnal Pedagogi Dan Pembelajaran*, *1*(2), 112. https://doi.org/10.23887/jp2.v1i2.19338 **[*In Indonesian language*]**

Hui, H. B., & Mahmud, M. S. (2023). Influence of game-based learning in mathematics education on the students. *Frontiers in Psychology*, 14, 1105806. https://doi.org/10.3389/fpsyg.2023.1105806

In'am, A., & Sutrisno, E. S. (2020). Strengthening Students' Self-efficacy and Motivation in Learning Mathematics through the Cooperative Learning Model. *International Journal of Instruction*, *14*(1), 395–410. https://doi.org/10.29333/IJI.2021.14123A **[*In Indonesian language*]**

Karlina, L., Nugraha, A., & Merliana, A. (2023). Development of Truth Or Dare Card Media For Fifth Grade Ecosystem Material at SDN 2 Sukaraja. *COLLASE (Creative of Learning Students Elementary Education)*, *6*(6), 1021–1027. https://doi.org/10.22460/collase.v6i6.18838 **[*In Indonesian language*]**

Lestari, P. T., Sudibyo, E., Aulia, V. (2023). Application of the Teams Games Tournament learning model to improve student learning outcomes. *Pensa: E-Jurnal Pendidikan Sains*, 11(1), 16–21. https://ejournal.unesa.ac.id/index.php/pensa **[*In Indonesian language*]**

Ling, N. S., & Aziz, A. A. (2022). The Effectiveness of Game-based Learning Strategies on Primary ESL Learners' Vocabulary Learning. *International Journal of Academic Research in Progressive Education and Development*, *11*(2). https://doi.org/10.6007/ijarped/v11-i2/13266

Nanda, A. A., & Ulfa, S. W. (2024). Development of videoscribe-based learning media for biodiversity material with the environmental potential of Rahmat Zoo and Park A . Introduction. *BIO-INOVED: Jurnal Biologi-Inovasi Pendidikan*. *6*(3), 331–341.

Nurindah, N., Afiif, A., Syahriani, S., & Syamsul, S. (2022). Development of Digestive System Media in Humans Using Recycled Materials in Class XI at State Senior High School 2 Gowa. *BIOEDUKASI (Jurnal Pendidikan Biologi)*, *13*(1), 35. https://doi.org/10.24127/bioedukasi.v13i1.5302 **[*In Indonesian language*]**

Pada, A., & Faizal Amir, F. (2022). Elevating Social Sciences Learning Outcomes: TGT Type Cooperative Learning Model. *Jurnal Ilmiah Sekolah Dasar*, *6*(4), 620–

626. https://doi.org/10.23887/jisd.v6i4.54046

Permana, E. P., & Nourmavita, D. (2017). Development of Interactive Multimedia for Science Subjects Describing the Life Cycle of Animals in the Environment Surrounding Fourth Grade Elementary School Students. *Jurnal PGSD*, *10*(2), 79–85. https://doi.org/10.33369/pgsd.10.2.79-85 **[*In Indonesian language*]**

Pramesti, H. P. (2024). Development of TGT-based Truth or Dare Media To Improve Learning Outcomes In Respiratory System Material. *BioEdu: Jurnal Pendidikan Biologi*, 12(1). https://ejournal.unesa.ac.id/index.php/bioedu **[*In Indonesian language*]**

Rahayu, D. (2019). The use of Truth or Dare games in Human Excretion Material To Improve Student Learning Outcomes at SMP Negeri 3 Sidoarjo *Pensa: Jurnal Pendidikan Sains*, 7(1), 6–10. **[*In Indonesian language*]**

Rahmi, S. N., & Yogica, R. (2021). Truth or Dare Play (TODP) Card Game Media on Virus Material. *Jurnal Penelitian Dan Pengembangan Pendidikan*, *5*(3), 399. https://doi.org/10.23887/jppp.v5i3.38995 **[*In Indonesian language*]**

Risqiyono, M. W. A., & Setyasto, N. (2025). Development of E-Learning Materials Assisted by Augmented Reality on Human Digestive System Material to Improve Elementary School Students' Learning Outcomes. *Jurnal Penelitian Pendidikan IPA*, *11*(1), 244–256. https://doi.org/10.29303/jppipa.v11i1.10229

Sari, S. M., & Adlini, M. N. (2024). Biology e-magazine integrated on wahdatul ' ulum : Learning media on reproductive system material A . Introduction. B*IO-INOVED: Jurnal Biologi-Inovasi Pendidikan*. *6*(2), 137–145.

Simanjuntak, M. F., & Sudibjo, N. (2019). Improving Students' Critical Thinking Skills and Problem-Solving Abilities Through Problem-Based Learning. *JOHME: Journal of Holistic Mathematics Education*, *2*(2), 108. https://doi.org/10.19166/johme.v2i2.1331 **[*In Indonesian language*]**

Sofyan, E. (2022). Application of the Cooperative Learning Model Type Teams Games Tournament to Improve Biology Learning Outcomes. *SCIENCE : Jurnal Inovasi Pendidikan Matematika Dan IPA*, *2*(2), 227–237. https://doi.org/10.51878/science.v2i2.1270 **[*In Indonesian language*]**

Sugiyono. (2017). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Penerbit Alfabeta. **[*In Indonesian language*]**

Sya'adah, U., Sutrisno, S., & Happy, N. (2023). The Effectiveness of the Teams Games Tournament (TGT) Learning Model Assisted by Question Cards on Student Interest and Learning Outcomes. *AKSIOMA : Jurnal Matematika Dan Pendidikan Matematika*, *14*(2), 147–158. https://doi.org/10.26877/aks.v14i2.15073 **[*In Indonesian language*]**

Thiagarajan, S., Semmel, D.S. & Semmel, M.I.. (1974). *Intructional Development For Training Teachers Of Exceptional Children*. Washington, D.C : National Center for Improvement of Educational System.

Wicaksono, D., & Iswan. (2019). Efforts to Improve Student Learning Outcomes Through the Application of Problem-Based Learning Models in Grade IV at Muhammadiyah 12 Pamulang Elementary School, Banten. *HOLISTIKA: Jurnal Ilmiah PGSD*, *3*(2), 111–126. **[*In Indonesian language*]**

How To Cite This Article, with *APA style* :

Kinanti, A. A., & Manalu, K. (2025). Development of '*Truth or Dare*' Team Games Tournament-Based Biology Media for Teaching Digestive System in Senior High School. *Jurnal Pembelajaran dan Biologi Nukleus*, *11*(2), 657-676. https://doi.org/10.36987/jpbn.v11i2.7635

Conflict of interest : The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Author contributions : All authors contributed to the study's conception and design. Material preparation, data collection and analysis were performed by all authors. The first draft of the manuscript was submited by [**Aulia Andin Kinanti**]. All authors contributed on previous version and revisions process of the manuscript. All authors read and approved the final manuscript.