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Development of Digestive Ludo Learning Media to Improve Student Learning Outcomes

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Abstract

The learning process in the classroom often causes boredom in students, which has an impact on low student learning outcomes; this is evident from the results of initial observations at elementary schools in Cluster II, Jembrana District, which showed that the learning outcomes of IPAS for grade V students were still low. The purpose of this study was to develop Ludo learning media in learning IPAS on the human digestive system in grade V elementary schools, to analyze the feasibility and effectiveness of ludo digestion learning media to improve the learning outcomes of IPAS for grade V elementary school students. This study used the research and development (R&D) method with the ADDIE model. The data collection techniques used were interview, observation, questionnaire, test, and documentation. The validation results of the ludo digestion learning media were considered very feasible, with an average percentage of 97.92% in the material validation test and 92.50% in the media validation test. The ludo digestion learning media is also effective in improving the learning outcomes of IPAS for grade V elementary school students, as reviewed by a 2-tailed significance value of 0.000 and an n-gain value of 0.73. Based on these results, it can be concluded that the digestive Ludo learning media is feasible and effective for improving student learning outcomes in IPAS learning for grade V on the human digestive system material at elementary schools in Cluster II, Jembrana District.

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INTRODUCTION

Learning media plays a crucial role in creating a quality learning process. Arsyad (2014) argues that learning media can clarify the information to be conveyed, facilitating the learning process and improving learning outcomes. According to Febrita and Ulfah (2019), learning media is anything that can be used as a channel for messages or information so that educators can condition students in the learning process.

Supporting the same view, Mustaqim (2016) said that learning media is an intermediary used in the learning process to connect and channel messages from educators to students so that an effective and efficient learning process occurs. In line with this view, Wahyu et al. (2020) said that the use of learning media can provide explanatory emphasis on parts of the material that are considered important, clarify learning messages or information, present variations in learning, help present a clearer learning structure, and can motivate students in the learning process. Meanwhile, according to Firmadani (2020), learning media is any form of aid used to present certain facts, concepts, principles, or procedures to appear more concrete and real. This view shows that the presence of learning media in the learning process is very important.

The learning media applied in the learning process should meet the characteristics of elementary school students and facilitate students being directly involved in learning activities based on hands-on activity. Hands-on activity is a model designed to involve students directly in searching for information, finding and doing activities, collecting data, analyzing, and making conclusions (Wulandari et al., 2015). According to Kholiq et al. (2017), applying hands-on activity in the learning process can help improve students' problem-solving skills. Supporting this view, Tadris et al. (2017) said that hands-on activity is useful for increasing interest and motivation in learning, strengthening memory, overcoming learning difficulties, avoiding misunderstandings, and stimulating students' critical thinking skills. In line with this view, Putri and Ulya (2023) stated that applying hands-on activity in the learning process can increase student motivation and learning outcomes. Several of these opinions indicate that applying hands-on activity in the learning process can positively impact students' ability to understand material and improve student learning outcomes.

Educational games are one of the learning media based on hands-on activity. Educational games are learning media that combine learning activities and playing activities and can stimulate users to gain knowledge (Yulianti & Ekohariani, 2020). According to Pradana and Nita (2019), educational games are a means of student entertainment that contains educational content to facilitate the delivery of learning materials to students. In line with this opinion, Hikmah et al. (2023) stated that educational games have educational elements and are used to convey learning information.

Supporting this opinion, Wahyudi et al. (2017) said that educational games are designed to teach someone about a specific object and certain skills. Meanwhile, according to Windawati and Koeswanti (2021), educational games aim to increase students' interest in learning through a combination of playing and learning activities to create a feeling of pleasure in the learning process. Several opinions have been presented to explain that educational games combine playing and learning activities to foster a sense of pleasure in the learning process, making delivering learning materials easier.

Educational games can be a solution to the problems obtained during observation activities carried out on 14 December 2023 at SDN 2 Dauhwaru, then on 4 May 2024 at SDN 5 Dauhwaru, and on 20 May 2024 at SDN 1 Dauhwaru, Jembrana Regency, Bali Province, which showed that the learning outcomes of natural and social sciences (IPAS) of grade V students were still low. The results of this observation are the results of learning IPAS of grade V students at SDN 1 Dauhwaru in the end-of-semester summative activities, which obtained an average score of 55, and as many as 53.3% of students obtained scores below 60. Meanwhile, the results of learning IPAS of grade V students

at SDN 2 Dauhwaru in the end-of-semester summative activities showed an average score of 46.2, and as many as 64.2% of students obtained scores below 60. The results of learning IPAS of grade V students at SDN 5 Dauhwaru also showed the same thing that the results of learning IPAS of students were still low as viewed from the end-of-semester summative scores, which obtained an average score of 54.6 and as many as 52.6% of students obtained scores below 60.

These results indicate that students need help understanding learning, so various efforts must be made to overcome this problem. One effort that can be made is to develop learning media in the form of educational games appropriate to the characteristics of elementary school students so that students can understand the material and be directly involved in fun learning activities. Educational games that can be used as learning media to improve student learning outcomes in the context of IPAS learning in elementary schools are ludo games. According to Awalina et al. (2022), the ludo game has existed since the 6th century and originated in India with another name, pachisi. Ludo media is a game on a square-shaped board with equilateral sides, usually played by 2-4 players (Ulfa et al., 2022). In line with this view, Angguntari and Nugraha (2019) said that ludo media is a game that uses a racing system, is played by 2 to 4 players and has four colour sections, where each colour represents one player. Supporting this view, Jihan et al. (2019) argue that Ludo is a derivative of pachisi, namely a game using a racing system and consisting of 2 to 4 players; each player must be able to set their strategy to compete to move their pieces based on the value of the dice that appear until they achieve victory.

According to Sanjiwani et al. (2022), Ludo media can increase students' focus on following the learning process, give rise to students' initiative to seek knowledge on their own, attract interest in learning, and improve learning outcomes. Supporting this view, Siti et al. (2021) said that the advantages of Ludo media are that it can activate students to think critically because this game requires precision. Through the Ludo game, students have a sense of responsibility to complete tasks that arise when playing Ludo.

The above view shows that ludo media is a type of game in the form of an equilateral square with 2 to 4 players and implements a competition system that requires players to complete their tasks to move pieces from start to finish. Learning media in the form of ludo games can also attract interest and motivation to learn, activate students, and improve student learning outcomes. This view is by several previous studies, such as research conducted by Anggreini and Dewi (2020), Voliani (2021), and Jihan et al. (2019), which state that ludo learning media can be used to improve conceptual understanding, student activity, student learning outcomes, and student learning motivation.

The empirical studies that have been presented in succession focus on studying the development of Ludo media with a focus on the excretory system material in class VIII, studying the development of Ludo media with a focus on the solar system material in class VI of elementary school, and studying the development of Ludo media with a focus on the theme of always saving energy in class IV of elementary school, while this research and development will develop Ludo learning media that focuses on the human digestive system material in IPAS learning in class V of elementary school.

The purpose of this research and development is to develop a ludo learning media that focuses on the material of the human digestive system in learning IPAS in grade V of elementary school, analyzing the feasibility and effectiveness of the digestive Ludo learning media to improve the learning outcomes of IPAS of grade V students in elementary schools in Cluster II, Jembrana District. The benefits of this research and development are to make it easier for students to understand the concept and material of the human digestive system with learning media that provide students with space to be directly involved in the learning process and to improve student learning outcomes optimally in learning IPAS in grade V of elementary school on the material of the human digestive system.

METHOD

This study uses the research and development (R&D) research method by applying the ADDIE research model. According to Hayyuningtyas and Batubara (2021), the ADDIE model has 5 stages, namely analysis, design, development, implementation, and evaluation. The ADDIE research stages can also be seen in Figure 1.

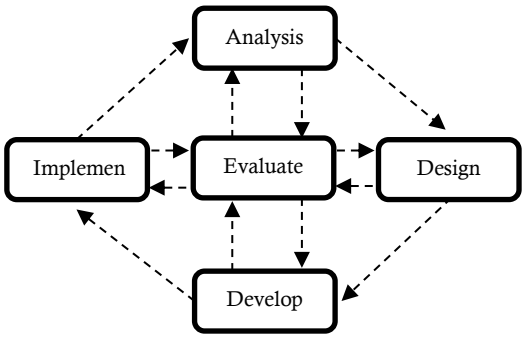

Figure 1. ADDIE Development Model

The dotted arrows on the ADDIE model chart indicate a feedback cycle or evaluation process that can lead back to previous stages for revision or improvement. The ADDIE model places an evaluation stage at each stage so that revision or improvement is more focused. This research was conducted in elementary schools in Cluster II, Jembrana District, consisting of SDN 1 Dauhwaru, SDN 2 Dauhwaru, and SDN 5 Dauhwaru. The subjects of this study consisted of small-scale and large-scale groups. The subjects in the small scale involved seven students of SDN 5 Dauhwaru, while the subjects in the large scale involved 11 students of SDN 1 Dauhwaru and 13 students of SDN 2 Dauhwaru so the total number of students who were the subjects of the large-scale study was 24 students.

The data collection techniques used in this research and development are interview techniques, observation techniques, questionnaire techniques, test techniques, and documentation techniques. The data collection instruments used in this research and development include interview guidelines, observation sheets, documentation, teacher and student needs questionnaires, material expert and media expert validation sheets, teacher and student response questionnaires, and pretest and posttest questions.

Product Feasibility Analysis

The feasibility of the product development in the form of digestive Ludo learning media to improve the learning outcomes of IPAS of grade V students at elementary schools in Cluster II, Jembrana District, is seen from the results of media and material validation tests with the following assessment criteria.

a) Maximum score percentage: 100%
b) Minimum score percentage: 25%
c) Determining the range: 100-25 = 75
d) The number of interval classes required is 5 (Highly Feasible, Feasible, Moderately Feasible, Less Feasible, and Not Feasible)
e) Determining the length of the interval class:
   Ji = (t - r) / Jk
   Description:
   Ji : interval distance
   t : maximum score
   r : minimum score
   Jk : number of interval classes
   Therefore, Ji = 75/5 = 15

Based on the calculations above, the assessment criteria for media and material validation tests are presented in Table 1.

Table 1. Product Eligibility Criteria

Percentage (%)	Criteria
$85 < x \leq 100$	Highly Feasible
$70 < x \leq 85$	Feasible
$55 < x \leq 70$	Moderately Feasible
$40 < x \leq 55$	Less Feasible
$25 < x \leq 40$	Not Feasible

Analysis of Teacher and Student Response Questionnaires

The questionnaire of teacher and student responses to the digestive Ludo learning media was given to teachers and seven students who participated in the small-scale trial. The results of teacher and student responses were analyzed using the assessment criteria determined as follows.

a) Maximum score percentage: 100%
b) Minimum score percentage: 0%
c) Determining the range: 100-0 = 100
d) The number of interval classes required is 5 (Highly Feasible, Feasible, Moderately Feasible, Less Feasible, and Not Feasible)
e) Determining the length of the interval class:
   Ji = (t - r) / Jk
   Description:
   Ji : interval distance
   t : maximum score
   r : minimum score
   Jk : number of interval classes
   Therefore, Ji = 100/5 = 20

Based on the calculations above, the assessment criteria for teacher and student responses are presented in Table 2.

Table 2. Teacher and Student Response Criteria

Percentage (%)	Criteria
$80 < x \leq 100$	Highly Feasible
$60 < x \leq 80$	Feasible
$40 < x \leq 60$	Moderately Feasible
$20 < x \leq 40$	Less Feasible
$0 < x \leq 20$	Not Feasible

Analysis of the Effectiveness of Implementing Ludo Digestive Learning Media

The effectiveness of the digestive ludo learning media is seen based on the results of the pretest and posttest, which are analyzed with a series of tests, including normality tests, paired t-tests, and n-gain tests. Normality tests are carried out to determine the condition of the data and whether the data obtained is normally distributed or not. The normality test in this study was carried out using the Shapiro-Wilk test through the SPSS version 25 application. Decisions are taken at a significance level of 5%, meaning that the data is normally distributed if the significance value is ≥ 0.05, but if the significance value is <0.05, then the data is not normally distributed. Data that has been declared normally distributed will then be analyzed using the paired t-test.

The paired t-test was conducted to determine the difference in the average between two related samples. The paired t-test was conducted with the help of the SPSS version 25 application. The decision was taken at a significance level of 5%, meaning that if the significance value is > 0.05, there is no significant difference between the pretest and posttest values in the application of the digestive ludo learning media, but if the significance value is ≤ 0.05, there is a significant difference between the pretest and posttest values in the application of the digestive ludo learning media. After conducting the paired t-test, the next test that needs to be done is the n-gain test.

The n-gain test was conducted so that researchers could find out how high the increase in student learning outcomes was after the application of the digestive ludo learning media. The gain used in this research and development is the normalized gain (N-Gain). The process of calculating n-gain in this study was carried out using the help of the Microsoft Excel application with the following formula.

$$\langle g \rangle = \frac{\langle \text{Posttest score} \rangle - \langle \text{Pretest score} \rangle}{\langle \text{Total Maximum score} \rangle - \langle \text{Pretest score} \rangle}$$

The decision to improve student learning outcomes is reviewed based on the criteria according to Sapitri et al. (2016) which are presented in Table 3.

Table 3. N-Gain Test Criteria

N-Gain	Criteria
$\langle g \rangle \geq 0.70$	High
$0.30 < \langle g \rangle < 0.70$	Medium
$\langle g \rangle \leq 0.30$	Low

RESULTS AND DISCUSSION

Analyze Phase

The analysis stage in this study was carried out by analyzing the problems that exist in schools by means of observation and interviews with class V homeroom teachers, analyzing the needs of teachers and students by using student needs questionnaires and teacher needs questionnaires, and analyzing several libraries related to the problems found when conducting observations and interviews at schools.

The results of observations and interviews at elementary schools in Cluster II, Jembrana

District, consisting of SDN 1 Dauhwaru, SDN 2 Dauhwaru, and SDN 5 Dauhwaru, show that students' learning outcomes in IPAS are still relatively low and there is a lack of learning media that can support students' learning processes, especially in IPAS subjects. The results of observations and interviews that have been presented indicate that efforts are needed to improve students' understanding so that student learning outcomes can improve. One effort that can be made is to develop ludo learning media.

Ludo media was chosen based on the literature study conducted by the researcher. The researcher analyzed 15 scientific articles related to the Ludo game. The researcher also analyzed the needs required to develop learning media by using teacher and student needs questionnaires as research instruments. The results of the teacher need analysis show that teachers need game-based learning media in physical form, attractive and effective, and have bright and harmonious colours; sentences on the learning media must be short, clear, and concise, according to the level of student understanding, and can be used in the classroom in groups. In line with the needs of teachers, students also need learning media that contain illustrations, have bright and harmonious colours, can be used in the classroom, and can be used in groups. The results of the analysis of teacher needs and student needs that have been presented will certainly be used as a basis for carrying out the next stage, namely the design stage.

Design Phase

The design stage is an activity to design learning media based on problems, needs, and literature studied in the analysis stage. The process of designing learning media for digestive ludo consists of several stages, namely determining the layout, determining the colour, choosing ornaments that are appropriate to the material, and determining the size of each component of the learning media for digestive ludo.

The components that need to be designed in the development of this digestive ludo learning media include: 1) a digestive ludo board, which is a square board measuring 40 cm x 40 cm in which there are four colored sections and there is a path as a pawn track; 2) a pawn, which is a piece measuring 3 cm x 5.5 cm that represents the player to move on the ludo game board; 3) a challenge card, which is a card measuring 7 cm x 10 cm in which there are challenges in the form of questions about the human digestive system with three levels of difficulty, namely difficult, medium, and easy; 4) a referee card, which is a card measuring 8.5 cm x 13.5 cm in which it presents the answer key to the questions presented on the challenge card; 5) a guidebook, which is a book measuring 8.5 cm x 13.5 cm that presents illustrations of the components of the digestive ludo learning media, regulations for using the digestive ludo learning media, and brief material related to the human digestive system; and 6) dice, which are 2 cm x 2 cm cubes that have six sides and each side has a number from 1 to 6 and aims to determine the number of actions in the game through the random numbers generated.

The development of digestive ludo learning media is adopted from the general ludo game, but is developed into a learning media that has new innovations including: a) digestive ludo learning media will provide a display in the form of a square board in the form of an equilateral square that is designed harmoniously and inserts images of human digestive system organs as supporting ornaments and has a path that must be passed by each player to reach the finish; b) this digestive ludo learning media presents challenges in the form of challenge cards that must be completed by each player to be able to continue the game; c) three types of challenge cards are presented containing questions with different levels of difficulty; d) there is a referee card that contains the answer key to the three types of challenge cards; e) four types of character pawns related to human digestive system organs are presented and presented in different colors; f) presents human digestive system material in IPAS subjects for grade V; g) there is a guidebook containing illustrations of digestive ludo learning media components, digestive ludo game rules, and brief material related to the human digestive

system; and h) digestive ludo game rules that are adjusted to the results of the analysis of problems, needs, and literature so that they are different from the general ludo game rules. The design of the digestive ludo learning media is then realized at the development stage.

Development Phase

The development stage in this research was carried out using the CorelDraw version 2019 application. The initial process in the development stage was to digitally design each component of the digestive ludo learning media one by one. The digital design of the digestive ludo learning media components that had been completed was then continued to the next stage, namely the printing stage. The digestive ludo board was printed using vinyl sticker material, which was then attached to corrugated plastic boards as a base so that the surface of the digestive ludo board would become sturdy and flat. Challenge cards, referee cards, and guidebook covers were printed using art carton material, while the contents of the guidebook were printed using HVS paper material. The pawn components were printed using mica material, while the dice were printed using PVC plastic. The components of the printed learning media were then put together in a box so that they became complete digestive ludo learning media. The developed digestive ludo learning media can be seen in Figure .

Figure 2. Learning Media (LUNA) ludo digestion

The digestive ludo learning media was then validated in terms of both media and material. The material validation process was carried out by two expert material validators. The results of the material validation can be seen in Table 4.

Table 4. Recapitulation of Material Validation Results

No.	Indicator	Validation 1	Validation 2
1	Compliance with CP, ATP, TP	12	12
2	Suitability to students' level of thinking	8	8
3	Accuracy of material	15	16
4	Impact of material presentation	7	8

No.	Indicator	Validation 1	Validation 2
5	Relevance of language	4	4
Total		46	48
Percentage		95.83%	100%
Average percentage		97.92%	
Criteria		Highly Feasible	

The results that have been presented show that the material presented in the digestive ludo learning media is very feasible to be tested on elementary school students. The expert material validator also provided some input as material for revising the developed media. The learning media resulting from the development in the form of digestive ludo was also validated in terms of media carried out by two expert media validators. The results of the media validation can be seen in Table 5.

Table 5. Recapitulation of Media Validation Results

No.	Indicator	Validation 1	Validation 2
1	Suitability of learning media with learning outcomes	23	22
2	Compliance of learning media with standard grammar	11	12
3	Suitability of learning media with the correct material concept	4	3
4	The practicality of learning media in its use	38	35
Total		76	72
Percentage		95%	90%
Average percentage		92.50%	
Criteria		Highly Feasible	

The media expert validator also provided suggestions to revise the size of the guidebook for using the Ludo digestive learning media, which was originally 8.5 cm x 13.5 cm, enlarged to 12 cm x 16 cm, and the language used to be adjusted to the level of elementary school students in grade V. The results of the material validation and media validation tests that have been presented indicate that the Ludo digestive learning media is very feasible to implement; however, to ensure that the Ludo digestive learning media can be implemented well in the learning process in the classroom, a small-scale trial is needed. The small-scale trial was conducted on homeroom teachers and grade V students of SDN 5 Dauhwaru with a total of 7 students. The results of the teacher and student response questionnaires in the small-scale trial can be seen in Figure 3.

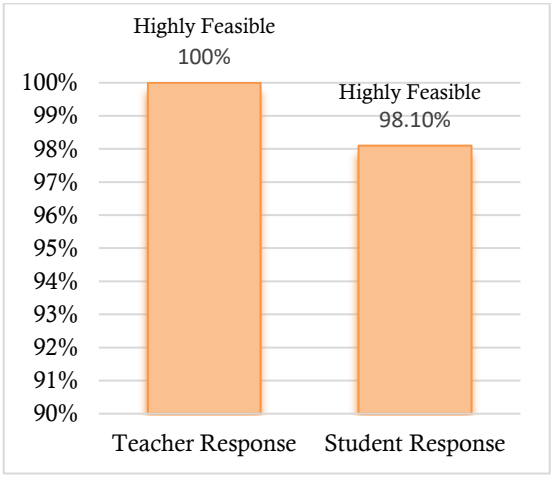

Figure 3. Teacher Response and Student Response Results in Small-Scale Trials

The results of material validation, media validation, and small-scale trials that have been presented show that the digestive ludo learning media is very feasible to be applied in learning IPAS for grade V elementary schools on the human digestive system material. The results that have been presented are in line with the results of research and development conducted by Pawazah et al. (2023), Aulawy et al. (2023), and Voliani (2021), which concluded that the ludo learning media is feasible to be applied in learning IPAS in elementary schools. Based on the results that have been presented, the digestive ludo learning media can be implemented on a larger scale.

Implementation Phase

The product of the development in the form of a digestive ludo learning media that has passed the validation stage and small-scale trials with very feasible criteria can be implemented on a larger scale in IPAS learning for grade V elementary schools. Large-scale trials were conducted at SDN 1 Dauhwaru with 11 students, and SDN 2 Dauhwaru with 13 students, so the total number of students who became respondents was 24.

The learning process in large-scale testing activities begins by giving a pretest to students, after which the researcher carries out the learning process by dividing students into small groups consisting of 2-4 students and then applying the Ludo digestion learning media. After the learning process is complete, students are then given a posttest. Student learning outcomes in the form of pretests and posttests are then analyzed with a series of tests, including normality tests, paired t-tests and n-gain tests. The normality test is carried out to determine the condition of the data and whether the data obtained is normally distributed or not. The results of the normality test can be seen in Table 6.

Table 6. Results of the Normality Test of Student Pretest and Posttest Data

Data Types	Shapiro-Wilk			Conclusion
	Statistic	df	Sig.	
Pretest	.966	24	.566	Normal
Posttest	.938	24	.150	Normal

Based on the results of the data normality test, it can be concluded that the pretest value data and posttest value data can be stated to be normally distributed so that the statistics that will be used are parametric statistics by conducting a paired t-test. The paired t-test is conducted with the aim of determining the difference in average between two related samples, namely the pretest value and the posttest value. The results of the paired t-test can be seen in Table 7**.**

Table 7. Paired T-test Results

Data Types	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Pretest Posttest	-36.11083	8.99169	1.83542	-39.90769	-32.31397	-19.674	23	.000

The results of the paired t-test at a 2-tailed significance value indicate a significant difference between student learning outcomes before the application of the digestive ludo learning media or pretest and student learning outcomes after the application of the digestive ludo learning media or posttest. After conducting the paired t-test, the next test that needs to be done is the n-gain test. The n-gain test is carried out so that researchers can find out how high the increase in student

learning outcomes is after applying the digestive ludo learning media. The results of the n-gain test can be seen in Table 8.

Table 8. N-Gain Test Results

Data	Average	Average Value Difference	N-Gain	Criteria
Pretest	49.72	36.11	0.73	High
Posttest	85.83			

The results of the n-gain test showed that the learning outcomes of IPAS of grade V students increased significantly after implementing the digestive ludo learning media so that the digestive ludo learning media was effective in improving the learning outcomes of IPAS of grade V students of elementary schools in Cluster II, Jembrana District on the human digestive system material. The results of this study are in accordance with the results of research conducted by Nurvitasari & Mintohari (2024) and Novada et al. (2023), which concluded that the ludo learning media was effective in improving the learning outcomes of IPAS of elementary school students.

Evaluation Phase

The evaluation stage in this study was carried out at each stage so that revisions or improvements were more focused. The evaluation was carried out based on suggestions, input, and criticisms provided by expert validators, grade V teachers, and students. The evaluation in this study was only given by expert validators, while grade V teachers and students did not provide evaluations. The evaluation was carried out to improve the quality of the digestive ludo learning media so that it is more feasible to be applied in the learning process and can be utilized effectively and optimally.

CONCLUSION

This research produces a product in Ludo learning media on the human digestive system. Digestive Ludo learning media is feasible and effective in improving learning outcomes in IPAS learning for grade V students on the human digestive system material in elementary schools Cluster II, Jembrana District. This digestive Ludo learning media presents challenges like challenge cards that can stimulate students to compete in learning and solving problems. This digestive ludo media is highly recommended to be applied in the process of learning IPAS so that it makes it easier for students to understand the learning material and can improve student learning outcomes, especially in learning IPAS on the human digestive system material in grade V elementary schools.

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