

DEVELOPMENT OF LUDO-MONOPOLY (LUPI) LEARNING MEDIA ON THE DIGESTIVE SYSTEM TO ENHANCE ELEMENTARY STUDENTS' LEARNING OUTCOMES IN SCIENCE

DESENVOLVIMENTO DE MÍDIA DE APRENDIZAGEM LUDO-MONOPOLY (LUPI) NO SISTEMA DIGESTIVO PARA MELHORAR OS RESULTADOS DE APRENDIZAGEM DE ALUNOS DO ENSINO FUNDAMENTAL EM CIÊNCIAS

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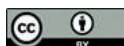
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Abstract

This study aimed to develop an innovative learning medium called Lupi (Ludo Monopoly), integrated into the Team Games Tournament (TGT) cooperative learning model. The research focused on evaluating the feasibility and effectiveness of the medium in enhancing student learning outcomes in Natural Sciences, specifically the topic of the human digestive system for Grade V elementary students.

Resumo

Este estudo teve como objetivo desenvolver um meio de aprendizagem inovador chamado Lupi (Ludo Monopoly), integrado ao modelo de aprendizagem cooperativa Team Games Tournament (TGT). A pesquisa focou na avaliação da viabilidade e eficácia do meio para aprimorar o desempenho dos alunos em Ciências Naturais, especificamente no tópico do sistema digestivo humano, para alunos do 5º ano



Employing a Research and Development (R&D) approach using the ADDIE model (Analyze, Design, Development, Implementation, Evaluation), the study was conducted in two elementary schools. A limited-scale trial involved 20 students, while a broader-scale trial involved 29 students. Validation results demonstrated high feasibility, with scores of 91.25 from the content expert and 90.97 from the media expert. Normality tests yielded significance values of 0.129 and 0.115 (>0.05), indicating normally distributed data. A homogeneity test result of 0.523 (>0.05) confirmed the data's homogeneity. The N-Gain score of 0.5731 indicated a significant improvement in learning outcomes. Educator responses, based on questionnaires from both trials, averaged a score of 90, categorized as highly feasible. Overall, the findings support that the Lupi learning medium contributes positively to teaching and learning processes, offering an engaging and effective tool for improving science learning outcomes in elementary education.

Keywords: Innovative Learning Media. Team Games Tournament (TGT). ADDIE Development Model. Natural Science Education. Learning Outcomes Improvement.

do Ensino Fundamental. Empregando uma abordagem de Pesquisa e Desenvolvimento (P&D) utilizando o modelo ADDIE (Análise, Projeto, Desenvolvimento, Implementação, Avaliação), o estudo foi conduzido em duas escolas de Ensino Fundamental. Um teste em escala limitada envolveu 20 alunos, enquanto um teste em escala mais ampla envolveu 29 alunos. Os resultados da validação demonstraram alta viabilidade, com notas de 91,25 do especialista em conteúdo e 90,97 do especialista em mídia. Os testes de normalidade apresentaram valores de significância de 0,129 e 0,115 ($>0,05$), indicando dados com distribuição normal. Um resultado de teste de homogeneidade de 0,523 ($>0,05$) confirmou a homogeneidade dos dados. A pontuação N-Gain de 0,5731 indicou uma melhoria significativa nos resultados de aprendizagem. As respostas dos educadores, baseadas em questionários de ambos os ensaios, obtiveram uma pontuação média de 90, classificada como altamente viável. No geral, os resultados apoiam a ideia de que o meio de aprendizagem Lupi contribui positivamente para os processos de ensino e aprendizagem, oferecendo uma ferramenta envolvente e eficaz para melhorar os resultados de aprendizagem em ciências no ensino fundamental.

Palavras-chave: Meios de Aprendizagem Inovadores. Torneio de Jogos em Equipe (TGT). Modelo de Desenvolvimento ADDIE. Educação em Ciências Naturais. Melhoria dos Resultados de Aprendizagem.

1 INTRODUCTION

The utilization of engaging instructional materials is recognized for its effectiveness in capturing students' attention through distinctive and appealing learning resources. To support this instructional process, one of the key strategies involves the creation of learning environments that align with the subject matter. The implementation of compelling learning strategies entails the use of innovative and engaging educational materials designed to foster student interest. It is essential, therefore, that the learning environment be adapted to accommodate the learners' characteristics (Novada et al., 2023). The integration of media into the teaching and learning process has become an indispensable component. Educational media are regarded as essential tools that facilitate the transmission of instructional content from teachers to students in an effective manner.

The success rate of knowledge transfer may vary depending on the types of learning materials employed. Learning media serve as crucial instruments that enable the transfer of knowledge from educators to learners within a well-structured environment, ensuring that instructional objectives are achieved efficiently (Saleh et al., 2023).

In certain subjects, the use of instructional media is considered essential as a supporting tool. However, it is crucial that such tools be utilized appropriately and in alignment with specific educational objectives. Media selection must be guided by the intention to enhance the achievement of these goals. Any media that fails to contribute to this aim should be temporarily excluded from the instructional process. As auxiliary instruments, educational media are designed to facilitate the attainment of learning outcomes. This perspective reflects the belief that integrating media into teaching and learning activities can significantly enrich students' educational experiences over time. Consequently, learners are expected to undergo more effective learning processes and attain improved academic results when media are employed to support their study. Ultimately, media serve as valuable tools within the educational system, enabling educators to deliver knowledge more effectively and accomplish pedagogical objectives. This study has been informed by prior research conducted by Khalida Ulfalia and Lia Rozalina (2019), in which a monopoly-based instructional medium was developed for teaching the digestive system. The implementation of this media was found to be more effective and student-centered, encouraging greater learner engagement during the learning process. In addition, a study by Novada et al. (2023) introduced the development of Ludo IPAS (Lupas) for elementary students, which was evaluated as highly valid, practical, and effective in enhancing science learning outcomes. Given the importance of utilizing engaging teaching media, the present study focuses on the development of *Lupi Education* a modified instructional tool combining elements of Ludo and Monopoly, adapted to incorporate science content. This media was designed to be implemented either individually or in groups, promoting open competition among students through the completion of subject-related questions, thereby encouraging active participation and reinforcing prior knowledge science and social science integration learning.

Inadequate instructional practices have been found to contribute to students' ongoing difficulties in comprehending key concepts in science, particularly those related to the human digestive system. These learning obstacles have limited students' ability to correctly answer and complete related assessment tasks. This issue is evident from the

average test score of 60.25 achieved by Grade V students at School X and School Y during the 2023/2024 academic year, which falls below the established Minimum Mastery Criterion of 75.00. To address this challenge, educational innovations in both instructional models and learning media have been deemed necessary. Various strategies have been explored, one of which involves the integration of cooperative learning models. Cooperative learning is designed not only to improve academic achievement but also to cultivate essential social competencies, such as interpersonal communication. Among these models, the *Team Games Tournament* (TGT) approach where students are organized into heterogeneous groups of five to six members based on diverse abilities, genders, and ethnic backgrounds has been recognized for its potential to foster active student participation (Fisika et al., 2017). The TGT model, structured similarly to games or role-play scenarios, provides an engaging and enjoyable learning environment. This approach has been associated with increased student motivation and participation, ultimately contributing to improved academic outcomes. While previous studies have investigated various instructional media for teaching the digestive system, the present study introduces a novel development *Lupi Education*, an innovative learning medium that integrates Ludo-Monopoly gameplay with the cooperative TGT model. This newly developed tool is designed for direct application in classroom settings to enhance learning outcomes more effectively.

2 METHODOLOGY

This study was conducted using a Research and Development (R&D) approach. The educational product developed in this research was an instructional medium titled *Lupi*, which combines elements of Ludo and Monopoly, specifically designed to support the teaching of the human digestive system for fifth-grade students at School X. The study addressed aspects of product planning, development outcomes, trial implementation, and data analysis. The development process followed the ADDIE model, consisting of the stages: Analysis, Design, Development, Implementation, and Evaluation.

2.1 Analysis

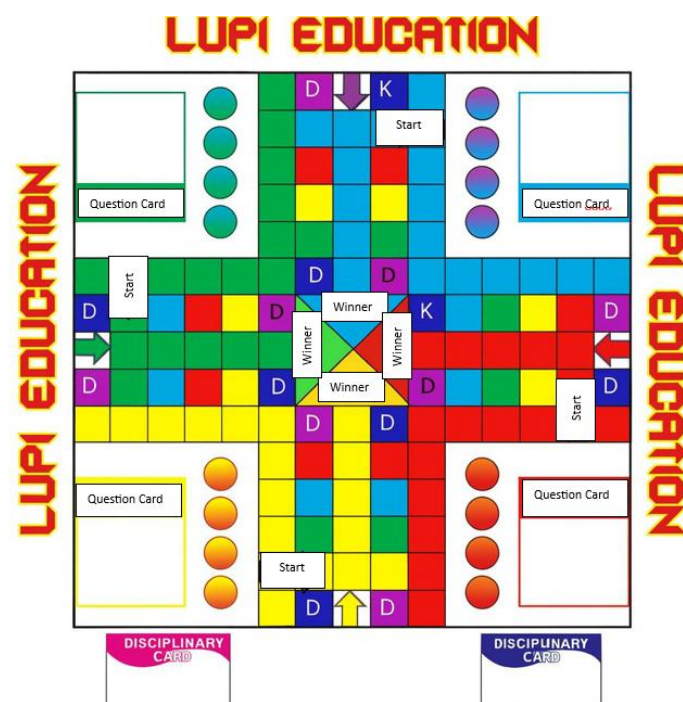
In the analysis phase, the problems encountered by students and the field-based instructional needs were systematically examined. This initial stage was carried out by gathering relevant data and information, which served as the foundation for the development of the instructional media product. In this study, the resulting product was the *Lupi* Learning Media a hybrid of Ludo and Monopoly designed to be implemented within the cooperative learning framework of the Team Games Tournament model.

2.2 Design

The second stage of the ADDIE development model is the design phase. During this phase, a conceptual framework for the intended product *Lupi* (a combination of Ludo and Monopoly) was structured. This stage involved three key activities: designing an engaging game board layout suitable for elementary students, selecting appropriate materials for media development, and organizing all necessary supporting components for the instructional media.

Figure 1

Board of Lupi



2.3 Development

The third stage of the ADDIE development model is the development phase. This stage was intended to evaluate the feasibility of the Lupi instructional media that had been previously designed. As a continuation of the design process. The Lupi (Ludo-Monopoly) learning media, integrated with a cooperative learning model through team-based tournaments, was developed to improve students' learning outcomes in 6lement, specifically the human digestive system topic for 6lementar school students.

2.4 Implementation

The fourth phase in the ADDIE development model is the implementation stage. The Lupi instructional media was implemented after it had fulfilled the eligibility requirements based on validation from subject matter and media experts. The initial implementation was carried out at School X with a sample of 20 fifth-grade students. For the broader scale testing, the media was applied at School Y involving 29 fifth-grade students as respondentes.

2.5 Evaluation

The final phase of the ADDIE development model is the evaluation stage. During this stage, revisions were made to improve the quality of the product by analyzing the data collected from the preceding implementation phases.

3 RESULT AND DISCUSSION

3.1 Feasibility assessment of the lupi learning media

The feasibility of the Lupi learning media, which integrates the Team Games Tournament (TGT) model, was assessed to determine its appropriateness for use in educational settings. The validation process was carried out by subject matter experts and media specialists who were asked to review and provide constructive feedback on the developed product. The evaluation instrument, completed by the validators, was

accompanied by a structured rubric to ensure clarity and consistency in assessment criteria.

The results of the validation process indicated that the Lupi media was considered suitable for implementation in the learning process. The assessment involved two university lecturers and two practitioners with extensive experience in both research and education. Their evaluations confirmed the media's viability as an instructional tool. The inclusion of detailed evaluation rubrics within the validation sheets provided a systematic basis for judging various aspects of the media, ensuring the assessment was well-organized and targeted. Through this expert validation process, the Lupi media was deemed pedagogically sound and effective for use in the classroom, particularly within cooperative learning environments supported by the TGT model.

Table 1

Expert Validation of the Lupi Learning Media (Content and Material Feasibility)

No	Observed Aspect	Assessment Items	Expert 1	Expert 2
1	Content Feasibility	Alignment of material presentation with Learning Activity Plan	4	4
		Alignment of material with targeted competencies	4	4
		Alignment of material with learning outcomes in the syllabus	4	4
		The presented material fosters students' critical thinking	4	4
2	Presentation Feasibility	The presented science material is easy to understand	3	3
		The presented science material aligns with primary school science activities	4	4
		The sufficiency of science material in relation to elementary learning competencies	3	4
3	Content Depth	The depth of science material aligns with elementary science competencies	4	4
		Fulfills the correctness of basic science concepts	4	4
		The material is up-to-date with current scientific developments	4	4
4	Developmental Appropriateness	The material is appropriate to students' developmental stage	3	3
		Alignment of science material with students' cognitive development	3	3
		The material is engaging for students to learn elementary science	3	4
		The material stimulates students' curiosity	4	4
5	Language Feasibility Aspect	Coherence and logical sequence	4	3
		Conciseness	3	3
		Communicativeness	3	3
		Dialogical and interactive	3	3
		Suitability with child development	3	4
		Compliance with language rules	4	4

No	Observed Aspect	Assessment Items	Expert 1	Expert 2
	Criteria	Expert 1	Expert 2	
	Total Score	63	66	
	Maximum Score (N)	72		
	Percentage	87%	91%	
	Category	Highly Feasible	Highly Feasible	

The total scores obtained were 71 and 73, as assessed by Expert 1 and Expert 2, respectively, out of a maximum score of 80. These scores correspond to percentage values of 88% and 91%, indicating a high level of feasibility. Based on these results, the media was categorized as “Highly Feasible” by both experts. The average score of the two evaluations was calculated at 72, with an average percentage of 90%. Therefore, the overall language feasibility of the learning media was confirmed to fall within the “Highly Feasible” category, demonstrating that the media meets the necessary linguistic criteria for effective use in elementary education settings.

3.2 Media

The validators in the media feasibility test in this study consisted of two media experts, with scores provided by each expert.

Table 2

Media Expert Feasibility Test

No	Observed Aspect	Assessment Item	Expert 1	Expert 2
1	Content and Media Evaluation	The Lupi Education media used aligns with the basic competencies and learning objectives.	4	4
		The Lupi Education media corresponds to the scope and clarity of the learning material.	4	4
		The Lupi Education media facilitates understanding of the learning content.	4	4
		The evaluation questions are aligned with the material presented in the media.	4	4
		The instructions for using the media are clear.	3	4
		The media is flexible and adaptable for various needs and situations.	4	4
2	Media Display	The Lupi Education media provides illustrations related to the learning material.	4	4

3 Media Quality	The text readability is clear and appropriate for students' cognitive level.	3	3
	The image design creates a positive impression and stimulates interest in learning.	4	4
	The media has a good aesthetic and is appropriate for the target users.	3	3
	The media incorporates creativity and innovation.	4	4
	The printed game board is clear and precisely aligned with the media.	3	3
	The materials used are safe for both teachers and students.	3	3
	The media includes clear and understandable user instructions.	3	4
	The language used in presenting the material is communicative.	3	4
	The media is made of durable and long-lasting materials.	3	3
	The media is easy to use and understand for both teachers and students.	3	3
	The color harmony enhances interest in using the media.	4	4
	Criteria	Expert 1	Expert 2
	Total Score	63	66
	Maximum Score (N)	72	
	Percentage	87%	91%
	Category	Highly Feasible	Highly Feasible
	Average Score	6.5	
	Average Percentage	89.58%	
	General Category	Highly Feasible	

Based on the Table 2 of the media expert feasibility test, a total score of 63 out of 72 (equivalent to 87%) was awarded by Expert 1, while a score of 66 out of 72 (or 91%) was awarded by Expert 2. A combined percentage of 89.58% was recorded, and the media was categorized as Highly Feasible. When analyzed by aspect, the Content and Media Evaluation aspect was given the highest ratings, reaching 95.8% by Expert 1 and 100% by Expert 2, indicating that the *Lupi Education* media was judged to be well aligned with basic competencies, learning objectives, and material clarity. The Media Display aspect was rated at 87.5% by both experts, showing that the appearance of the media was considered attractive but improvements in text readability and aesthetics were still recommended. The lowest ratings were received by the Media Quality aspect, with 79.2% from Expert 1 and 87.5% from Expert 2, indicating that enhancements in material

durability, safety, clarity of user instructions, and language readability were suggested. Overall, the media was assessed as highly feasible for use in the learning process, with priority improvements expected in physical quality and user instructions so that an even higher level of feasibility can be achieved.

3.3 The effectiveness of the Lupi learning media on student learning outcomes

was analyzed through both a limited-scale trial and a large-scale trial. In the limited-scale trial, instruction was delivered to 20 fifth-grade students of School X, while the large-scale trial was carried out with 29 fifth-grade students of School Y. The Lupi instructional media was employed within the science subject on the topic of the human digestive organs as a teaching aid implementing the Team Games Tournament (TGT) model to enhance student achievement. Prior to the use of the media, a pretest was administered to measure the students' initial understanding of the material. After the learning sessions were conducted with the Lupi media, a posttest and a questionnaire were administered to evaluate the improvement in learning outcomes. The students' pretest and posttest results were then subjected to statistical analysis to determine the significance of the learning gains.

Table 3

Test of Normality

	Kolmogorov–Smirnov		Shapiro–Wilk	
	Statistic	df Sig.	Statistic	df Sig.
Limited Trial				
Pretest	0.188	20 0.063	0.923	20 0.114
Posttest	0.134	20 0.200*	0.926	20 0.129
Large-Scale Trial				
Pretest	0.147	29 0.112	0.944	29 0.128
Posttest	0.142	29 0.141	0.942	29 0.115

The results of the Tests of Normality from Table 3 show that all significance (Sig.) values in both the Kolmogorov–Smirnov and Shapiro–Wilk tests are greater than 0.05, indicating that the data are normally distributed. For the limited trial, the Kolmogorov–Smirnov test produced Sig. values of 0.063 (pretest) and 0.200 (posttest), while the Shapiro–Wilk test produced Sig. values of 0.114 (pretest) and 0.129 (posttest). For the

large-scale trial, the Kolmogorov–Smirnov test yielded Sig. values of 0.112 (pretest) and 0.141 (posttest), and the Shapiro–Wilk test produced Sig. values of 0.128 (pretest) and 0.115 (posttest). Because all these values exceed the 0.05 threshold, it can be concluded that the pretest and posttest data from both the limited and large-scale trials meet the assumption of normality, allowing for the use of parametric statistical tests in subsequent analyses.

Table 4

Test of Homogeneity

		Levene Statistic	df1	df2	Sig.
Posttest	Based on Mean	.415	1	47	.523
	Based on Median	.321	1	47	.574
	Based on Median and with adjusted df	.321	1	46.997	.574
	Based on trimmed mean	.363	1	47	.550

The results of the homogeneity test based on Table 4 using Levene’s method show that the posttest data meet the assumption of variance equality. Based on the mean, the Levene statistic is 0.415 with $df1 = 1$ and $df2 = 47$, producing a significance value (Sig.) of 0.523. When calculated based on the median, the Levene statistic is 0.321 ($df1 = 1$, $df2 = 47$) with a Sig. of 0.574, and when adjusted for degrees of freedom it remains 0.321 ($df1 = 1$, $df2 = 46.997$) with a Sig. of 0.574. Similarly, when calculated based on the trimmed mean, the Levene statistic is 0.363 ($df1 = 1$, $df2 = 47$) with a Sig. of 0.550. Since all significance values are greater than 0.05, it can be concluded that the variances of the posttest scores are homogeneous, allowing the use of parametric tests (such as the independent t-test) for further analysis.

Table 5

Score of N-Gain

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
N_Gain	49	.29	.89	.5731	.14142
Presen	49	29.41	88.64	57.3122	14.14188
Valid N (listwise)	49				

The descriptive statistics based on Table 5 show that the analysis was conducted on 49 valid data sets (N = 49). For the N-Gain score, which measures the normalized improvement in learning outcomes, values ranged from a minimum of 0.29 to a maximum of 0.89, with a mean of 0.5731 and a standard deviation of 0.14142. This indicates that, on average, students achieved a 57.31% normalized gain, with moderate variation among participants. Similarly, the percentage increase (Presen) shows a minimum of 29.41% and a maximum of 88.64%, with a mean of 57.31% and a standard deviation of 14.14%. These results suggest that, on average, students' learning outcomes improved by more than half of the possible gain after using the Lupi learning media, with some students achieving nearly a 0.90 N-Gain or almost 89% improvement, while the lowest recorded improvement remained above 29%, indicating that positive learning progress was consistently experienced across the sample.

Table 6

Sample t-test

T-Test									
Paired Samples Statistics									
		Mean	N	Std. Deviation	Std. Error Mean				
Pair 1	Pretest	64.49	49	7.197	1.028				
	Posttest	84.69	49	5.945	.849				
Paired Samples Correlations									
		N	Correlation	Sig.					
Pair 1	Pretest & Posttest	49	.578	.000					
Paired Samples Test									
Paired Differences									
		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pretest - Posttest	-20.204	6.141	.877	-21.968	-18.440	-23.032	48	.000

The paired-sample t-test results indicate a significant improvement in student learning outcomes after the use of the Lupi learning media. From the Paired Samples Statistics, the mean pretest score was 64.49 (N = 49, SD = 7.197, SE = 1.028), while the mean posttest score increased to 84.69 (SD = 5.945, SE = 0.849). The Paired Samples Correlation between pretest and posttest scores was 0.578 with a significance value of 0.000, showing a moderate positive relationship between the two sets of scores. The Paired Samples Test shows that the mean difference between pretest and posttest was

–20.204 points ($SD = 6.141$, $SE = 0.877$). The 95% confidence interval of the difference ranged from –21.968 to –18.440, and the t -value was –23.032 with 48 degrees of freedom, yielding a p -value of 0.000 ($p < 0.001$). Because the significance value is well below 0.05, it can be concluded that the increase from a pretest mean of 64.49 to a posttest mean of 84.69 is statistically significant, indicating that the Lupi learning media produced a substantial and reliable improvement in students' learning achievement.

4 CONCLUSION

The development and implementation of Lupi Education, an instructional medium combining elements of Ludo and Monopoly within the Team Games Tournament (TGT) cooperative learning model, demonstrated strong feasibility and clear effectiveness in improving science learning outcomes among fifth-grade students. Validation by subject matter and media experts confirmed the product's high feasibility, with content and material aspects rated at 87–91%, media display aspects at 87.5%, and media quality aspects at 79.2–87.5%, all of which fall into the Highly Feasible category. Normality tests showed all pretest and posttest data to be normally distributed (Kolmogorov–Smirnov Sig. ≥ 0.063 ; Shapiro–Wilk Sig. ≥ 0.114), and Levene's test confirmed homogeneous variances (Sig. ≥ 0.523), thereby meeting the assumptions for parametric analysis. Descriptive statistics revealed a mean N-Gain of 0.5731 ($\approx 57.31\%$), with improvement percentages ranging from 29.41% to 88.64%, indicating consistent and meaningful learning progress across the sample. The paired-sample t -test further showed a statistically significant increase in achievement, with pretest and posttest means rising from 64.49 to 84.69 (mean difference = 20.204, $t = -23.032$, $p < 0.001$). These results demonstrate that the use of Lupi Education produced a substantial positive effect on students' mastery of the human digestive system topic. Overall, the study confirms that Lupi Education is both pedagogically viable and empirically effective as a science learning medium. By integrating engaging game mechanics with cooperative learning principles, the media successfully fostered student interest, active participation, and improved academic performance, making it a practical and innovative tool for elementary science instruction.

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Authors' Contribution

Both authors contributed equally to the development of this article.

Data availability

All datasets relevant to this study's findings are fully available within the article.

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