

DEVELOPMENT OF SCRATCH GAMIFICATION OF IPAS LEARNING FOR GRADE V ELEMENTARY SCHOOL STUDENTS

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Journal info

Jurnal Pendidikan Glasser

p-ISSN : 2579-5082

e-ISSN : 2598-2818

DOI : <http://doi.org/>

Volume : 9

Nomor : 2

Month : 2025

Keywords: Gamification, Scratch, IPAS Learning

Abstract.

IPAS learning in elementary schools needs learning innovation in the use of technology-based media such as Scratch Gamification learning media. This research seeks to evaluate the feasibility of Scratch Gamification learning media in learning IPAS and to assess their effectiveness in enhancing student IPAS learning outcomes after implementing learning. The problems in this study are the difficulty of students understanding IPAS material and the limitations of learning media, especially technology-based. The study addresses challenges such as students' difficulty in grasping IPAS concepts and the lack of technology-integrated learning resources. A Research and Development (R&D) approach was applied, utilizing the 4D framework consisting of four phases: definition, design, development, and dissemination. Data were collected through expert validation, and learning outcomes tests and analyzed quantitatively and statistically. The validation results showed that media experts awarded a score of 96%, while material experts gave a score of 93%, both of which fall under the "Very Feasible" category. Student learning outcomes showed a marked improvement following the use of Scratch Gamification as a media with the average pre-test score recorded at 51.25 and the post-test average rising to 87.75. The resulting N-Gain value of 0.75 falls within the high category. These findings indicate that Scratch Gamification is an effective and appropriate tool for enhancing student learning outcomes in IPAS instruction.



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A. INTRODUCTION

Education is a stage that never stops in supporting learners into a better era. Not only that, education aims so that we can appreciate and treat fellow humans better (Sujana, 2019). To enhance the standard and effectiveness of education, it is essential for the educational system to align with the ongoing advancements in Information and Communication Technology (ICT). Education also aims to

guide learners to develop positively for themselves and others (Mubarak, dkk., 2023).

Learning with technology is able to increase creativity, problem-solving skills, as well as students' interest in IPAS learning. Important to integrate technology in teaching and learning through the development of digital media, such as the internet, programming, and technological devices such as computers, gadgets, and projectors for (Satria, dkk., 2022). The use of technology in the teaching and

learning process also increases students' digital literacy. So that with technology learning becomes interactive and students are more interested in learning.

An initial needs assessment carried out in October 2024 through classroom observations and interviews with the fifth-grade teacher at SDN Sidokare 3 revealed that students faced challenges in comprehending IPAS subject matter. Additionally, the availability of instructional media, particularly those utilizing technology, was found to be limited. This is reflected in the value of IPAS learning outcomes, where 55% have a score above 80 from the KKTP set, while 45% have a score below 80, with a class average score of 78 which is still below KKTP. Learning outcomes as results achieved such as thinking, changes in behavior or assessment through learning (Ikhsan, 2022). Learning outcomes can also be caused by observation and social relationships as well as various personal factors including self-confidence.

In light of the previously identified issues, learning media is needed that can foster the enthusiasm of students to carry out IPAS learning activities and can also improve students' IPAS learning outcomes. Researchers developed an interestingly designed Scratch Gamification learning media. The utilization of advances in information and communication technology through Scratch media is one of the factors in supporting success in learning. So that it can provide a pleasant learning experience for students.

Learning media as a means that is able to support learning activities so that the meaning of the information provided is more focused as well as learning objectives can be obtained efficiently and effectively (Liana & Suriansyah, 2023). Learning media are classified into 3 including audio media, visual media, and audiovisual media with the aim of increasing the efficiency and effectiveness of learning. Learning media is not only to clarify the meaning conveyed, but also stimulate student thinking. So that learning media is considered as one of the important elements in achieving learning goals.

The benefits of media for learning are the provision of subject matter that can be uniformed, learning activities become clearer as well as fun, efficiency in energy as well as time, learning activities become very interactive, improve the quality of student learning outcomes. (Widiatmika, 2015). Media provides opportunities for learning activities that can be carried out anytime and anywhere. Media is able to increase the positive behavior of students with material and learning activities, change the role of teachers to be better as well as productive. This can facilitate interaction between teachers and students so that learning is more effective.

Digital-based learning innovations in the education process to improve learning experiences and learning outcomes. One form of digital-based learning innovation is gamification. Gamification as a combination of game and nongame components with positive goals for learning (Ariani, 2020). Of course, this has a positive value in learning, which can

make students better understand and face problems in learning.

Scratch as a programming language can show animation and sound, and is able to design an educational game creatively, interestingly, and interactively (Sarah, dkk., 2017). Scratch is easily accessible through the internet, and easy to use to create projects. This makes it easier for teachers to design learning according to students' needs. So by combining Gamification and Scratch, we can design a game through the Scratch platform with the aim of creating interactive learning interactions as well as improving student learning outcomes.

In previous research from 3 studies, namely (Ningrum & Novtiar, 2023), (Nabilah, dkk., 2023), and (Azaharani, dkk., 2024) showed that Scratch-based learning media are highly feasible and well-suited for use in educational settings.. The differences in previous studies are in the type of development research, the existence of gamification, the design of Scratch features, the previous education level of junior high school, and the previous subjects applied, namely mathematics and informatics.

Based on the explanation that has been presented previously, this research leads to the development of Scratch Gamification in IPAS learning. There is a problem formulation for this research as follows: How is the feasibility of developing Scratch Gamification media in learning IPAS grade V elementary school. How are student learning outcomes after using Scratch Gamification media in fifth grade IPAS learning. Therefore, the researchers were motivated to create Scratch-based gamified

learning media for teaching IPAS to fifth-grade elementary school students.

B. RESEARCH METHOD

This research employs a Research and Development (R&D) method to assess the suitability and effectiveness of the designed learning media in enhancing student learning outcomes. The study follows the 4D model framework, which includes four key stages: Define, Design, Develop, and Disseminate, as depicted in the diagram below.

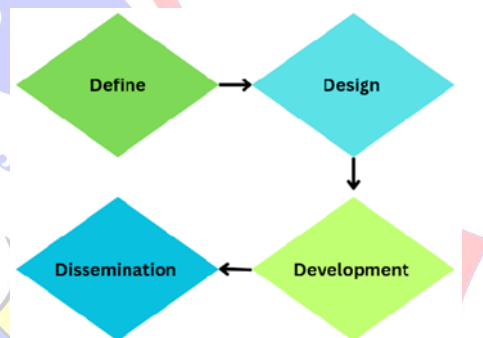


Figure 1. Stages of the 4D Model

This research was conducted at SDN Sidokare 3 and involved a sample of 20 fifth-grade students during the 2024/2025 school year. Data collection involved the use of validation sheets filled out by subject and media experts to evaluate the quality of the developed instructional media. To assess the enhancement of students' learning outcomes, pre-test and post-test assessments were administered, and the results were analyzed using the N-Gain technique.

1. Media and Material Expert Validation

The creation of the Scratch Gamification learning media included an analysis of expert evaluation results, starting with the tabulation of data gathered from the validation sheets. Then the tabulated data is converted into a

percentage type in the feasibility percentage formula:

$$P = \frac{\sum x}{\sum xi} \times 100\%$$

Description :

P : Percentage of feasibility

$\sum x$: The number of scores obtained

$\sum xi$: Total maximum score

Table 1. Categories of Feasibility Percentage

Feasibility Percentage	Category
81% - 100%	Very Feasible
61% - 80%	Feasible
41% - 60%	Feasible enough
21% - 40%	Not Feasible
0% - 20%	Very Unfeasible

Source: (Suharsimi, 2021)

2. Learning Outcome Analysis

This analysis serves to assess student learning outcomes and determine whether the use of Scratch Gamification media leads to measurable improvement in the classroom. The assessment includes a total of 15 items (comprising 10 multiple-choice and 5 description) administered during both the pre-test and post-test phases. To verify the quality of these items, specific standards are applied. Item validity is determined by ensuring the calculated r-value exceeds the r-table threshold of 0.468. Reliability, on the other hand, is measured using Cronbach's Alpha, with a minimum acceptable value of 0.6 to confirm the instrument's consistency and precision. The extent of learning improvement is then calculated using the N-Gain formula.

1) Test Validity

$$r_{hitung} = \frac{n(\sum XY) - (\sum X)(\sum Y)}{\sqrt{(n(\sum X^2) - (\sum X)^2)(n(\sum Y^2) - (\sum Y)^2)}}$$

Description:

n : Number of respondents

X : Respondent's answer

Y : Total score on the variable in the n-th respondent

2) Test Reliability

$$r_{11} = \left[\frac{k}{k-1} \right] \left[1 - \frac{\sum \sigma_b^2}{\sigma_t^2} \right]$$

Description:

r_{11} : Reliability of the instrument

k : Number of question items

$\sum \sigma_b^2$: Number of item variants

σ_t^2 : Total variance

3) Improved Learning Outcomes

Student learning progress was evaluated by analyzing the results of both pre-test and post-test assessments. The N-Gain formula was used to assess the difference in student achievement before and after the use of Scratch Gamification media in the learning process..

$$N\text{-Gain} = \frac{Skor\ Posttest - Skor\ Pretest}{Skor\ Ideal - Skor\ Pretest}$$

After being analyzed using the N-Gain formula, the students' test results are then assessed using a percentage-based classification table to determine the degree of learning improvement, as shown below.

Table 2. N-Gain

Large Percentage	Interpretation
$g > 0,7$	High
$0,3 < g < 0,7$	Medium
$g < 0,3$	Low

C. RESULTS AND DISCUSSION

By following several stages of development that have been described previously to realize Scratch Gamification

products in IPAS learning, so that results can be obtained according to the stages of development research utilizing the 4D model, as below:

1. Define

During the initial define phase, the researchers conducted data collection to identify student needs and uncover challenges encountered during the learning process. This step is essential for determining suitable solutions to address the identified issues in instruction. First, conduct an initial analysis of existing problems to find the difficulties, conditions, and potential of students in learning. Second, analyzing students looking for the needs and characteristics of students who do not understand the material due to limited learning media. Third, task analysis by determining the Learning Outcomes (CP) that will be included in the material to be developed in the learning media. Fourth, a concept analysis was carried out by reviewing teaching modules and Grade V IPAS textbooks aligned with the independent curriculum. In response to the identified challenges, the researchers designed a gamified learning media product using the Scratch platform as the development tool.

2. Design

In the product design stage, the step taken is to prepare the design using the Scratch platform. The learning media developed in this research involves a combination of text, animation, audio, images, games, quiz and gamification elements. The process begins with setting the strategy, establishing the concept, preparing the material, designing the questions

to be discussed, and given entertainment games. Then after the preparation and data collection is complete, the researcher makes a product design to facilitate the product development process. At the define stage, researchers gathered data to assess what students require and to pinpoint difficulties faced during classroom instruction. This process is crucial for formulating appropriate strategies to overcome the identified learning challenges.

3. Development

For this stage, the learning media that has been designed in the Canva application will carry out the development stage which is applied using the Scratch platform. Following this phase, the learning media undergoes validation by both media and subject matter experts prior to its implementation with students. This validation process is intended to gather expert feedback and assess the quality and effectiveness of the Scratch Gamification media, based on the following evaluation criteria:

1. Media expert validation

$$P = \frac{73}{76} \times 100\% \\ = 96\%$$

2. Material expert validation

$$P = \frac{45}{48} \times 100\% \\ = 93\%$$

The media expert's evaluation resulted in a score of 96%, whereas the material expert's assessment produced a score of 93%. Both results fall into the "Very Feasible" category. Additionally, constructive feedback and recommendations were also provided by the media expert.

Table 3. Expert Validation Results		
No	Experts	Feasibility Percentage
1	Media Validation	96%
2	Material Validation	93%
Category		Very Feasible

In these results, it can be seen that the percentage of media validation feasibility reached 96% and material validation reached 93% in the “Very Feasible” classification. This suggests that the use of Scratch Gamification learning media is effective and appropriate for enhancing the teaching and learning process.

The following is the Scratch Gamification media design after revision:



Figure 2. Scratch Gamification Design

4. Dissemination

The concluding phase of this research involves analyzing the data obtained from the implementation of Scratch Gamification learning media. After conducting validation, it was continued with the validity test of 15 questions which were tested on 20 fifth grade students.

Table 4. Validity Test Results

Question Item No	R count	R table	Conclusion
1	0,600	0,468	Valid
2	0,764	0,468	Valid
3	0,575	0,468	Valid
4	0,471	0,468	Valid
5	0,490	0,468	Valid
6	0,500	0,468	Valid
7	0,837	0,468	Valid
8	0,837	0,468	Valid

Question Item No	R count	R table	Conclusion
9	0,673	0,468	Valid
10	0,688	0,468	Valid
11	0,606	0,468	Valid
12	0,490	0,468	Valid
13	0,514	0,468	Valid
14	0,661	0,468	Valid
15	0,471	0,468	Valid
R count > R table = Valid			

The results of the validity test indicate that all question items for each variable obtained r-count values higher than the r-table threshold of 0.468. This confirms that the items are valid and appropriate for use in the study. Subsequently, a reliability test was performed to evaluate the consistency of the measurement instrument. An instrument is deemed reliable if the Cronbach's Alpha coefficient exceeds 0.6. The results of this reliability analysis are detailed below:

Table 5. Reliability Test Results

Reliability Statistics	
Cronbach's Alpha	N of Items
0,881	15
0,881 > 0,6 = Reliable	

The findings from the reliability test indicate that all variables within the research instrument achieved a Cronbach's Alpha score exceeding 0.6, confirming the instrument's consistency and reliability.

Table 6. Pretest and Posttest Results

No	Respondents	Pretest Score	Posttest Score
1	AAS	70	85
2	AGA	65	100
3	BU	35	75
4	BFW	50	80
5	EA	50	100
6	EAP	40	80
7	FFC	55	80
8	KR	60	85

No	Respondents	Pretest Score	Posttest Score
9	KAI	50	75
10	MOC	65	100
11	MAZ	65	80
12	MMPA	30	75
13	MWCA	35	85
14	NA	30	80
15	NRK	50	95
16	ND	50	100
17	RR	25	80
18	SZR	80	100
19	YIK	50	100
20	ZARP	70	100
TOTAL		1025	1755

Moreover, the increase in student learning outcomes was examined using the N-Gain formula, with data analysis carried out through SPSS version 27, as outlined below.

Table 7. N-gain Results

Descriptive Statistics					
	N	Pretest	Posttest	N-Gain	Std. Deviation
<u>NGain</u>	20	51,25	87,75	0,75	9.771
<u>NGain 0,75>0,7=Tinggi</u>					

Based on the test findings, the average pre-test score was 51.25, while the post-test average rose to 87.75, indicating a significant improvement. The resulting N-Gain score of 0.75 falls within the "High" classification, demonstrating that the Scratch Gamification learning media effectively enhances student learning outcomes.

D. CONCLUSION

The results of the research and development of Scratch Gamification media, which focused on assessing its suitability and impact on improving IPAS learning outcomes, indicate that the media falls into the "Very Feasible" category. This is supported by validation results, showing a 96% score from media experts and a 93% score from material

experts. There was a notable improvement in student learning outcomes, with the average pre-test score at 51.25 and the post-test average reaching 87.75. The resulting N-Gain score of 0.75 places the improvement in the "High" category. These results support the conclusion that the Scratch Gamification learning media is not only feasible for use but also effective in enhancing student achievement.

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