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The Influence of Gamification on Problem Based Learning in Improving the Quality of Physical Education and Sports Learning at the Elementary School Level: Motivational Formation of Social and Cultural Character in Rural Papua Indonesia

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Keywords

Sports Learning; Cultural Character; Problem Based Learning

Abstract

This study analyzes the effect of Gamification Based Learning (GBL) on creative thinking ability and collaborative skills of students in rural Papua. By using 27 elementary schools in rural papua indonesia. data taken directly in the field through valid test results without flaws, this study ensures that all variables, including increasing the motivation of social character of students in rural papua with the application of gamification in sports learning are filled in completely, and can provide valid data. The results of the analysis showed that the application of gamification in sports learning significantly increased students' creativity. Hypothesis testing using t-statistics showed a significance value (p-value) of 0.000, well below the threshold0.005, indicating a significant difference between the experimental and control classes. In the experimental class, 100% of students moved to the "very creative" category after the implementation of gamification, while the control class showed a less encouraging distribution of scores. The process stages in GBL, integrated with gamification elements such as achievements and a supportive atmosphere, encouraged students to participate more actively. In addition, the study found that gamification also improved collaborative skills, with 50% of students in the experimental class being in the "highly collaborative" category after the treatment. However, challenges such as difficult classroom dynamics require good management from the teacher. This research emphasizes the importance of implementing gamification in increasing student engagement and motivation, as well as providing significant results in cognitive and collaborative aspects, which is highly relevant in the context of education in Papua Indonesia.

INTRODUCTION

Problem Based Learning (PBL) is an educational approach that focuses on problem solving as the primary method for acquiring knowledge. (Pellas, 2025), In PBL, students are exposed to real situations or problems that require analysis and solutions. This process encourages students to actively engage, think critically, and cooperate with their peers.(Li et al., 2025a) Thus, PBL is not just a transfer of knowledge from teachers to students, but also an interactive process where students play an active role in learning. (Jones & Turner, 2006) PBL operates based on several basic principles. One of them is group-based learning, where students work in small teams to encourage collaboration. In groups, they discuss with each other, share ideas, and seek solutions together.(Duncan, 2007) ,In addition, PBL also encourages students to conduct independent research. They are expected to obtain relevant information and develop innovative solutions to the problem at hand.(Pellas, 2025b) ,The reflection process is also an important part, where students understand their understanding and the learning process that has been passed.(Li et al., 2025b) ,Through this experience, they not only gain knowledge about the environment, but also critical and analytical thinking skills that are very important in everyday life. One of the main benefits of PBL is the development of critical thinking skills. (Heliso et al., 2025),It teaches students to analyze information, make arguments, and make data-driven decisions. In addition, PBL also improves collaboration skills, as students have to work together in groups to achieve a common goal. Thus, they learn to appreciate others' points of view and communicate effectively. (Ulya et al., 2024) ,Although PBL offers many advantages, there are some challenges that need to be considered. One of them is the need for sufficient time to plan and implement the project. Teachers must prepare materials and assist students during the learning process.(GUO, 2025) ,In addition, not all students may feel comfortable with this approach, especially if they are used to more structured traditional learning methods. Therefore, it is important for teachers to create a supportive and inclusive environment. The role of teachers in PBL is crucial. They are not only the deliverers of information, but also the facilitators who help students in the learning process.

Having understood the concept of PBL, it is important to explore how gamification can be involved in this process.(Sal-de-Rellán et al., 2025) ,Gamification is the application of game elements in a non-game context to increase engagement and motivation. (Barcala-Furelos et al., 2025),In education, elements such as points, levels, challenges and rewards are used to create a more engaging learning experience. When PBL is combined with gamification, students will be more motivated to participate in learning activities. The integration of gamification in PBL can create a more dynamic and interactive learning atmosphere. For example, teachers can award points for each task completed or challenge successfully overcome.(Holguin-Alvarez et al., 2025) ,This gives students a sense of accomplishment and encouragement to continue learning. With a more fun atmosphere, students are likely to feel more engaged and excited in the problem-solving process. One of the benefits of gamification in PBL is increased student engagement. When students feel more engaged, they tend to be more active in the learning process. (Giles Girela et al.n.d.) , Gamification also helps students develop critical and analytical thinking skills, as they have to analyze the problem from multiple points of view. In addition, the competitive element in gamification can improve collaboration and team spirit, as students work together to achieve a common goal. (Lopez-Barreiro et al., 2024).Through gamified PBL, students not only learn academically, but also develop important social skills. Group work facilitates communication and negotiation, while joint problem solving increases empathy and understanding. These skills are invaluable in the world of work and social interactions in society, where collaboration and effective communication are key to success.(Anggraeni et al.n.d.-a) , While gamification offers many advantages, there are challenges that must be faced in its implementation. One of them is the time and effort required from teaching to design effective and engaging learning experiences. In addition, not all students may respond well to game elements; some may feel pressured by competition.

Gamification, which involves applying game elements in non-game contexts, has attracted attention as an innovative strategy in education. This concept aims to increase motivation, engagement and learning outcomes by using elements such as points, challenges and rewards.(Saleem et al., 2022) et al.,)However, In the context of physical education and sports (PJOK) at the elementary school level, gamification can have a significant impact on how students learn, participate, and interact in physical activities.(Ferriz-Valero 2020),Physical education and sports in elementary schools have an important role in developing students' physical fitness, social and emotional skills.(Dehghanzadeh et al., 2024, especially in inadequate facilities.)in many areasthe interior of Papua, challenges such as

limited facilities, , and inadequate physical education and sports facilities are not availableHowever, in many areas, especially in the interior of Papua, challenges such as limited facilities, inadequate infrastructure, and geographical constraints make it difficult to implement effective learning.(Cigdem et al., 2024),Therefore, more innovative approaches, such as gamification, are needed to overcome challenges in Papua.

Papua,as a region with very strong social and cultural diversity, requires a learning approach that is sensitive to local values. In this case, gamification can be an effective tool to integrate local cultural elements into physical education. This approach allows students to learn through games that reflect their social, cultural and local wisdom values, while increasing their engagement in learning activities. Although gamification has been applied in various fields of education, its influence on PJOK activities in the interior of Papua is still very limited.(Wibowo et al., 2024),In this context, it is important to explore how gamification can impact students in areas with limited access to technology and adequate educational facilities.(Pérez-Jorge et al., 2024),Gamification-based learning that is simple and easy to access, such as using traditional tools, can be a solution that is more suited to conditions in rural Papua. It is important to understand that gamification is not only related to the use of technology, but also to how game elements can be adapted to the local social and cultural context.(Lin et al., 2024),In the interior of Papua, game elements that contain the values of togetherness, cooperation, and the spirit of mutual cooperation can be applied to create relevant and meaningful learning experiences for students. In the application of gamification in PJOK can help increase student motivation to actively participate in physical activities.(Lim et al., 2024),With a simple reward system, students can feel a sense of accomplishment and appreciation for their efforts, which in turn can increase their self-confidence and a spirit of healthy competition.(Roy et al., 2024),In the Papuan context, gamification can also function as a tool to teach social values, such as teamwork, mutual respect, and the importance of involvement in the community.(Wibowo et al., nd),However, the implementation of gamification in the interior of Papua must be done by considering the existing limitations. Access to sophisticated technology such as smartphones or computers is very limited in remote areas.(Setyo Guntoro et al., n.d.),Therefore, a traditional gamification 2024)approach is needed, ,Therefore, a traditional-based gamification approach, which leverages existing resources, such as local gaming tools, may be a more practical and effective option.(Tambaip et al. 2025)One of the main challenges in implementing gamification in the interior of Papua is the low awareness of the importance of physical education and sports.(Flores & Mean, 2025)People in this area focus more on more practical and direct activities, such as farming or hunting.(Riyanto et al., 2024)Therefore, it is important to adapt gamification by emphasizing the relevance of PJOK learning to the daily lives of students and the surrounding community. In addition, gamification can utilize local culture in game design. Some traditional Papuan games, which contain social and cultural values, can be modified to create more interesting and meaningful learning experiences for students.(Hasil et al., 2025),Thus, gamification not only functions as an educational tool, but also as a means to maintain and revive local traditions and culture.(Sabon & Telussa, 2024),Parental and community involvement is also important in the implementation of gamification. In the context of Papua, families and communities have a very large role in children's education. Therefore, involving parents and community leaders in designing and supporting gamification programs can increase the success of its implementation.(Widiyasari et al., nd),Active community participation can help create learning that is more relevant and acceptable to students.(Madada et al., nd)Evaluation of the influence of gamification in PJOK learning in the interior of Papua also needs to be carried out using an approach based on direct observation.(Kogoya et al., 2024),It is important to understand the extent to which gamification elements can change students' behavior, increase their motivation, and develop social skills necessary in everyday life.(Zukmadini et al., 2024),In this context, it is also necessary to see the long-term impact of the implementation of gamification on the physical and emotional development of students. In addition, the development of gamification must pay attention to the balance between game elements and the learning objectives to be achieved.(Dritsas & Trigka, 2025),The use of reward and challenge systems in gamification must be in accordance with the values to be taught in physical education and sports.(Damopolii et al., 2024)2025),Thus, gamification can be an effective means of creating a more enjoyable and beneficial learning experience for students.In the context of education in the interior of Papua, gamification can also play a role in introducing the concept of healthy and fair competition.(Ashilah et al.2025), , In a society that has high values of togetherness and collectivity, healthy competition can teach students about the importance of working hard, respecting each other, and achieving common goals.

(Roman et al., 2025), gamification in PJOK can introduce students to these concepts in a fun and easy-to-understand way.(Zhang et al., 2025),However, it is important to remember that gamification will not succeed without strong support from the government. educators, and the community. Therefore, educational policies that support the implementation of gamification in physical education and sports need to be considered.(Ahmed et al., 2025),Local governments need to provide training to teachers and other educational staff on how to implement gamification in learning activities at school.

Gamification in physical education learning activities at elementary school level in the interior of Papua with a focus on its influence on students' motivation, involvement, and socio-cultural development.(Micheal et al., 2025), this will analyze how elements of gamification can be adapted to the social and cultural context of Papua to create a more effective and relevant learning experience for students. Thus, gamification can be an important strategy in improving the quality of physical education and sports in the interior of Papua.(Bazargani et al., 2025)It is hoped that new ways can be found to overcome the challenges that exist in education in remote areas, while maintaining and developing local cultural values that are very important for Papuan society.

METHOD

Participants

This study used a descriptive statistical approach, pre-test-post-test to analyze the effect of gamification on Problem Based Learning in improving the quality of physical education and sports learning at the primary school level: Motivation of social and cultural character building in rural Papua Indonesia on Physical Education and Sport learning at primary school level in rural Papua. With 27 students involved in the main focus of this study, and can illustrate how the influence of gamification on the involvement of elementary school students in Papua in learning activities as well as changes in their social and cultural interactions. Data was collected through questionnaires measuring students' perceptions of gamification, including motivation, participation, and learning experiences

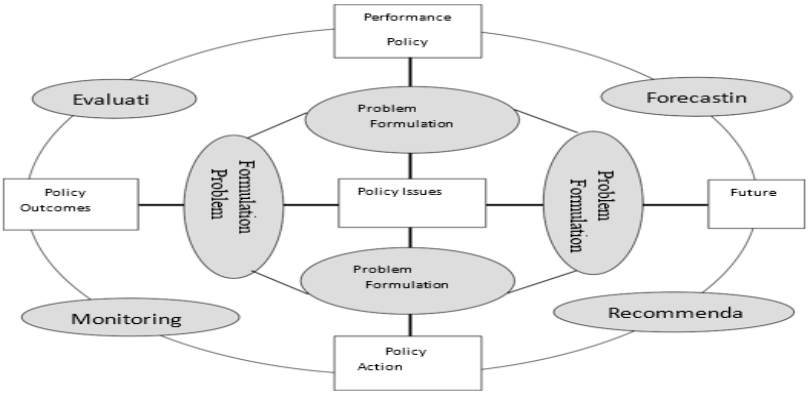

Figure 1. Cyclical process in policy Data collection process in learning

Table 1. Social And Cultural Character Motivation Items For Gamification-Based Learning

NO	Dimensions/Components	Code	Item/Items
A	Interest/Enjoyment	P.1	I liked the learning activities in the construction equipment gamification app.
		P. 1.2	I think the activities in the construction equipment gamification app are interesting.
		P. 1.3	The activities in this gamification app are fun to do.
		P.1.4	I found the activities in this gamification app boring. (R)
		P.1.5	The activities in this gamification app do not capture my attention. (R)
B	Perceived Competence	P.2.1	I think I did pretty well with the activities in this gamification app.

NO	Dimensions/Components	Code	Item/Items
		P.2	I feel like I can do the activities in this gamification app better than other students.
		P.2.3	After doing activities in this gamification app for a while, I felt competent.
		P.2.4	I am quite good at doing the activities in this gamification app.
		P.2.5	The activities in this construction equipment gamification app I can't do well. (R)
C	Effort/Importance	P.3.1	I put a lot of effort into the activities in this gamification app.
		P.3.2	I tried very hard on the activities in this gamification app.
		P.3	It is very important for me to do well on the tasks in this gamification app.
		P.3.4	I didn't put much effort into this gamification activity. (R)
		P.3.5	I don't allocate much energy to doing these gamification activities. (R)
D	Pressure/Tension	P.4.1	I don't feel nervous when doing activities in this gamification app. (R)
		P.4.2	I feel tense when doing tasks in this gamification app.
		P.4.3	I feel very relaxed doing activities in this gamification app. (R)
		P.4	I feel anxious when performing tasks in this gamification app.
		P.4.5	I feel stressed while doing the activities in this gamification.
English	Perceived Choices	P.5.1	I feel like I have choices in carrying out activities in this gamification app.
		P.5.2	I felt it was not my choice to do the activities in this gamification app. (R)
		P.5.3	I feel compelled to do the activities in this gamification app. (R)
		P.5.4	I did the activities in this gamification app because I wanted to.
		P. 5.5	I did the activities in this gamification app because I had no other choice. (R)
F	Value/Use	P.6.1	I think this gamification activity helped me learn to be brave during the pandemic.
		P.6.2	I think this gamification activity is important because it provides learning options during the pandemic.
		P.6.3	I believe that this gamification activity adds value to me.
		P.6.4	I feel that this gamification activity is a rewarding activity.
		P.6.5	Activities in this gamification app are important activities.
G	Results	P.7.1	In general, I feel highly motivated to learn when doing the activities in the construction equipment gamification app.
		P.7.2	In general, I feel that my motivation to learn has increased after doing this gamification activity.
		P.7.3	In my estimation, how well did I learn the construction equipment in this gamification activity?
		P. 7.5	Do you agree that a gamified learning approach to construction equipment can be a bold alternative to learning?

Research Design

This research is an experimental type using a quasi-experimental design model and a quantitative approach. This research uses pretest - posttest control design to see the effect of (GBL) learning. There is a measurement of initial ability before being applied in the learning process, after which there is a measurement after the application of the learning model. This study used 2 classes, namely the control class and the experimental class. The design of this research is as follows;

Table 2. Research Design

Class	Pre- Test	Treatment	Post- Test
Experiment	O1	X	O2
Control	O3	-	O4

Source: (Birnstiel & Morschheuser, 2024)

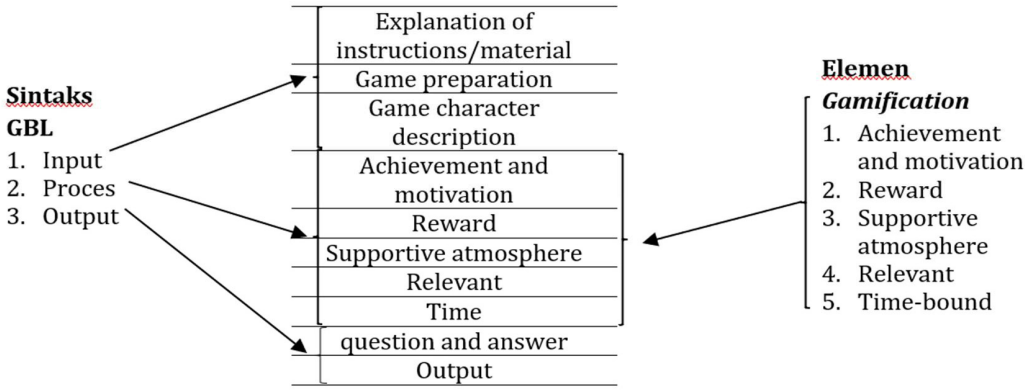

Chart 1. Student collaborative skills research flow school

The experimental class applied gamification-based learning (GBL) with Gamification, while the control class applied the Conventional model of Lecture method. The syntax of GBL consists of input, process, and output. Then integrated with gamification elements consisting of the achievement of character building social motivation of students in achieving awards, a supportive atmosphere, and relevant. The following is the design of GBL syntax integrated with Gamification elements.

Table 3. Results of even semester final exam scores for sports subjects in class III C and IV,V D

Class	Average
UAS III C	82,89
IV,V D	82,75

This study used 2 types of instruments, namely test and non-test instruments. The test instrument used was an essay test consisting of 10 questions. The test was conducted before the application of Gamification Based Learning (GBL), this was done to measure students' initial abilities. The test was also conducted after the application of GBL, this was done to measure the effect of the GBL model. The non-test instrument used was a questionnaire sheet to measure the collaborative skills variable. This questionnaire was filled in by students to assess themselves and their peers. The research test instrument was tested on class VI which was not used for research subjects. If the instrument meets its validity and reliability, then the instrument is good. The validity test of the instrument in this study using SPSS 25 using the Bivariate Pearson technique of 5% significance and the value of r table for 36 subjects of 0.339 resulted in a sig value for item no. 1 (0,012), no 2 (0.000), no 3 (0.002), no 4 (0.002), no 5 (0.000), no 6 (0.009), no 7, (0.017), no 8 (0.004), no 9 (0.000), and no 10

(0.013) so that each item of essay questions is declared valid (because the Sig value <0.000). r table value). While the reliability test uses Cronbach's alpha technique with a constant value of 0.60. The results of the Cronbach's alpha value. amounting to 0.712 which means greater than the constant value, so the instrument is declared reliable.

Data Analysis

Data on creative thinking skills using pre-test and post-test scores. Both values are processed and produce N-Gain values which will be used for further data analysis. Then, for collaborative skills data using self-assessment and peer assessment data. Both data will be averaged, and the results will be used for further data analysis. The classification of abilities and character formation in the formation of improving the character and social motives of students.

Table 4. Classification of social and cultural motivation skills and characteristics

Rate	Category
81 - 100	Very Collaborative/Creative
61 - 80	Collaborative/Creative
41 - 60	Moderately Collaborative/Creative
21 - 40	Less Collaborative/Creative
0 - 20	Not Collaborative/Creative

Source: Widoyoko in (Nurmayasari et al., 2022) (Wijaya et al., 2022)

Data processing in this study was carried out using descriptive and inferential statistical methods. The data were processed statistically and then described. Inferential statistical tests were carried out using parametric/non-parametric methods using multiple linear regression analysis to test the effect of independent variables on one or more dependent variables. In multiple linear regression analysis, the t test is used to test the effect of variables partially, while the F test is used to test the effect of variables simultaneously. Before hypothesis testing is carried out, prerequisite tests are first carried out which include normality and homogeneity tests of research data.

The normality test aims to determine whether the data is spread normally or not. The technique used in the normality test is Kolmogorov-Smirnov, which can be applied to both small and large samples. The normality test results for data on the application of the learning model (X) show a value of 0.075 for the experimental class and 0.133 for the control class, which means the data is spread normally. The normality test results for creative thinking ability (Y1) are 0.200 (experimental class pre-test), 0.123 (experimental class post-test), 0.122 (control class pre-test), and 0.200 (control class post-test), all of which indicate the data is normally distributed. The normality test results for collaborative skills (Y2) were 0.065 for the experimental class and 0.200 for the control class, which also showed the data were normally distributed.

Homogeneity test is conducted to obtain information whether the research data obtained is homogeneous or not. The technique used in this homogeneity test is levene which can show homogeneity of variances information from 2 to more data groups. The homogeneity test results for this study are 0.015 (creative thinking ability data) and 0.041 (collaborative skills data) which means not homogeneous. The decision for the prerequisite test in this study is normal but not homogeneous, so the hypothesis test is continued with the 't' test on the basis of making a decision that the two data are not homogeneous or called equal variance not assumed. The hypothesis testing process uses SPSS 25 for windows software.

RESULT AND DISCUSION

Information results regarding the amount of valid data and no missing data in this study. All the variables listed, including gender, age, class, game, motivation, participation, culture, social, group, and skills, had 27 valid data, with no missing data. This shows that the data used in this study is complete and reliable, which gives more confidence in the results of the analysis to be conducted. With 27 valid data in each category, researchers can ensure that all variables related to this study have been filled in completely. The existence of valid data is important because it provides a more accurate picture of the influence of gamification on physical education and sports learning activities in rural Papua. The availability of complete data also allows researchers to analyze relationships between different variables, such as the influence of gender, age, and grade on student motivation, participation, and skills in the context of gamification-based learning.

The application of Gamification Based Learning (GBL) with Gamification helps the sports learning process to be effective. Because GBL with gamification is very supportive of abilities and skills.(Torrado Cespón & Bárcena Toyos, 2025a) ,GBL encourages students to solve problems, one of which is the problem of cultural diversity. (Granados & De La Concepción Muñoz González, 2024), Followed by gamification, students become more collaborative with each other to discuss steps to minimize problems from cultural diversity appropriately. The GBL model has 3 stages, namely input, process and output. (Habachi et al., 2024),This model is integrated with gamification which has 5 elements, namely achievement and motivation, rewards, a supportive atmosphere, relevance, and time which are included in the process stage.Input is the initial stage in gamification-based learning (GBL). At this stage, the teacher provides instructions regarding the raw material of cultural diversity material to students. This helps students prepare themselves for the next stage.(Gupta et al., 2024), This stage is also used to introduce the gamification/game that is carried out at the next stage. This helps students understand the flow of learning with games to be more focused and careful.

Process is the second stage in Gamification Based Learning (GBL). At this stage is the process of playing in learning or game cycle. (Sargo Ferreira Lopes et al., 2024), it is at this stage that gamification elements are included, namely the existence of achievements, rewards, a supportive atmosphere, relevance and time. These gamification elements become part of the process stage. Students do group work to discuss social and cultural motivation character building issues. Gamification elements make the atmosphere more competitive, because students seem to feel challenged to get awards from games in this learning. Output is the third or final stage in gamification-based learning (GBL). (Das et al., 2024), at this stage a debriefing/question and answer session is conducted. The session helps students' understanding more formed related to cultural diversity material. After that, together students make conclusions from the material that has been played together. Finally, the teacher provides reflection and evaluation to straighten students' opinions after which the lesson will be closed.

The hypothesis test results of the effect of Gamification Based Learning with gamification on creative thinking skills using t statistics with the condition that equal variances are not assumed. The results of the value distribution and hypothesis testing results are as follows;

Table 5. Data distribution of social and cultural motivation ability of experimental and control classes

Interval	Category	Exp. Pre-test (f / %)	Exp. Post-test (f / %)	Control Pre-test (f / %)	Control Post-test (f / %)
81 - 100	Very creative	0 (0.00%) [2]	34 (100.00%) [3]	0 (0.00%) [4]	0 (0.00%) [5]
61 - 80	Creative	6 (18.00%) [6]	0 (0.00%) [7]	4 (12.00%) [8]	3 (9.00%) [9]
41 - 60	Moderately creative	20 (59.00%) [10]	0 (0.00%) [11]	14 (41.00%) [12]	17 (50.00%) [13]
21 - 40	Less creative	8 (23.00%) [14]	0 (0.00%) [15]	16 (47.00%) [16]	13 (38.00%) [17]
0 - 20	Not creative	0 (0.00%) [18]	0 (0.00%) [19]	0 (0.00%) [20]	1 (3.00%) [21]
	Total	34 (100%) [22]	34 (100%) [23]	34 (100%) [24]	34 (100%) [25]

Source: Primary data analysis results

The experimental class pre-test scores were only scattered in the less creative (f=8, 23%), moderately creative (f=20, 59%) and creative (f=6, 18%) categories. Post-test scores were centered in the

very creative category (f=34, 100%). In the experimental class pre-test scores were scattered in the less effective (f=16, 47%), moderately creative (f=14, 41%) and creative (f=4, 12%) categories. Then the post-test scores decreased and were scattered in the categories of not creative (f = 1, 3%), less creative (f = 13, 38%), moderately creative (f = 17, 50%), and creative (f = 3, 9%).

Table 6. Effect of Gamification Based Learning in shaping social and cultural character motivation

Test Type	Assumption	t	df	Sig. (2-tailed)
Psychomotor Ability Test	Equal variances not assumed	12.168	39.406	.000

Source: Primary data analysis results

Sports learning using gamification-based learning (GBL) with gamification effectively influences students' creative thinking skills. The results of data analysis show a significant value of 0.000 which is smaller than 0.005, indicating that the GBL model with gamification has a significant influence on students' creative thinking skills. Comparison of score frequencies also showed significant differences between the experimental and control classes. After the treatment, the value distribution in the experimental class was centered in the very creative category (f=34, 100%), while in the control class 50% were in the moderately creative category and the rest were scattered in the uncreative, less creative, and creative categories (f=1, f=13, f=3).

Table 7. t test based on indicators of the ability of students' social motive character using the application of gamification

Indicator	Sig. (2-tailed)
Fluency [28]	0.000 [29]
Flexibility (flexible thinking) [30]	0.000 [31]
Originality (original thinking) [32]	0.000 [33]
Elaboration (detailed thinking) [34]	0.000 [35]

Source: Primary data analysis results

The process stage in Gamification Based Learning that uses gamification has an impact on 21st century skills including creative thinking skills in students. This stage significantly impacts the indicators of fluency (fluent thinking), flexibility (flexible thinking), originality (original thinking) and elaboration (elaboration thinking), this is supported by the results of data analysis which shows the sig value. 0,000 < 0,005. Students really like games, especially gamification-based games.(Qian et al., 2024) ,Games used in learning help students' cognitive abilities.(Fitton Davies et al., 2024) ,The existence of gamification elements, namely achievement and motivation at the process stage, motivates students to reach the level displayed. Providing learning game levels, encourages students to be more fluent in generating ideas. (Molina-García et al., 2024) ,Students try to create answers quickly and precisely, so as not to miss the level.(Prieto-Andreu & Moreno-Ger, 2024) ,This triggers fluency in generating innovative ideas and fluency in criticizing the issue of diversity of social and cultural character motivation. In addition, the gamification element is a supportive atmosphere that makes students challenged on conflicts or problems displayed, such as cultural pluralism issues. The challenge used in the game raises a sense of challenge in problem solving so that it supports the ability to think flexibly. (Delage et al. 2024),, Students tend to be able to organize the problems given to the situation. This helps students think flexibly on the problem of cultural diversity in Malang city which is quite significant. Because students see from the context that they feel directly. It also helps students to think originality and elaboration. Students can plan steps to minimize the impact of cultural pluralism procedurally. This is the challenge of the game that includes conflicts or problems that arise due to cultural pluralism, can make students think of the right steps to minimize the impact felt at this time. Moreover, students must think about the right steps as a student and resident in inland Papua. Because it needs thinking according to the context and situation that students currently feel.

The influence of gamification-based learning on the formation of students' social and cultural motivation character

The hypothesis test results of the effect of Gamification Based Learning with gamification on collaborative skills using t statistics with the condition that equal variances are not assumed. The results of the value distribution and hypothesis testing results are as follows;

Table 8. Collaborative skills score of experimental and control classes

Interval	Category	Clas f	Experiment %	Kelas f	%
>80	Very Collaborative	17	50,00	0	0,00
>60 - 80	Collaborative	16	47,00	19	56,00
>40 - 60	Collaborative Enough	1	3,00	15	44,00
>20 - 40	Less Collaborative	0	0,00	0	0,00
≤20	Not Collaborative	0	0,00	0	0,00
Total		34	100,00	34	100,00

Source: Primary data analysis results

The value of collaborative skills in the experimental class was spread in the category of moderately collaborative (f = 1, 3%), collaborative (f = 16, 47%) and very collaborative (f = 17, 50%). While in the control class, the scores were scattered in the moderately collaborative (f = 15, 44%) and collaborative (f = 19, 56%) categories.

Table 9. Gamification Based Learning on Skills and the formation of students' social and cultural character.

Test Type	Assumption	t	df	Sig. (2-tailed)
Creative Thinking Ability Test	Equal variances not assumed	12.168	39.406	.000

Source: Primary data analysis results

Sports Learning using gamification-based learning (GBL) with gamification is effective for students' collaborative skills. This is supported by the results of data analysis which shows the sig value. 0,000 < 0,005. The comparison of the frequency of scores also appears significant between the experimental class and the control class. In the experimental class, the distribution of scores after treatment was about 50% in the very collaborative category. While in the control class, about 56% were in the collaborative category.

Table 10. t test based on collaborative skills indicators

Indicator	Sig. (2-tailed)
Work productively with others [38]	0.000 [39]
Actively participate and contribute [40]	0.000 [41]
Co-responsible for getting the job done [42]	0.000 [43]
Respectful attitude [44]	0.000 [45]

Source: Primary data analysis results

Gamification Based Learning (GBL) with gamification has an impact on 21st century skills including collaborative skills. This stage significantly impacts the indicators of working productively with others, actively participating and contributing, being jointly responsible for completing work and an attitude of respect, this is supported by the results of data analysis which shows a sig value. 0,000 < 0,005. Because the game is immersion so that it can create the involvement of all students together in the game. (Gkintoni et al., 2024), The nature of immersion in the game applied in Gamification Based Learning (GBL) affects working productively and mutual respect. It is also supported by the achievement and relevant elements of gamification. This is because the game atmosphere supports students to work actively with each other in groups to excel their respective groups in reaching higher levels. (Westmattelmann et al., 2025). This supports students trying to solve the issue of cultural diversity together. Students can also gather points of view related to the issue of cultural pluralism from each other to get a complete concept in answering the challenges of cultural pluralism material games.

The input stage of gamification-based learning (GBL) impacts on students' active participation and contribution skills. In this stage, the initial preparation is done before going to the process stage. Based on observations, students tend to be active in dividing the jobdesc or responsibilities of each member during the preparation and introduction of the game flow. (Price et al., 2022), During the playing process, each group member understands their respective functions and performance. Students also divide roles in the group, who plays the role of chairman will be decided by consensus. So that students can complete planning to minimize the impact that arises due to cultural diversity procedurally with each student task.

The reward and time elements of gamification in the process stage of Gamification Based Learning (GBL) support responsible problem-solving skills. With rewards, students feel challenged so that their group finishes within the allotted time and get an award. (Yazdi et al., 2024) , students tend to coordinate with each other and fill in the shortcomings of the jobdesc of unfinished group friends. Thus, students can take a role in discussing complex cultural diversity issues.

The Effect of Gamification on Creative Thinking Ability and Collaborative Skills

The results of hypothesis testing of the effect of Game Based Learning with gamification on creative thinking skills and collaborative skills using the F test. The results of the value distribution and hypothesis testing results are as follows;

Table 11. The influence of Gamification Based Learning in character building and student motivation

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	9953.285 [48]	2 [49]	4976.642 [50]	85.414 [51]	.000 [52]
Residuals	3787.230 [53]	65 [54]	58.265 [55]		
Total	13740.515 [56]	67 [57]			

Source: Primary data analysis results

Simultaneously, gamification-based learning (GBL) with gamification effectively affects students' creative thinking ability and collaborative skills. This is supported by the results of data analysis which shows the sig value. 0,000 < 0,005. The factor of influence is the process part of the GBL

model which is a process of playing in learning, helping students feel enjoyment in learning. As for the process part, GBL is integrated with gamification elements, namely achievement and motivation, rewards, a supportive atmosphere, relevance, and time. And the treatment according to the achievement and relevant elements encourages students to think creatively. Because, the achievement of levels makes students strive to reach all existing levels, so that students will try to be fluent in generating an idea and quickly answer the questions given.(Camacho-Sánchez et al., 2023) ,As for the use of appropriate games that greatly support the learning atmosphere, of course it can attract student focus and help students in attributing situations. The use of games that have a storyline makes students participate in the story, so that students participate in thinking in problem solving to think of a way out in the learning process.

Treatment according to the elements of a supportive atmosphere and time can encourage collaborative skills between students.(Liu & Lipowski, 2021) ,In addition, the treatment of the reward element encourages students to strive for collaborative skills simultaneously. This is because, awards are given to each group that gets the highest points (collaborative). The award can encourage students to be more creative in solving a problem, and collaborate with the group to get the award. Whatever the form of the award, students must be encouraged to compete against other groups so as to produce a competitive atmosphere. (Fonseca et al., 2023), The advantages of applying the gamification-based learning (GBL) model with gamification are that students become more enthusiastic in learning because the game makes students feel challenged and competitive. Students who tend to be silent also feel challenged so that they are encouraged to try to think and contribute to the group. In addition, the application of GBL also has the disadvantage that the classroom atmosphere becomes chaotic. So the teacher needs to have good classroom management skills. The emergence of a sense of not wanting to lose to other groups so that it makes arguments between groups. Then, the preparation for the implementation of GBL with gamification takes a long time.

DISCUSION

The results of this study indicate that the application of Gamification-Based Learning (GBL) with gamification has a significant effect on students' creative thinking ability and collaborative skills. Hypothesis testing using t-statistics with the condition that equal variances are not assumed shows a significance value (p-value) of 0.000, which is much smaller than 0.005. This explains that there is a significant difference between the experimental class that implemented gamification and the control class that did not. Data on the distribution of students' creative thinking ability scores in the experimental class showed that in the pre-test, students were mostly in the ''moderately creative'' category (59%), while after the post-test treatment, 100% of students were in the ''highly creative'' category. In contrast, the control class showed a less encouraging distribution, with only 50% of students in the ''moderately creative'' category and mastering the other categories. This shows that gamification not only improves creative thinking ability, but also motivates students to achieve better results.

The process stages in GBL are proven to have a positive impact on students' creative thinking skills. Gamification elements such as achievement and motivation encourage students to try harder in achieving the set targets. Students who are engaged in the game tend to be faster in generating ideas and solutions. This is in accordance with previous research which shows that gamification elements can increase student engagement and motivation. (Anggraeni et al., n.d.-b.2025), Indicators of creative thinking skills such as fluency, flexibility, originality, and elaboration showed significant results with a p-value of 0.000. Students who played in the context of gamification felt more engaged and motivated to think creatively. Digital-based games used in learning improve students' cognitive skills, helping them to organize and defeat complex issues, such as cultural plurality. In the context of collaborative skills, the analysis showed that the experimental class also experienced significant improvement. About 50% of students in the experimental class were in the "highly collaborative" category after the implementation of gamification. Meanwhile, the control class was dominated by students in the "collaborative" category. (Çakır et al., n.d.2025),This shows that gamification not only enhances creativity but also cooperation skills among students.

Gamification treatments that include rewarding elements and a supportive atmosphere encourage students to collaborate. The reward given to the group that achieves the highest points creates a positive competitive atmosphere. Students strive to not only complete tasks but also actively contribute to the group. This is in line with the research. (Masfi et al., 2025), which emphasizes the importance of awarded elements in improving collaborative skills. However, implementing GBL with

gamification also has its challenges. The classroom atmosphere that sometimes becomes difficult requires good classroom management from the teacher. Inability to cope with classroom dynamics can disrupt the learning process. Therefore, training teachers in classroom management and gamification implementation is necessary to maximize the potential of this method. Previous research, such as that conducted by (Amalin Ulfah et al., n.d.2025), shows that gamification elements can increase student engagement and motivation. The results emphasize that gamification contributes to the improvement of students' learning experience. However, this study has a more specific focus on two main aspects: students' creative thinking ability and collaborative skills. Using the Gamification-Based Learning (GBL) approach, this study showed a significant impact on creative thinking ability, where 100% of students in the experimental class moved to the "highly creative" category after the treatment. This shows that the implementation of gamification not only increases motivation, but also produces noticeable changes in students' cognitive abilities.

The advantage of this study lies in the use of more in-depth analysis methods, with the t-statistic hypothesis test showing a significance value (p-value) of 0.000. (Torrado Cespón & Bárcena Toyos, 2025b), showing a significant difference between the experimental and control classes. In addition, this study also explored specific elements of gamification, such as achievement and a positive competitive atmosphere, which encouraged students to collaborate and try harder,This differentiates this study from previous, more generalized research, by providing concrete evidence of how gamification can be applied to improve collaborative skills and creativity.This study also highlighted the challenges faced in implementing GBL with gamification, such as the need for good classroom management. This shows the awareness of complex classroom dynamics and the importance of training for teachers in implementing this method. In addition, the study notes that gamification can transform students who tend to be passive into more active participants, creating an inclusive learning environment. Thus, the results of this study not only provide evidence on the effectiveness of gamification, but also offer practical recommendations for its implementation in the classroom, making it a valuable contribution in the context of education in Papua.

Another advantage of implementing GBL is that students who tend to be passive can be encouraged to participate more actively. Gamification creates an inclusive learning environment, where all students feel they have an important role in the learning process. This helps students to not only learn from teaching but also from interaction with their peers. In conclusion, gamification-based learning is proven to be effective in improving students' creative thinking ability and collaborative skills. This research suggests that the GBL method with gamification can be applied more widely in educational contexts, especially in learning that requires collaboration and creativity. As a way forward, it is important for educational institutions to provide the necessary training and resources for teachers to implement gamification effectively. This will ensure that all students get the maximum benefit from innovative learning methods.

Ethics Committee Statement

The publication ethics used in this research refer to The Committee on Publication Ethics (COPE) and Regulation of the Head of LIPI Number 5 of 2014 concerning the Code of Ethics for Scientific Publications, Regulation of the Minister of Research, Technology and Higher Education of the Republic of Indonesia Number 9 of 2018 concerning Accreditation of Scientific Journals.

Conflict of Interest Statement

The authors declare no conflicts of interest related to this article.

Data Availability Statement

Data is available upon request to the correspondence author, as this is specific information on culture-based education in Papua Indonesia.

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