

## Jumathji: Its Acceptability as an Interactive Learning Material for Enhancing Skills in Solving Linear Equation

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### ABSTRACT

The study evaluated the acceptability of JUMATHJI as a tool for enhancing students' skills in solving linear equations. Mathematics teachers from public schools in Quezon City reviewed the material and assessed its usefulness, subject matter, quality, and appeal to the target user. The board game was rated highly across all indicators, with teachers noting its relevance and ability to motivate students to engage with the subject matter. Findings showed that JUMATHJI supports the development of critical and logical thinking—skills essential in mathematics—and helps build students' confidence and positive attitudes toward the subject. The researchers recommend integrating JUMATHJI into instruction to enhance students' problem-solving abilities and encourage active engagement in learning linear equations.

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## INTRODUCTION

Mathematics is often referred to as the "Queen of Sciences" because it plays a crucial role in various fields, such as technology and industry (Maheshappa, 2013). It is also a fundamental subject that we use throughout our lives, involving skills such as computing, analyzing, measuring, counting, and describing. Even in our daily routine, mathematics is present, from calculating the fare in a public utility vehicle to measuring the distance from the terminal to school.

Despite its importance, many students dislike mathematics, making it challenging for teachers to teach it effectively. Teachers use various techniques, styles, and approaches to engage their learners, such as incorporating games into their lessons. Games are not only a source of entertainment for students but can also motivate them to learn, as it provides an enjoyable way of grasping a lesson. For instance, board games can offer entertainment and learning (Greenhalgh, 2019). However, games should be challenging, as they can bore students. A game should include challenges that encourage engagement and consider the players' cognitive, affective, and psychomotor skills. Through games, students can practice what they are learning, and it can motivate them to learn more.

To address the challenge of students' lack of interest in mathematics, researchers created a board game called "JUMATHJI." Inspired by the game Jumanji, the researchers incorporated math into the game's name, as it revolves around the subject. The game aims to provide an interactive environment for students to develop their social, thinking, and problem-solving skills, which are useful in game and non-game environments.

## THEORETICAL REVIEW

This study is supported by Everett Rogers' (2010) Theory of Diffusion of Innovation. The researchers will use the theory to conceptualize the acceptability level of JUMATHJI as a learning material in Mathematics.

Table 1. Stages of Theory of Diffusion of Innovation

Stage	Definition
<b>Knowledge</b>	The individual is initially introduced to a new idea, concept, or innovation but may still need a complete understanding. They may seek additional information at this stage.
<b>Persuasion</b>	The person is curious about the innovation and actively seeks out information and details about it.
<b>Decision</b>	The individual evaluates the benefits and drawbacks of adopting an innovation before deciding whether to adopt or reject it.

In this study, the researchers utilized the Diffusion of Innovations Process by Everett M. Rogers, as shown in Figure 1, as their guide. The Knowledge stage included all ideas and features of the proposed board game "JUMATHJI," which aimed to enhance problem-solving skills involving linear equations. The Persuasion stage involved using questionnaires and interviews to determine the

acceptability of the game as a learning tool. In the Decision stage, the researchers assessed the game's acceptability and potential to aid teachers and students in their learning experience. The feedback obtained from this study will help the researchers determine the usefulness of "JUMATHJI" and its potential to improve the learning process.

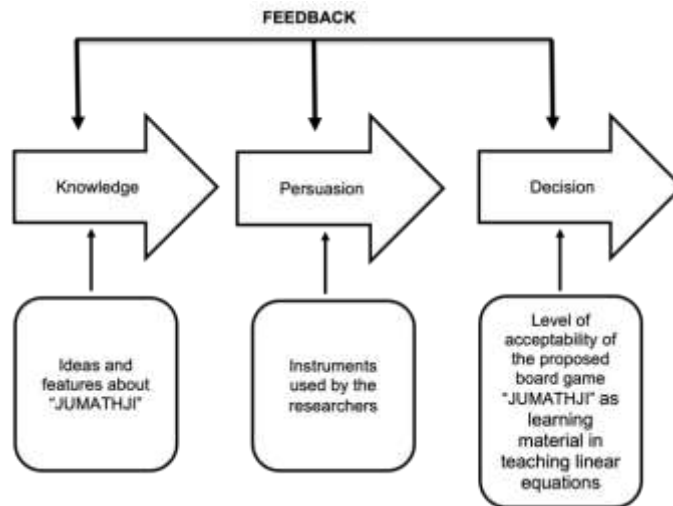


Figure 1. Conceptual Framework

## METHODOLOGY

In the study, the researchers utilized the descriptive research method. This method involves identifying, describing, and determining what exists (Ethridge, 2004) and aims to comprehensively understand current issues or problems through data collection (Fox & Bayat, 2007). The researchers distributed survey forms with a rating scale for respondents to complete. Additionally, they presented a board game to evaluate the suitability of JUMATHJI as a Mathematics learning material.

The researchers selected three public high schools in District II of Quezon City to participate. The total population of public high school teachers in these schools was 60. Of this population, 36 teachers were chosen as respondents for the study, representing 60% of the total population. The researchers obtained their sample through random sampling using the fishbowl method. The selected schools were Batasan Hills National High School, Commonwealth High School, and Judge Feliciano Belmonte Sr. High School.

The researchers utilized a survey questionnaire to gather data that would help determine the level of acceptance of JUMATHJI as a Mathematics learning material. The survey contains questions that would guide the respondents' answers and assist in determining whether JUMATHJI is an acceptable learning material.

The researchers used a researcher-made instrument, which was modified and evaluated by three experts from the Polytechnic University of the Philippines, College of Education. The instrument includes indicators such as subject matter, quality, usefulness, and appeal to the target user, as well as the

respondents' profiles and evaluations of acceptability. The researchers used the scale below to obtain what is required in this study.

Table 2. Acceptability Scale

Description	Numerical Equivalent
Highly Acceptable	4
Acceptable	3
Fairly Acceptable	2
Poorly Acceptable	1

The consolidated points from the respondents' answers to each item were interpreted as follows:

Table 3. Verbal Interpretation of Acceptability of JUMATHJI

Mean	Description
3.25-4.00	Highly Acceptable
2.50-3.24	Acceptable
1.75-2.49	Fairly Acceptable
1.00-1.74	Poorly Acceptable

The study's collected data was organized and sorted according to the research design and formulated problems. To present and interpret the results, the data underwent coding, tallying, and tabulation, utilizing the following statistical tools:

1. Frequency and Percentage Distribution: The researchers used a Frequency Table to summarize the distribution of values, while percentage distribution referred to the fraction or ratio of an item with 100 as the denominator. This statistical tool was used to obtain the overall percentage of the respondents, calculated through the following formula.

$$\% = \frac{f}{N} \times 100$$

where: % = percentage  
 f = frequency or number  
 N = number of respondents

2. Sample Mean: The researchers used the sample mean to determine the average score of JUMATHJI's acceptability as a teaching-learning material, covering subject matter, content, clarity, usefulness, language, and style, among public secondary Mathematics teachers. Mean is the ratio of the

sum of all the responses in the dataset and the number of respondents. The formula in finding the mean is:

$$Mean = \frac{\sum_{i=1}^n X_i}{N}$$

Where:

$X_i$  = number of  $i$ th responses

$N$  = number of respondents

- ANOVA (Analysis of Variance): ANOVA is a statistical model that evaluates whether the means of different groups are equal. The researchers used this tool to determine whether there is a significant difference in the level of acceptability of JUMATHJI as a teaching-learning material based on the respondents' profiles, including age, civil status, years in service, and highest educational attainment. In ANOVA, the variance observed in a particular variable was partitioned into different groups based on the source of variations.

## RESULTS AND DISCUSSION

The level of acceptability of the proposed learning material was evaluated and assessed by the teacher-respondents as to the following variables:

Table 4. Evaluation Mean of JUMATHJI in terms of Subject Matter

Statements	Mean	Verbal Interpretation
1. The learning material is aligned to support the objectives of the subject matter.	3.94	Highly Acceptable
2. The learning material supplements the objectives of the subject matter.	3.81	Highly Acceptable
3. The learning material for the subject matter is relevant, interesting and self-motivating.	3.86	Highly Acceptable
4. There is sufficient and varied information in the learning material.	3.86	Highly Acceptable
5. The ideas and concepts from Math are well expressed in the learning material.	3.83	Highly Acceptable
<b>Overall Mean</b>	<b>3.86</b>	<b>Highly Acceptable</b>

The acceptability level of the proposed board game "JUMATHJI" in terms of subject matter is shown in Table 4. The data indicates that the statement "The learning material is aligned to support the objectives of the subject matter" has the highest score among indicators, with a mean score of 3.94, indicating that it is highly acceptable. The statements "The learning material for the subject matter is relevant, interesting and self-motivating" and "There is sufficient and varied

information in the learning material" both have a mean score of 3.86 and are also highly acceptable. The statement "The ideas and concepts from Math are well expressed in the learning material" has a mean score of 3.83 and is also highly acceptable. The statement "The learning material supplements the objectives of the subject matter" had the lowest score among the indicators in this variable but is still considered highly acceptable. The overall mean of the responses in this variable is 3.86 and is interpreted as highly acceptable.

According to Dio (2015), teachers may use student engagement projects as a teaching strategy for students to better relate to the subject matter while also learning and enjoying it. This implies that the learning material must be relevant, interesting, and self-motivating for the subject matter. Dio's study suggests that the game can be used as a strategy to make teaching more interesting and relevant while integrating the lesson. Engaging students in their own learning can help them discover the relevance of the subject matter and motivate them to learn the lessons.

Table 5. Evaluation Mean of JUMATHJI in terms of Quality

<b>Statements</b>	<b>Mean</b>	<b>Verbal Interpretation</b>
1. The learning material is organized and clear.	3.89	Highly Acceptable
2. The rules of the learning material are understandable and easy to follow.	3.92	Highly Acceptable
3. The concept of the learning material is well explained.	3.97	Highly Acceptable
4. The learning material can easily be recognized.	3.83	Highly Acceptable
5. The learning material is relevant to the lesson.	3.94	Highly Acceptable
<b>Overall Mean</b>	<b>3.91</b>	<b>Highly Acceptable</b>

Table 5 displays the level of acceptance for the proposed board game "JUMATHJI" in terms of quality. The data collected shows that the statement "The concept of the learning material is well explained" received the highest mean score of 3.97 and is considered highly acceptable. Similarly, the statements "The learning material is relevant to the lesson" and "The rules of the learning material are understandable and easy to follow" received mean scores of 3.94 and 3.92, respectively, and were interpreted as highly acceptable. The statement "The learning material is organized and clear" also received a highly acceptable interpretation with a mean score of 3.89. However, the statement "The learning material can easily be recognized" had the lowest mean score of 3.83 but was still considered highly acceptable. Overall, the mean score for quality was 3.91 and interpreted as highly acceptable.

According to Silva et al.'s (2010) study, collaboration between universities and urban schools is crucial and highly needed. The National Assessment of

Education Progress (2004) reported a significant difference in mathematical understanding and skills between low-income and middle to high-income families. The use of games can assist in closing this gap in mathematical abilities and skills, highlighting the importance of introducing board games as learning materials in mathematics for urban communities. Therefore, the learning material must be clear, organized, and well-explained. This will enable students to use this material to hone their math skills with the guidance of their teachers and bridge the gap between learning concepts and understanding the lesson. Introducing a well-explained and easily recognizable learning material can help students improve their education quality.

Table 6. Evaluation Mean of JUMATHJI in terms of Usefulness

Statements	Mean	Verbal Interpretation
1. The learning material prepares the students to think logically and critically.	3.81	Highly Acceptable
2. The learning material serves as ready-made learning material for the teachers and students.	3.86	Highly Acceptable
3. The learning material provides opportunities for the development of mathematical skills among students.	3.92	Highly Acceptable
4. The learning material provides adequate information on the topic presented.	3.75	Highly Acceptable
5. As a whole, the learning material can facilitate teaching for enhancing skills in solving linear equations.	3.81	Highly Acceptable
<b>Overall Mean</b>	<b>3.83</b>	<b>Highly Acceptable</b>

Table 6 evaluates the proposed board game "JUMATHJI" based on its usefulness. The table shows that the statement "The learning material provides opportunities for the development of mathematical skills among students" received the highest mean score of 3.92, considered highly acceptable. The statement "The learning material serves as ready-made learning material for the teachers and students" is the second highest indicator with a mean score of 3.86, also considered highly acceptable. "The learning material prepares the students to think logically and critically" and "As a whole, the learning material can facilitate teaching for enhancing skills in solving linear equations" both received a mean score of 3.81 and are considered highly acceptable. The statement "The learning material provides adequate information on the topic presented" had the lowest mean score of 3.75, but it is still considered highly acceptable. The overall mean score for the board game quality is 3.83, which is also highly acceptable.

According to Treher (2011), board games can effectively provide and organize information to make complex problems and mathematical concepts more concrete and understandable. When played together, board games can help all members learn together without anyone being left out. The challenges presented in a game can also help players verify their understanding and transform abstract concepts into tangible ones.

Treher (2011) also suggests that team-based and individual games require critical thinking and strategy, which can help students hone their skills in critical thinking, communication with others, and brainstorming. Therefore, learning materials should be designed to prepare students to think logically and critically. Making the board game a logical and well-designed material can be an effective tool for teaching students to use their skills, especially when faced with abstract problems. Furthermore, learning materials should provide opportunities for the development of mathematical skills among students. If the board game is executed effectively, it can help students realize their learning and make complex mathematical concepts more readily understandable.

Table 7. Evaluation Mean of JUMATHJI in terms of Appeal to the Target User

<b>Statements</b>	<b>Mean</b>	<b>Verbal Interpretation</b>
1. The learning material will captivate the learner's interest.	3.86	Highly Acceptable
2. The learning material will stimulate the learner's interest in answering the different exercises.	3.78	Highly Acceptable
3. The learning material will enable learners to develop their critical thinking.	3.75	Highly Acceptable
4. The learning material will strengthen the students' perceptive in Mathematics.	3.75	Highly Acceptable
5. The learning material is worth of time, effort, and energy of the students.	3.83	Highly Acceptable
<b>Overall Mean</b>	<b>3.79</b>	<b>Highly Acceptable</b>

The acceptability level of the proposed "JUMATHJI" is presented in Table 7, which indicates that the statement "The learning material will captivate the learner's interest" has the highest mean of 3.86, indicating that it is highly acceptable to the target user. The statements "The learning material is worth the time, effort, and energy of the students" and "The learning material will stimulate the learner's interest in answering the different exercises" have means of 3.83 and 3.78, respectively, which are also interpreted as highly acceptable. The mean for both "The learning material will enable learners to develop their critical thinking" and "The learning material will strengthen the students' perception in

Mathematics" is 3.75, the lowest among the indicators but still considered highly acceptable. The overall mean for the level of acceptability in terms of its appeal to the target user is 3.79, which is highly acceptable for the respondents.

According to Sherman et al. (2009), teachers should provide ample opportunities and experiences in problem-solving, challenging questions and activities, and real-life problems or situations when teaching mathematics. This allows students to relate to the subject and gain experience solving challenging problems involving reasoning. Suppose students are taught in a way that relies too heavily on memorization without proper integration of real-life situations. In that case, they may need help to retain knowledge of math concepts and may not be exposed to problem-solving, reasoning, and generalizations.

Engaging students in mathematics is crucial as it helps them become more engrossed in the subject and see its relevance to their lives, as Sherman et al. (2009) noted. This means that learning material should be able to students' perception of Mathematics. Suppose students are taught in a way that only focuses on the subject matter without proper integration of real-life situations. In that case, they may end up hating the subject or finding it difficult to relate to Mathematics. Using learning materials or board games that integrate the subject's lesson can strengthen students' perception of Math while engrossing them in the subject matter.

Table 8 shows the summary of the acceptability of the proposed learning material from the Public School Teachers, confirming with this subject matter, quality, usefulness, and appeal to the target user with the mean of 3.86, 3.91, 3.83, and 3.79, respectively, which all got the interpretation of Highly Acceptable. These variables gained an overall mean of 3.85, which is also interpreted as Highly Acceptable.

Table 8. Evaluation Summary of the Acceptability of the Proposed JUMATHJI in all variables

	<b>Mean</b>	<b>Verbal Interpretation</b>
Subject Matter	3.86	Highly Acceptable
Quality	3.91	Highly Acceptable
Usefulness	3.83	Highly Acceptable
Appeal to the Target User	3.79	Highly Acceptable
<b>Overall Mean</b>	<b>3.85</b>	<b>Highly Acceptable</b>

***Comparison in the Level of Acceptability of JUMATHJI when the Respondents are grouped according to their Profile***

Table 9 presents the results of a study on the acceptability of proposed learning materials based on the gender of the teachers. The data shows that the subject matter received the highest indicator with a computed p-value of 0.988, followed by usefulness with 0.861, quality with 0.844, and appeal to the target user with 0.235. The overall average of all indicators is 0.732, which is higher than the 0.05 level of significance.

According to Martin et al. (2016), while some students may prefer teachers of the same gender for personal and emotional reasons, academic performance is

often the primary concern. Students focus on how well the teacher teaches, regardless of gender, and how they can make learning simple and accurate.

This suggests that the gender of the teacher does not significantly affect the acceptability of the proposed learning materials. As long as the teacher can effectively develop their students' learning through extensive teaching, it can positively impact their growth as an individual.

Table 9. Significant Difference in the Level of Acceptability of JUMATHJI in terms of their Gender

	<b>p-value</b>	<b>Decision</b>	<b>Remarks</b>
Subject Matter	0.988	Do Not Reject Ho	There is no significant difference
Quality	0.844	Do Not Reject Ho	There is no significant difference
Usefulness	0.861	Do Not Reject Ho	There is no significant difference
Appeal to the Target User	0.235	Do Not Reject Ho	There is no significant difference

In Table 9, it is shown that the level of acceptability of the proposed learning material based on Civil Status is the same. The indicators' computed p-values are 0.603 for subject matter, 0.355 for quality, 0.829 for usefulness, and 0.752 for appeal to the target user, with an overall average of 0.635, more significant than the level of significance.

According to the study of Oselumese et al. (2016), a teacher's Civil Status does not significantly impact their performance. The Civil Status is only identified to determine any weaknesses to be addressed and to help them cope so it will not affect their classroom instruction. It implies that a teacher's effectiveness will depend on their performance, not their status. Therefore, the Civil Status of the respondents is similar in the level of acceptability of the proposed learning material.

Table 10. Significant Difference in the Level of Acceptability of JUMATHJI in terms of their Civil Status

	<b>p-value</b>	<b>Decision</b>	<b>Remarks</b>
Subject Matter	0.603	Do Not Reject Ho	There is no significant difference
Quality	0.355	Do Not Reject Ho	There is no significant difference
Usefulness	0.829	Do Not Reject Ho	There is no significant difference
Appeal to the Target User	0.752	Do Not Reject Ho	There is no significant difference

Table 11 evaluated the proposed learning material based on the Highest Educational Attainment of the Teachers. The computed p-values for subject matter, quality, usefulness, and appeal to the target user were 0.611, 0.493, 0.258, and 0.872, respectively. The average computed was 0.559, which is higher than the level of significance.

According to a study by Zhang (2008), having an advanced degree or additional units in a teacher's field does not guarantee their ability to teach secondary school students effectively. While teachers are trained in their respective fields may need help transferring their knowledge to high school students. This highlights the importance of a teacher's willingness, creativity, and innovativeness in teaching rather than their highest educational attainment.

Therefore, the proposed learning material can assist teachers in executing their lesson plans, regardless of their highest educational attainment. As such, the acceptability of the proposed material is similar based on the respondents' Highest Educational Attainment.

Table 11. Significant Difference in the Level of Acceptability of JUMATHJI in terms of their Highest Educational Attainment

	<b>p-value</b>	<b>Decision</b>	<b>Remarks</b>
Subject Matter	0.611	Do Not Reject Ho	There is no significant difference
Quality	0.493	Do Not Reject Ho	There is no significant difference
Usefulness	0.258	Do Not Reject Ho	There is no significant difference
Appeal to the Target User	0.872	Do Not Reject Ho	There is no significant difference

According to Table 12, the level of acceptability of the proposed learning material was the same based on the age of the respondents. The p-values for each indicator, including subject matter, quality, usefulness, and appeal to the target user, were computed and ranged from 0.290 to 0.865, with a mean of 0.628. These values were more significant than the level of significance.

Sánchez-Mena et al. (2017) found that the age of teachers did not affect how they viewed the execution of game-based learning activities in their teaching. However, they did suggest that teachers may need a different approach when introducing learning materials to account for the generation gap. Despite this, teachers varied in their perception of board games as either a hindrance or a contribution to student learning.

Table 12. Significant Difference in the Level of Acceptability of JUMATHJI in terms of their Age

	<b>p-value</b>	<b>Decision</b>	<b>Remarks</b>
Subject Matter	0.541	Do Not Reject Ho	There is no significant difference
Quality	0.865	Do Not Reject Ho	There is no significant difference
Usefulness	0.814	Do Not Reject Ho	There is no significant difference
Appeal to the Target User	0.290	Do Not Reject Ho	There is no significant difference

According to Table 13, the proposed learning material was analyzed about the number of years teachers have been in service. The data shows indicators with p-values ranging from 0.361 in subject matter to 0.911 in appeal to the target user. The overall average was 0.467, which is higher than the level of significance.

Zhang (2008) conducted a study that found years in service do not strongly impact student learning compared to other factors. While it is true that teachers with more years of experience may not necessarily be more effective, it does not mean that using learning materials cannot help improving their teaching practices. Therefore, the level of acceptability of the proposed learning material was similar based on the number of years teachers have been in service.

Table 13. Significant Difference in the Level of Acceptability of JUMATHJI in terms of their Years in Service

	<b>p-value</b>	<b>Decision</b>	<b>Remarks</b>
Subject Matter	0.361	Do Not Reject Ho	There is no significant difference
Quality	0.135	Do Not Reject Ho	There is no significant difference
Usefulness	0.460	Do Not Reject Ho	There is no significant difference
Appeal to the Target User	0.911	Do Not Reject Ho	There is no significant difference

## CONCLUSIONS AND RECOMMENDATIONS

The study has produced some critical findings. Firstly, most respondents are female, indicating that many mathematics teachers are women. Secondly, it suggests that marital status does not impact teaching effectiveness, as most teachers are married. Additionally, about half of the teachers have completed a Bachelor's Degree with Master's Degree units, indicating a desire for higher education. Moreover, the age group of 31-40 is the most common, indicating that age is not a barrier to pursuing a teaching career. Lastly, most respondents have eight years of teaching experience or less, revealing a mix of new and experienced teachers.

Regarding the acceptability of the proposed board game, the study shows that it aligns well with subject matter objectives, making it highly suitable for teaching mathematics. The quality of the board game is also excellent, as it is well-explained, relevant, easy to understand, organized, and user-friendly. Furthermore, the usefulness of "JUMATHJI" is highly acceptable, indicating its potential to enhance mathematical skills critical thinking, and serve as a valuable teaching tool. The game's appeal to the target audience is also highly acceptable, suggesting it will engage learners and strengthen their mathematical abilities.

Finally, the data analysis regarding significant differences in acceptability shows that gender, civil status, educational attainment, age, and years in service do not significantly affect the acceptability of the proposed board game. In essence, the acceptance of the learning material remains consistent regardless of these demographic factors.

Based on the findings and conclusions, the researchers recommend the following actions. They suggest that teachers use JUMATHJI as a learning tool to improve students' ability to solve linear equations. Additionally, students are encouraged to engage with the game to enhance their skills in this area. The study's primary objective is to improve students' mathematics skills while enjoying the game, which will also help achieve the secondary objective.

#### **FURTHER STUDY**

For future research, the following suggestions are made: (1) provide a diverse range of linear equations, (2) incorporate a local TV series or settings into the game, and (3) gather students' perspectives on the learning material.

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