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Freshmen College Students' Perception of Effectiveness of JC Snakes and Ladders Game in Improving Mathematical Ability

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ABSTRACT

The game "JC Snakes and Ladders" was developed to improve mathematical ability. It was pilot tested among freshmen college students of Romblon State University Cajidiocan Campus. This paper presents the evaluation results of the developed game in terms of motivation such as attention, relevance and reliability; user experience such as satisfaction, immersion, challenge, social interaction and fun; and knowledge. Results showed that JC Snakes and Ladders is perceived to be effective in raising students' motivation, experience, and knowledge. Utilization of the intervention is recommended.

Keywords: *JC snakes and ladders game, Mathematics in the Modern World, Learning Gains, Immersion, Challenge, Satisfaction.*

INTRODUCTION

Mathematics in the Modern World is described as a course on the nature of Mathematics, including appreciation of its practical, intellectual, and aesthetic dimensions, and application of Mathematical tools in daily life. It allows the students to look beyond the common perception of Mathematics as nothing more than a collection of formulas but of beauty through natural patterns and potent language ruled by logic and reason (CHED, 2013).

Mathematics is fundamental in day-to-day living. It serves as the bedrock of man's daily existence. Mathematics is everywhere, as it is said. People deal with Mathematics every time they wake up, look at the clock, or walk. Mathematics teaches reasoning power, creativity, problem-solving ability, abstract or spatial thinking, and practical communication skills. When asked about mathematics, many people said it is difficult and tedious because it always deals with numbers, shapes, and problems they do not care about. As a result, it is difficult for teachers to pique their students' interests. That is why teachers are constantly looking for new strategies, approaches, and techniques to assist students in improving their Mathematics performance.

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Teachers are using intervention to ensure that all students succeed in dealing with today's challenges. When assisting students with difficulty in Mathematics, the teacher must select an appropriate time and strategy. The foundation of Mathematics in the Modern World reveals that the course addresses the stigma through interactive and facilitative encounters that emphasize its practical application. These interactions are influenced by the teacher's skills as well as students' characteristics and difficulties.

In the classroom, games can be a valuable tool for math. It also allows students to expand their knowledge and reasoning abilities. Thus, teachers should give students multiple opportunities to play and enjoy the game, then allow students to emerge with new patterns, relationships, and strategies as a result of their experiences (Osman & Bakar, 2012). Enjoyable and motivating games appeal to people of all ages, and students can learn about basic number concepts such as sequence counting, one-to-one correspondence, and computation strategies.

The new normal situation is challenging for students, especially in Mathematics. Learners' usual activities, such as face-to-face interaction, have been replaced by modular learning, online learning, and blended learning; all of which impact on each student's learning style and competencies. Thus, the researchers came up with a game-based learning solution to help students improve their math skills.

To attain the course's goals, the researchers developed "JC Snakes and Ladders," a game that

summarizes the competencies discussed in the course Mathematics in the Modern World, to improve students' mathematics abilities, aid students' learning, emphasize real-world applications, and promote good study habits. Because this team game requires critical thinking to win, it addresses students' mental and social aspects and the stigma associated with mathematics.

METHODOLOGY

Research Design

The cross-sectional survey design was used in this study to evaluate the developed "JC Snakes and Ladders" game. In a cross-sectional study, the investigator measures the outcome and the exposures in the study participants at the same time. This approach was primarily used to assess present attitudes, beliefs, and behaviors (Creswell, 2012).

The Samples

All officially enrolled first-year students (n=60) of Romblon State University – Cajidiocan Campus during the second semester of the school year 2020-2021 provided relevant data and information for this study. Majority of the respondents were female (80%), while 20% were male. The participants were from the BTLEd program (n=15), BEEd program (n=10) and the rest were from BSEd Math, English and Science (n=35).

The Intervention

The "JC Snakes and Ladders" game is named after its creators, Judy Ann and Crystal Jeane, and is divided into three difficulty levels: easy, average, and difficult. The easy level focuses on number series and sequences, the average level focuses on variables, and the difficult level focuses on logical operations. The game was designed using the syllabus for the course Mathematics in the Modern World.

The game is played using a "JC Snakes and Ladders" board, cards, paper, and pen. Players are divided into groups of three and each group selects a representative to play against another group. The game begins when each player simultaneously chooses a card to determine their turn order. The number on the card is the number of spaces a player moves on the board. If a player lands on a tile with a question, they must answer it and write it down on the provided paper. If a player's card lands on top of a snake, they slide down to the bottom of the snake. If a player's card lands at the base of a ladder, they immediately climb to the top. The first player to reach the finish line is declared the winner.

Data Gathering

The researchers obtained approval from the campus director before conducting their study. After obtaining consent, they approached the target respondents and sought their participation. All respondents were invited to participate in a board game session in a classroom setting, where the game's rules were explained to them. The session lasted 20-30 minutes, followed by completion of an evaluation form. Participation in the survey was based on the respondents' voluntary consent, respecting ethical considerations.

The study utilized a survey questionnaire divided into the demographic profile and evaluation of the board game. Part one asked for the respondent's profile information, such as age, sex, and course. The second part consisted of questions for the evaluation of the board game, adapted from the instrument created by Savi, Wangenheim, Ulbricht, and Vanzin (2010) and was presented on a Likert scale ranging from 1 to 5, with 1 representing "strongly disagree" and 5 representing "strongly agree."

Data Analysis

Mean was used in analyzing the students' evaluation of the "JC Snakes and Ladders Game." Descriptive interpretation and level of each of the respective scales are detailed below.

RESULTS AND DISCUSSION

The evaluation results of the respondents on the developed "JC Snakes and Ladders" in terms of attention, relevance, reliability, satisfaction, immersion, challenge, social interaction, fun, and knowledge are shown in Table 1.

Table 1. Evaluation of the respondents in terms of attention, relevance, reliability, satisfaction, immersion, challenge, social interaction, fun, and knowledge.

Parameters	Mean	VD
A. Attention		
1. There was something interesting at the beginning of the game that caught my attention.	4.62	SA
2. The design of the game interface is attractive.	4.45	A
Grand Mean	**4.54**	**SA**
B. Relevance		
1. It became clear to me how the content of the game is related to things I already knew.	4.32	A
2. I liked the game so much that I would like to learn more about the subject covered by it.	4.15	A
3. The content of the game is relevant to my interests.	4.12	A
4. I could relate the content of the game to things I've seen, done, or thought.	4.23	A

Parameters	Mean	VD
5. The content of the game will be useful to me.	4.40	A
Grand Mean	**4.24**	**A**
C. Reliability		
1. The game was harder to understand than I would like.	2.57	MA
2. The game had so much information that it was difficult to identify and remember the important points.	2.67	MA
3. The activities of the game were very difficult.	2.33	D
4. I could not understand a good portion of the game material.	2.18	D
Grand Mean	**2.44**	**D**
D. Satisfaction		
1. I learned some things with the game that were surprising or unexpected	3.92	A
2. I felt good after completing the game.	4.18	A
Grand Mean	**4.05**	**A**
E. Immersion		
1. I did not realize the time passing while playing.	3.92	A
2. I struggled to get good results in the game.	3.33	MA
3. There were times when I wanted to give up the game.	2.67	MA
4. I felt stimulated to learn from the game.	3.72	A
Grand Mean	**3.41**	**MA**
F. Challenge		
1. I liked the game and did not feel anxious or bored.	4.00	A
2. The game kept me motivated to continue using it.	4.25	A
3. This game is adequately challenging for me; the tasks are not too easy or too difficult.	4.13	A
Grand Mean	**4.13**	**A**
G. Social Interaction		
1. Collaboration in the game helps learning.	4.53	SA
2. The game supports social interaction between players.	4.62	SA
Grand Mean	**4.58**	**SA**
H. Fun		
1. I would play this game again.	4.23	A
2. I was hoping for the game to end soon.	3.03	MA
Grand Mean	**3.63**	**A**
I. Knowledge		
1. After the game, I can remember more information related to the theme presented in the game.	3.93	A
2. After the game I feel that I can better apply the themes related to the game.	4.27	A
Grand Mean	**4.10**	**A**

Legends:
VD – Verbal Description
SA – strongly agree; A – agree; MA – moderately agree; D - disagree

The respondents felt the game was generally good. It related to their existing knowledge, piqued their attention, was in line with their personal interests, allowed for linkages with their experiences, and was viewed as valuable, as evidenced by their finding it relevant (*M*=4.24). However, they expressed skepticism regarding the game's dependability (*M*=2.44), notably in relation to its degree of difficulty, amount of information presented, and readability. Despite this, they said they were happy with the game (*M*=4.05), thought it was educational and offered surprise or unexpected learning experiences (*M*=3.92), and that it made them feel good (*M*=4.18).

Studies have demonstrated that educational games are more likely to be viewed as relevant and engaging when they correspond with learners' prior knowledge and personal interests (Savery & Duffy, 2001). The respondents' worries regarding the game's dependability, particularly with regard to the degree of difficulty, information overload, and comprehensibility, are in line with other research emphasizing the significance of creating games that strike a balance between challenge and accessibility (Tuomisto, 2018).

The respondents' assessments of immersion were generally favorable (*M*=3.41). They felt inspired to learn from the game, encountered modest hurdles, and felt engaged while playing, albeit they occasionally had periods of frustration. In a physics game, Hamari et al. (2016) investigated the connection between immersion and learning. They discovered that greater immersion, as evidenced by a feeling of presence, involvement, and flow, was linked to improved learning results. Deep cognitive processing and increased motivation were fostered by immersive game experiences, which improved learning.

The challenge level of the game was rated favorably (*M*=4.13). The respondents agreed and voiced their delight, showing that they relished the game, didn't feel anxious or bored, and discovered a good balance between challenge and fun.

The respondents gave the social interaction component of the game a good rating (*M*=4.58). They were adamant that social connection among players was efficiently promoted by the game (*M*=4.62) and that

teamwork inside the game improved learning (*M*=4.53). The respondents stressed the benefits of teamwork and social interaction for learning, showing that the game exceeded their expectations in this area. Everyone who participated said they enjoyed the game and were willing to play it again in the future (*M*=3.63). They also showed no sign of wanting the game to end, indicating that they were enjoying it and wanted to keep playing.

The respondents gave their newfound knowledge a positive evaluation (*M*=4.10). They concurred that the game improved their recall of details pertaining to the game's theme and expressed confidence in their improved ability to apply the taught concepts in practical settings.

These findings support the idea that game-based learning can improve student engagement and appreciation for mathematics. According to White & McCoy (2019), game-based learning can increase students' mathematics awareness, as long as it is implemented in the classroom. Additionally, playing games in the classroom can help students feel more at ease and reduce their perception of mathematics as being difficult. According to Ke (2019), students can improve their mathematical knowledge through participating in problem-solving activities in gaming.

The findings show that participants gave the game generally positive evaluations, with social interaction receiving the highest marks, followed by attention, relevance, difficulty, and knowledge. The mean for social interaction was the highest (M=4.58), showing a high degree of agreement and placing it top among the dimensions that were considered. Attention came in second (*M*=4.54) while relevance came in third (*M*=4.24). Additionally, challenge and knowledge were rated favorably, placing fourth and fifth, respectively, (*M*=4.13 and *M*=4.10). Satisfaction came in sixth (*M*=4.05). Fun ranked sixth (*M*=3.63) which is considered to be moderately favorable. Immersion (*M*=3.41) also garnered a relatively favorable appraisal, placing ninth overall. The lowest rating was given to reliability(M=2.44) suggesting disagreement and placing it tenth.

Although there were differences in the rankings and means for each particular component, the aggregate mean of 3.90 indicates that the respondents expressed overall agreement and a good opinion of the game across these dimensions. The results of the respondents' evaluations of the "JC Snakes and Ladders Game" are consistent with previous research on player satisfaction and game evaluation. Participants gave positive ratings to the characteristics of social interaction, attention, relevance, difficulty, and knowledge, which is consistent with the significance of these elements in game evaluation.

The study by Kiili et al. (2014) emphasizes the value of using flow theory to evaluate the caliber of educational games. A high level of flow experience and a favorable game evaluation are influenced by the flow experience characteristics of control, clarity of goals, and challenge-skill balance.

This is consistent with the "JC Snakes and Ladders Game's" high ratings for challenge, information, and satisfaction. In addition, Yu et al.'s study from 2021 stresses the influence of difficulty and engagement on learning outcomes in game-based learning settings. The positive scores for challenge and difficulty in the "JC Snakes and Ladders Game" are consistent with the positive impact of challenge on learning, both directly and through greater engagement.

Additionally, the research by Johnson et al. (2015) offers insights into how players perceive various game genres, including the newly emergent MOBA games genre. This study emphasizes that cooperative games, which place an emphasis on social interaction, may have lesser levels of immersion but can still be satisfying due to competitiveness and teamwork. This result is consistent with the high social interaction rating in the "JC Snakes and Ladders Game".

The good ratings of the "JC Snakes and Ladders Game" across a variety of dimensions are supported by the available research, which also offer theoretical justification for the significance of social interaction, attention, relevance, difficulty, and knowledge in game evaluation and player experience.

CONCLUSION

The study concludes that with its intriguing interface, the game was able to capture the attention of its users and fully immerse them in exciting and relevant mathematical concepts. The students did not just enjoy the game; they were able to learn the subject quickly as it helped them understand the presented concepts clearly. Furthermore, the structure of the game, in which students competed with other groups, fostered their collaboration and communication skills through group discussion, removing students' misperception that Mathematics is dull and monotonous. The students learned to constructively assist one another to ensure that all group members understand how to solve the problems given in order to win. Incorporating the "JC Snakes and Ladders Game" into the classroom is advantageous to student learning.

In relation to that, Mathematics teachers may use "JC Snakes and Ladders" developed by the researchers to teach the concepts and enhance the students' skills in course Mathematics in the Modern World. Mathematics teachers should develop attention, relevance, satisfaction, immersion, challenge, social interaction, fun and knowledge in instructional materials like interventions for the students to gain mastery of the concepts and skills in solving mathematics problems.

Mathematics teachers should modify approaches to make learning fun and enjoyable since students learn best when they find activities engaging and useful.

Utilization of the intervention is recommended for other teachers experiencing similar problems as presented in this study. Researchers may also try the game in other disciplines to generate evidence on its effectiveness in helping students improve their academic achievement.

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AUTHORS' CONTRIBUTIONS

J.L. and C.J.R are the researchers and the game designers, C.A.R planned the research design and served as the Statistician of the study and conducted the data analysis, and C.J.J. served as the consultant and the language expert.

CONFLICT OF INTEREST

This investigation holds no conflict of interest across and between the samples of the investigation, institution where it was conducted, and other affiliations.

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