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Exploring Motivational Differences in Competitive and Cooperative Game-Based Learning through Educational Board Games

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Abstract: The purpose of this study was to determine whether educational board games have a significant impact on learning motivation by developing the information media literacy educational board game Hi-Life. It also examined the differences in learning motivation between the competitive group and the cooperative learning group through a randomized experimental design. A total of 26 students from a national university in northern Taiwan participated in the study, 14 students in the control group for cooperative game-based learning and 12 students in the experimental group for competitive game-based learning. Through the analysis of the Mann-Whitney U test, the results showed that the dimension of Relevance was significant in both the experimental and control groups. Although the rest of the dimensions are not significant, the overall data showed that the average values of the three dimensions of Relevance, Confidence and Satisfaction were all higher than 3.5. The students demonstrated a favorable learning motivation in the ARCS model after playing the educational board game.

Keywords: Game-based learning, competitive game-based learning, cooperative game-based learning, learning motivation

1. Introduction

Because technology enhances the pace of information exchange, people often receive the latest information about their lives through smart mobile devices such as computers and cell phones. As technology advances, people can post their own comments or share information on social media, which has raised concerns about the reliability of information. Thus, information media literacy has become an important issue that people need to be aware of. Therefore, there is an urgent need to develop innovative instructional material of information media literacy nowadays.

Game-based learning refers to the reimagining of learning tasks to make them more engaging and meaningful, ultimately leading to effective learning outcomes (Plass et al., 2020). Moreover, game-based learning incorporates various motivational elements for learners, such as enjoyment, competition, cooperation, and challenges (Olejniczak et al., 2020). In the realm of competitive and cooperative game-based learning, certain studies indicate that both competition and collaboration can provide beneficial learning effects for students, fostering a harmonious overall teaching atmosphere and promoting active engagement in the classroom (Rodríguez et al., 2023).

Collaborative game-based learning enhances the positive atmosphere in the classroom and encourages students to actively participate in learning activities (Naumoska et al., 2023). Competitive game-based learning makes learning more enjoyable and increases

student engagement and motivation. However, it may also lead to negative teaching environments and detrimental effects if not well-designed, emphasizing the importance of effective instructional design (Altawalbeh et al., 2023).

The sample of this study was drawn from students who took the theories and practice of digital learning at a national university in Taiwan. They were randomly divided into two groups: the cooperative group as a control group and the competitive group as an experimental group. Participants will learn information media literacy through educational board games. The study attempted to investigate the effect of game-based learning on learning motivation. It will also explore whether there was a difference in learning motivation between the cooperative group and the competitive group. Therefore, the research questions are as follows: (1).Did educational board games have a significant impact on learning motivation of information media literacy? (2).Was there a difference in learning motivation of information media literacy between competitive game-based learning and cooperative game-based learning?

2. Literature

2.1 Educational Board Games

Recently, game-based learning (GBL) has become popular in both teaching and learning. Compared to traditional learning methods, GBL can increase the effectiveness and efficacy of learning (Lin, 2019) and is more likely to increase motivation to learn (Plass et al., 2015). Among the many types of GBL, the design of a board game is the most commonly used method. Educational board game refers to use the teaching materials related to educational themes to design the board game. Students are immersed in the contexts or story situation to explore and learn through an event or storyline. In order to improve students' learning effectiveness and stimulate their learning interest and motivation while transforming the traditional lecture-based teaching approach, educational board games have been recently integrated into the curriculum to enable students to learn through playing the games.

2.2 Competitive vs cooperative GBL

Apart from playing board games, some studies have incorporated other elements into course design such as competition and cooperation in GBL. For example, researchers like Kirschner et al. (2011) gave students the opportunity to work individually or collaboratively to solve biology-related problems. Results showed that students were better able to handle complex and cognitively demanding problems when working cooperatively. Fu et al. (2009) helped students learn about computers through the web-based game-based learning; and findings suggested that both cooperative and competitive learning elements can boost students' enjoyment of learning and stimulate different types of knowledge growth. Students are more likely to exhibit stronger analytical skills when competition is introduced. On the other hand, cooperative learning helps create a greater degree of generalized abilities.

3. Method

The developed instructional board game was employed in this empirical study, with four information media literacy-related themes of copyright, personal assault, fake news, and fraud. A total of 26 students from a national university in northern Taiwan participated in the study, with 14 students in the control group and 12 students in the experimental group. The three-lesson experiment period with a total of 120 minutes was planned for the study. Prior to the study, the instructor explained information media literacy and rules of board games in 20 minutes. Then, the intervention was conducted using the designed themes in the board game. After the game, students completed the questionnaires on the learning motivation.

The study used the ARCS Learning Motivation Scale developed by Keller (2010), which consists of four dimensions: Attention (with an alpha value of .83), Relevance (with an alpha value of .81), Confidence (with an alpha value of .92), and Satisfaction (with an alpha value of .90). In this study, 4 to 5 questions were selected from each dimension, with a total of 17 questions. The questions were scored on a 5-point Likert scale, with a score of 1 for "strongly disagree" to 5 for "strongly agree". The definitions and sample questions are shown in the table below.

Table 1. ARCS model

Element	Definition	Questionnaire contents
Attention	Attract students' interest and curiosity	The application of this educational board game appeals to my curiosity in many ways.
Relevance	Make the needs of the students relevant to their objectives and foster a positive attitude toward learning	I can connect the board game's themes to things I've discovered, accomplished, or considered in my own life.
Confidence	Support students in believing that they can successfully learn and apply what they have learned	I am confident to be able to learn this course through this educational board game.
Satisfaction	Enabling students to feel a sense of satisfaction and accomplishment after learning	I feel satisfied when I have completed the activities in this educational board game.

4. Result

4.1 The post test of ARCS learning motivation

Table 2 shows the scores of ARCS after playing board games. According to finding, the mean value of attention is 3.10, relevance 3.58, confidence 3.50, and satisfaction 3.93. The three dimensions' scores—relevant, confident, and satisfied—are all greater than 3.5. The three demonstrates of the students' learning motivations were achieved after playing educational board games.

Table 2. Result of descriptive statistics on ARCS

	N	Min.	Max.	*M*	*SD*
Attention	26	2.50	4.25	3.10	0.47
Relevance	26	2.25	4.75	3.58	0.51
Confidence	26	2.80	4.20	3.50	0.41
Satisfaction	26	3.00	5.00	3.93	0.57

4.2 The post test of ARCS learning motivation using Mann-Whitney U test

Table 3 presents the difference in posttest scores between the control group and the experimental group using Mann-Whitney U test. The results revealed that the only dimension which differed significantly was Relevance (U = 37.50, p = .015). All other dimensions were not significantly different. This finding shows that the story of board games is relevant to the real-life or actual contexts in the competitive scenario. The results also suggests that when designing the game, students can be given real-life examples to play that are relevant to their

own lives or that they have studied, considered, or reflected on in their own lives with competitive pressures.

Table 3. Result of Mann-Whitney U tests for the experimental and control groups on ARCS

	Control group			Experimental group			Mann-Whitney	*p*
	N	*M*	*SD*	*N*	*M*	*SD*	U	
Attention	14	2.92	0.27	12	3.29	0.52	47.50	.051
Relevance	14	3.36	0.49	12	3.83	0.42	37.50	.015*
Confidence	14	3.46	0.40	12	3.45	0.44	83.50	.979
Satisfaction	14	3.79	0.63	12	4.10	0.46	62.50	.255

*p<.05

5. Discussion and conclusions

The sample of this study consisted of 26 students who were enrolled in a class on the theory and practice of digital learning. They were randomly divided into two groups: the cooperative group for the control group and the competitive group for the experimental group. Through Hi-Life, an instructional board game created in this study, students can access information media literacy relevant to life-related information. In this study, the impact of educational board game learning on learning motivation was investigated, along with exploring whether there was a difference in learning motivation between the cooperative group and the competitive group.

Through the analysis of the Mann-Whitney U test, the results showed that the dimension of Relevance was significant in both the experimental and control groups and the rest of the dimensions of ARCS are not significant. This suggests that information media literacy learning through board games have no significant effect on the ARCS learning motivation. The overall mean values of the three dimensions of relevance, confidence, and satisfaction are all higher than 3.5, despite the fact that there is no significant effect on each ARCS learning motivation dimension. This indicates that the students' ARCS learning motivation is still positive after playing the board game. This also aligns with the research conducted by Rodríguez et al., where both competition and collaboration can provide meaningful learning outcomes for students. Furthermore, collaborative game-based learning and competitive game-based learning could make learning more enjoyable and increase student participation and learning motivation (Naumoska et al., 2023; Altawalbeh et al., 2023).

In addition, only Relevance was found to be significant in the Mann-Whitney U test results, perhaps because the story situations of the board games were more relevant to students' daily lives. When students played the board games, they were able to associate them with situations that were related to their daily lives or experiences that had happened to them. In addition, the mean values of the experimental group were partially larger than those of the control group, which could be inferred from the fact that the competitive feature was more motivating to the students than the cooperative feature. This finding also echoes Fu et al.'s (2009) finding that students show higher analytical ability when competition is present. In other words, during the process of playing the board game, students compare their own experience with the story situation of the board game and analyze it to obtain scores.

The study aimed to investigate whether educational board games have an impact on the ARCS learning motivation, with the limited focus on the educational themes of information media literacy. Therefore, the research limitation is the challenging to determine whether the results of this study can be applied to other domains as well. In the future, it is expected to increase the comparison of pre- and post-tests results between the control group and the experimental group in the future. The sample size can also be increased to ensure greater confidence in the results of the learning difference in the ARCS motivation.

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