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Effects of Incorporating Augmented Reality into a Board Game for High School Students' Learning Motivation and Acceptance in Health Education

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Abstract: In traditional schools, where education and teaching tend to be subject-oriented, the standardization of the teaching materials of health education courses would be obscurely related to know-how of daily life. This frustrates the learners from developing the awareness of engagement, thereby decreasing their willingness to acquire new information or skill. Therefore, in this study, a board game assimilating augmented reality (AR) into health education is presented. It associates the card game, slides, and learning sheets gamification teaching model with the learning experience; and proposes the efficacy of the board games mingled with augmented reality to enhance the motivation in learning and confidence in technology. In this experiment for a health education board game, 52 high school students participated in this experiment. There were 25 in the experimental group (with AR) and 27 in the control group (without AR). The IMMS (instructional material motivation survey) and the TAM (technology acceptance model) are applied to acquire quantitative data for examination. The findings are as follows: (1) The acceptance was significantly affected by the integration of AR into the health education board game and (2) the learning motivation was significantly affected by the integration of AR into the health education board game.

Keywords: health education; game-based learning; board game; augmented reality; ARGBL; CSLS

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1. Introduction

In conventional schools, teaching strategies were prone to be subject-oriented, and the lack of variation in providing adequate teaching materials for health education destablized the connection to the experience of daily life. The standardization of course materials hardly arouses learners' learning motivation [1].

Learning can often be boring when learners lack motivation. Therefore, motivating learners has become an important factor of effective learning [2]. Over recent years, GBL (game-based learning) has been extensively utilized in teaching and learning. Compared with traditional learning methods, GBL can relatively improve effectiveness and increase motivation by making learning positive and informative [3].

Nowadays, there are various types of GBL, and board games consist of the most commonly used game-based teaching methods. Many courses are integrated into board games. With the advancement of technology, board games have gradually begun to add different elements to attract learners' attention and participation. The integration of augmented reality (AR) into GBL is one of the teaching tools used in recent years [4]. ARGBL may affect students' learning motivation, learning achievement, and academic performance [5]. Many research results also identified the integration of AR into GBL advanced teaching [6–9]. In 1989, Brown et al. [10] proposed the contextual learning theory; in the process of interaction between the learner and the context, the learner explores and acquires knowledge from personal experience and applies it flexibly. The promotion policy of health education urgently needs to be taken into consideration regarding the issues of living and contextualization. The learner can construct knowledge in the AR environment. The AR can guide students through contextual learning and allow them to experience the context of the desired learning area; therefore, combining AR with games can consolidate connection between health education and real life scenarios.

In addition to having appropriate teaching tools, there is still a need for appropriate teaching models to cooperate with the implementation. To enrich the learning process and achieve the integration of effective teaching and knowledge content, gamification teaching activity with card-games, slides, and learning-sheets (CSLS) is introduced. Huang et al. [11] stated that teaching activity of gamification combined with card games can enhance learners' motivation to participate in learning activities, achieve appropriate scaffolding guidance, and further promote learners' learning effectiveness. Therefore, this research will introduce this teaching model to make the whole game learning more complete and smooth.

The purpose of integrating digital tools into education is not to replace traditional schools but to improve the educational process. Based on the above content, to help high school students familiarize themselves with health education and improve their learning motivation and willingness to learn, we have developed a set of table games combined with AR, applied it to health education courses, and utilized CSLS as the additional implement to profoundly further the readiness of learners. The instructional material motivation survey (IMMS) and the technology acceptance model (TAM) are employed to obtain quantitative data for analysis. The influence of engaging AR in the board game for the better learning motivation has been emphasized, as well as its scaffold on learners' acceptance of the gamification as the learning aid for health education.

Based on the above discussion and motives of enhancing health education, the objectives of this study are as follows:

(1) To discuss the effect of integrating AR with the board game on learning motivation.
(2) To discuss the effect of integrating AR with the board game on acceptance of the game.

2. Related Work

The CDC's [12] research mentions that health education involves the use and abuse of alcohol and drugs, healthy diet/nutrition, mental and emotional health, personal health and wellness, physical exercise, safety and injury prevention, sexual health, and smoking and violence prevention. Lin's research [13] identified that planned health education courses cannot only improve students' ability to maintain and promote health but also help them prevent diseases.

Chan [1] indicated that traditional school education and teaching subjects tend to be subject-oriented, and the content of health medicine courses is easily out of touch with life. It is difficult for students to apply learned knowledge in real life, which makes learners less involved and lowers their willingness to learn. Moreover, the standardization of course materials hardly arouses learners' learning motivation. Chien [14] stated that to meet the trend of health education, a set of teaching methods that are diversified, life-oriented, and contextual are needed.

Through health education, everyone can learn the importance of health and the various factors by which disease can endanger health and establish correct healthy behaviors and lifestyles. However, it may be difficult to improve learning willingness and motivation if only traditional teaching methods are used. As a result, the issue triggered the interest of the researcher for further exploration.

The AR adds virtual objects to the real scene that stands between virtual reality and the real environment.

AR applications are widely used. AR can be seen in various fields such as news, tourism, sports, and business. The use of AR can be an exciting experience for its users [15].

In recent years, the development and trend of AR in the field of education have gradually attracted the attention of various scholars. Many scholars have also begun to study the application of AR in subject-related development and teaching, such as nature, mathematics, and English [16–19].

The AR technology is a very suitable teaching tool. It can be used to build a learning context to promote and stimulate learners' contextual interest. Additionally, it can increase attention and interest in the learning process [20]. Hung et al. [21] mentioned that compared with traditional textbooks, AR not only promotes learning but also increases learners' motivation for learning.

From the above literature it comes out that the application of AR in teaching field can not only bring the user closer to the real environment and virtual scene but also increase the user's understanding of the learning content. In addition to enhancing the learning effectiveness of users, it also brings users learning pleasure and generates learning motivation and enthusiasm.

GBL aims to conform learning into games. Learners can obtain knowledge during the game through the learning method of games, and then, achieve the purpose of learning. In recent years, GBL has received more and more attention and has been widely used in the field of education to actually let learners practice, which can help them remember what they learned. Compared with traditional education, GBL can effectively improve learners' learning effectiveness, and the observation and practice through hand-eye coordination can enhance the learning experience [22].

Chen and Lin [23] indicated that using game features to change learning motivation can enhance students' learning experience and achieve better learning results. Wu's [24] research mentioned that GBL vocabulary exercises can attract students' attention and interest. GBL has a high learning effect and provides positive feedback on learning motivation. Juan and Chao [25] identified that the learning motivation of game players is stronger than that of students participating in the lecture and they show better learning effects. GBL can stimulate learners' attention and interest and help them gain knowledge, thereby generating a high degree of satisfaction.

Based on the above, the effect of learning through games is apparent. The method can make the originally boring class content more interactive and make the learning process more interesting. Such learning methods can not only promote learners' learning motivation, intentions, and interests but also enhance learning effectiveness.

The incorporation of board games into teaching has gradually become a mainstream method in teaching. Wally, Bartfay, and Emma [26] promoted health science in schools through a board game and received significant improvement in the learning of anatomy and physiology, diet, and the relevant lifestyle and risk factors for cardiac diseases and cancer development. Carvalho et al. [27] mentioned that a board game can stimulate the players' curiosity, facilitate interaction between participants, and serve as an auxiliary tool for knowledge construction. Li et al. [28] integrated AR with a board game, where learners exhibited a higher level of flow status and acceptance of technology, which significantly increased their relevant knowledge on energy and carbon reduction.

From the above-related research, it comes out that board games can positively influence teaching and learning, as well as enable learners to actively participate in learning, and furthermore, enhance learning motivation. In these studies, it can also be seen that board games are widely used in curriculum learning. Therefore, game-based teaching has become an important teaching method today, confirming that games are attractive and enable people to play enthusiastically. When used in teaching, it can make people learn actively.

The Educational Game development group of the E-Learning Research Center, National Taiwan University of Science and Technology (NTUSTMEG) developed an innovative gamification teaching activity using CSLS.

The simple card gamification teaching model is composed of three basic media: card games, slides, and learning sheets. These three media have their own cognitive presentation characteristics and advantages. Teachers can use common presentation technology in the classroom with card game methods and study sheets that are more simplified than ordinary table games. The design of card games focuses on peer interaction and self-study motivation; briefings provide a contextual introduction, which can help learners focus and study sheets can help learners review [29]. Research by Huang et al. mentioned that CSLS can improve students' motivation to participate in learning activities and achieves appropriate scaffolding guidance, thereby promoting learners' learning effectiveness [30]. Chen et al. assisted the teaching of geography in secondary schools through CSLS, and the results of the study showed that learners have significantly improved their learning effectiveness, mental flow, acceptance, affection, and attitude [31].

From the above content, it comes out that self-learning motivation and peer interaction will affect the learning situation, and this teaching model allows learners to focus on learning. Therefore, to allow learners of this study to improve their cognitive presentation characteristics, which is AR combined with health education board games to understand the direction of the game faster and attract learners to learn actively, a gamification teaching model such as the simple card gamification teaching model is introduced.

3. Research Methods

This research will take the curriculum of health education as the main purpose to design and create a tabletop game and combine it with AR. The research objects are 52 grade-one senior high school students; certain students are assigned to the experimental (AR health education board game) group, whereas the others to the control group (no AR health education board game) in the teaching experiment. Both groups used CSLS and underwent a pre-test, experiment, and post-test to explore the impact of teaching tools and to probe the impact of AR in a board game on learning motivations.

3.1. Augmented Reality-Based Board Game for Health Education

The authors of the current study estimate that through this board game, learners will be able to comprehend their medical knowledge even more so that they will strive to learn everything there is to learn. Hence, the name "Get ahead in medical knowledge." The overall visual design is based on blue-green tones, which are the colors of surgical gowns or hospital beds that we can see in the medical world. Red, white, and yellow are used as auxiliary colors, which represent the blood, white robe, and hope, respectively (as shown in Figure 1 below). This research has developed two types of health education games: one is the AR health education board game and the other is the health education board game. The two experimental settings differ only in whether AR is added or not. In Figure 2, O indicates that this tabletop game has this accessory, and X indicates that this tabletop game does not have this accessory. A tablet can be used in the AR health education board game to scan question card and AR report. It uses the RAVVAR app. When the question card is placed on the AR report and scanned with a tablet, relevant information about the question will appear. Additionally, the non-AR health education board game designed graphics on the back of the question cards to provide AR version users with the same information. Question Card: Eight subjects, and approximately 56 questions including Department of Genitourinary (GU), Department of Chest Medicine (CM), Department of Family Medicine (FM), Department of Neurology (NS), Department of Otolaryngology (ENT), Department of Gastroenterology and Hepatology (GH), Department of Obstetrics and Gynecology (OBS), and Department of Hematological and Oncology (ONC).

Figure 1. Get ahead in medical knowledge with Health Education Board Game Map.

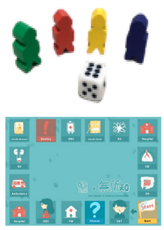
Game Component							
	Medical Records: Collect eight different subjects as fast as possible, and complete the medical records to be the winner				Characters, dice, and maps		
		AR	NO AR			AR	NO AR
		▯	▯			▯	▯
	Question Card: Eight subjects, and approximately 56 questions including ENT, FM, OBS, GU, ONC, NS, HG, and CM				AR Report: Scan the AR Report with a tablet. The results and information related to the AR Report will then display on the tablet.		
		AR	NO AR			AR	NO AR
		O Answer on the back	O No answer on the back			O	X
	Destiny/Chance Card: The Destiny Card will have to be used immediately. The Chance Card can either be used right away or kept as a card on hand.				Tablet: Scan the AR Report using a mobile device.		
		AR	NO AR			AR	NO AR
		O	O			O	X

Figure 2. Components of AR (Augmented Reality) health education board game.

The health education board game produced by this research institute is designed and developed based on the basic learning theories of situated learning theory, scaffolding theory, dual-coding theory, and over-learning and competition-based learning. This game refers to Wood, Bruner, and Ross [32] who proposed the scaffolding theory. In the AR health education board game, users need to use the developed App to scan question card on the inspection report. Guidance and correct answers will be provided at the back of the question card. According to the situated learning theory proposed by Brown, Collins, and Duguid [8], applying AR in a health education board game can provide a realistic situational environment for learners and stimulates learners' learning ability by means of guidance interest. To provide better learning effects, according to Paivio [33] who proposed the dual-coding theory, pictures and text are added to the question card as study aids. In addition, according to over-learning proposed by Ebbinghaus [34], if the user repeatedly reaches the same subject in the game, he/she needs to be challenged again to answer the question. Through repeated practice, the knowledge becomes a long-term memory and the learning goal of mastering the knowledge is achieved. The game method adopts Burguillo [35] proposed competition-based learning that uses the competition of the game to enhance the learning motivation of learners.

This board game is similar to Monopoly and increases education elements. This health education board game map includes Start, Destiny/Chance, Health Manual, Health Check, Hospital, Ambulance, and Eight Subjects. Eight subjects including GU, CM, FM, NS, ENT, GH, OBS, and ONC. Eight Subjects—After finding the symptoms and judging the disease, you should go to the right department to get a complete treatment and to further understand the disease. Hospital—The player can choose whether to move to another hospital. The Health Manual expresses the importance of health. When the player answers a question in any of the eight topics, the person who answers the wrong question must go here and take a break. Destiny/Chance can obtain cards by drawing lots, allowing players to use some functional cards, increasing the variability of the game. The last place is Health Check. If the player walks here, he must take a break. Ambulance—Allows players to specify where to go.

3.2. Experimental Process

This research explores and measures learning motivation and acceptance of importing AR board games in health education and uses CSLS to assist high school students in understanding health education. The two classes were randomly assigned to the control group and the experimental group. Before the start of the guided tour, the pre-test IMMS was performed for the measurement. The pre-test time was 5 min, and then, CSLS was implemented. The briefing to arouse students' motivation was 5 min. The control group used a no AR board game with a study sheet for game learning. The game time was 45 min. The experimental group used AR board games and matched learning sheets for game learning. The game time was 45 min. After the teaching activity, the post-test IMMS and acceptance are measured. The post-test time was 10 min (as shown in Figure 3 below).

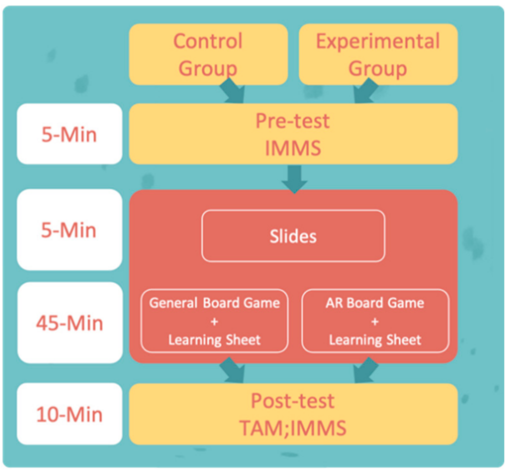


Figure 3. The research process flowchart.

3.3. Participants

The participants of the experiment were 52 first-year students from a high school located in southern Taiwan (30 males and 22 females) aged between 15 and 16. Students were divided into a control group and an experimental group, with 25 and 27 people, respectively, namely the health education board game and the AR health education board game. The experimental group and the control group were then divided into groups of three to four people for the experiment.

3.4. Research Tool

3.4.1. Instructional Material Motivation Survey

To explore the students' immersion in GBL and their learning motivation regarding the teaching materials from this study, we adopted the instructional materials motivation survey, which was designed by Keller [36] according to the ARCS (attention, relevance, confidence, satisfaction) learning motivation scale proposed by himself, and contains 36 questions that are scored using the Likert scale.

3.4.2. Technology Acceptance Model

To explore the learners' acceptance of the AR-based board game, in this research, we adopted TAM designed by Davis [37] with 11 questions. This is a Likert-scale questionnaire.

4. Results

4.1. Differences in Learning Motivation between Augmented Reality and Health Education Board Game

4.1.1. Pre-Test for Attention for the Learning Motivation of the Two Groups

Table 1 shows the results of the attention pre-test independent sample *t*-test. The results showed no significant difference in terms of attention between the two groups within the pre-test learning motivation. t (50) = 0.167, p = 0.868, control group score (M = 3.64, SD = 0.707), and experimental group score (M = 3.61, SD = 0.532) showed no significant difference. The significance of the two is 0.868 > 0.05.

Table 1. Attention pre-test independent sample *t*-test.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (n = 25)	**Experimental Group (n = 27)**			
Attention	3.64 (0.707)	3.61 (0.532)	50	0.167	0.868

4.1.2. Pre-Test for Relevance for the Learning Motivation of the Two Groups

Table 2 shows the results of the relevance pre-test independent sample *t*-test. The results showed no significant difference in terms of relevance between the two groups within the pre-test learning motivation. t (50) = −0.489, p = 0.627, control group score (M = 3.64, SD = 0.700), and experimental group score (M = 3.73, SD = 0.559) showed no significant difference. The significance of the two is 0.627 > 0.05.

Table 2. Relevance pre-test independent sample *t*-test.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (n = 25)	**Experimental Group (n = 27)**			
Relevance	3.64 (0.700)	3.73 (0.559)	50	−0.489	0.627

4.1.3. Pre-Test for Confidence for the Learning Motivation of the two Groups

Table 3 shows the results of the confidence pre-test independent sample *t*-test. The results showed no significant difference in terms of confidence between the two groups within the pre-test learning motivation. t (50) = −0.113, p = 0.910 control group score

(M = 3.60, *SD* = 0.681), and experimental group score (M = 3.61, *SD* = 0.512) showed no significant difference. The significance of the two is 0.910 > 0.05.

Table 3. Confidence pre-test independent sample *t*-test.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (*n* = 25)	**Experimental Group (*n* = 27)**			
Confidence	3.60 (0.681)	3.61 (0.512)	50	−0.113	0.910

4.1.4. Pre-Test for Satisfaction for the Learning Motivation of the Two Groups

Table 4 shows the results of the attention pre-test independent sample *t*-test. The results showed no significant difference in terms of satisfaction between the two groups within the pre-test learning motivation. t (50) = −0.469, p = 0.642 control group score (M = 3.62, *SD* = 0.740), and experimental group score (M = 3.70, *SD* = 0.520) showed no significant difference. The significance of the two is 0.642 > 0.05.

Table 4. Attention pre-test independent sample *t*-test.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (*n* = 25)	**Experimental Group (*n* = 27)**			
Satisfaction	3.62 (0.740)	3.70 (0.520)	50	−0.469	0.642

4.1.5. Comparison of the Pre- and Post-Test for the Two Groups Regarding Learning Motivation

Table 5 analyzes four aspects of learning motivation of the two groups. This research compares the two groups that did not use AR in the board game and applies the CSLS score changes. Table 5 below is the paired sample t. It is used to show analysis results of learning motivation of the two groups after playing the board game with AR and without AR. The four aspects of the experimental group have obvious differences. Compared to the board game without AR, the board game with AR can stimulate learners' learning motivation, which leads to better academic performance.

Table 5. Control group and experimental group learning motivation four-oriented mean, *p*, and d.

Dimension		Mean (*SD*)		*t*	*p*	**d**
		Pre-Test	**Post-Test**			
Control Group	Attention	3.64 (0.707)	3.66 (0.528)	−0.121	0.905	0.032
	Relevance	3.64 (0.700)	3.65 (0.569)	−0.045	0.964	0.016
	Confidence	3.60 (0.681)	3.69 (0.621)	−0.509	0.616	0.138
	Satisfaction	3.62 (0.740)	3.66 (0.582)	−0.212	0.834	0.060
Experimental Group	Attention	3.61 (0.532)	4.08 (0.472)	−4.564	0.000 ***	0.935
	Relevance	3.73 (0.559)	4.05 (0.473)	−2.910	0.007 **	0.618
	Confidence	3.61 (0.512)	4.07 (0.510)	−4.217	0.000 ***	0.900
	Satisfaction	3.70 (0.520)	4.08 (0.499)	−3.428	0.002 **	0.746

** $p < 0.01$, *** $p < 0.001$.

4.1.6. Post-Test for Attention for the Learning Motivation of the Two Groups

The results of the independent sample *t*-test are shown in Table 6. The results show that the two groups have significant differences in the attention aspect of post-test learning motivation, t (50) = −3.037, p = 0.004. The post-test of the control group (M = 3.66, *SD* = 0.528) is significantly different from the post-test of the experimental group (M = 4.08, *SD* = 0.472). The significance of the two is 0.004 < 0.05. There is a significant difference between the two groups. Analyzing the average of the post-test, the average learning effectiveness of the tests using the board game without AR is 3.66; the average learning motivation "Attention" of participants using the board game with AR is 4.08. It can be seen that the learning motivation of the board game with AR is higher than that of the board game without AR, and its effective value is also higher than that of the board game without AR.

Table 6. Post-test for attention independent sample *t*-test.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (*n* = 25)	Experimental Group (*n* = 27)			
Attention	3.66 (0.528)	4.08 (0.472)	50	−3.037	0.004 **

** $p < 0.01$.

4.1.7. Post-Test for Relevance for the Learning Motivation of the Two Groups

The results of the independent sample *t*-test are shown in Table 7. The results show that the two groups have significant differences in the relevance aspect of post-test learning motivation, t (50) = −2.763, p = 0.008. The post-test of the control group (M = 3.65, *SD* = 0.569) is significantly different from the post-test of the experimental group (M = 4.05, *SD* = 0.473). The significance of the two is 0.008 < 0.05. There is a significant difference between the two groups. Analyzing the average of the post-test, the average learning effectiveness of the tests using the board game without AR is 3.65; the average learning motivation "Relevance" of participants using the board game with AR is 4.05. It can be seen that the learning motivation of the board game with AR is higher than that of the board game without AR, and its effective value is also higher than that of the board game without AR.

Table 7. Post-test for relevance independent sample *t*-test.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (*n* = 25)	Experimental Group (*n* = 27)			
Relevance	3.65 (0.569)	4.05 (0.473)	50	−2.763	0.008 **

** $p < 0.01$.

4.1.8. Post-Test for Confidence for the Learning Motivation of the Two Groups

The results of the independent sample *t*-test are shown in Table 8. The results show that the two groups have significant differences in the confidence aspect of post-test learning motivation, t (50) = −2.456, p = 0.018. The post-test of the control group (M = 3.69, *SD* = 0.621) is significantly different from the post-test of the experimental group (M = 4.07, *SD* = 0.510). The significance of the two is 0.018 < 0.05. There is a significant difference between the two groups. Analyzing the average of the post-test, the average learning effectiveness of the tests using the board game without AR is 3.69; the average learning motivation "Confidence" of participants using the board game with AR is 4.07. It can be seen that the learning motivation of the board game with AR is higher than that of the board game without AR, and its effective value is also higher than that of the board game without AR.

Table 8. Post-test for confidence independent sample *t*-test.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (*n* = 25)	Experimental Group (*n* = 27)			
Confidence	3.69 (0.621)	4.07 (0.510)	50	−2.456	0.018 **

** $p < 0.01$.

4.1.9. Post-Test for Satisfaction for the Learning Motivation of the Two Groups

The results of the independent sample *t*-test are shown in Table 9. The results show that the two groups have significant differences in the satisfaction aspect of post-test learning motivation, t (50) = −2.808, p = 0.007. The post-test of the control group

(M = 3.66, *SD* = 0.582) is significantly different from the post-test of the experimental group (M = 4.05, *SD* = 0.499). The significance of the two is 0.007 < 0.05. There is a significant difference between the two groups. Analyzing the average of the post-test, the average learning effectiveness of the tests using the board game without AR is 3.66; the average learning motivation "Satisfaction" of participants using the board game with AR is 4.05. It can be seen that the learning motivation of the board game without AR is higher than that of the board game with AR, and its effective value is also higher than that of the board game without AR.

Table 9. Post-test for satisfaction independent sample *t*-test.

	Mean (*SD*)		***df***	***t***	***p***
	Control Group (*n* = 25)	**Experimental Group (*n* = 27)**			
Satisfaction	3.66 (0.582)	4.05 (0.499)	50	−2.808	0.007 **

** $p < 0.01$.

4.2. *Differences in Acceptance Using AR in Health Education Board Game*

From the average results of the game acceptance of the control group and the experimental group, it is found that the game acceptance in the board game method of the two groups is acceptable, indicating that it is easy to learn and operate during the game. Additionally, the obvious performance in the experimental group shows that learners get an average of more than 3 in each criterion, and the overall score is 4.08 (Table 10).

Table 10. Average and standard deviation of each dimension of acceptance (*n* = 52).

Group	**Dimension**	**Mean**	***SD***
Control Group	Perceived Usefulness	3.84	0.647
	Perceived Ease of Use	3.68	0.645
	Game Elements	3.58	0.585
	Overall Acceptance	3.67	0.578
Experimental Group	Perceived Usefulness	4.20	0.432
	Perceived Ease of Use	4.09	0.447
	Game Elements	4.02	0.506
	Overall Acceptance	4.08	0.412

4.2.1. Acceptance Analysis for the Two Groups—Perceived Usefulness

Table 11 shows the results of the perceived usefulness of the two groups using a paired sample *t*-test; both groups show significant differences in the perceived usefulness score in the post-test; t (50) = −2.348, $p = 0.023$. The post-test of the control group (M = 3.84, *SD* = 0.647) and the post-test of the experimental group (M = 4.20, *SD* = 0.432) are significantly different, and the significance of the two is 0.023 < 0.05, which implied that there were significant differences between the two groups. The result showed that the mean value for the two groups was higher than the median of 3, indicating that learning during playing is helpful to both groups, but it can be seen that AR in the experimental group is more helpful to learning.

Table 11. Independent sample *t*-test of cognitive usefulness of acceptance.

	Mean (*SD*)		***df***	***t***	***p***
	Control Group (*n* = 25)	**Experimental Group (*n* = 27)**			
Perceived Usefulness	3.84 (0.647)	4.20 (0.432)	50	−2.348	0.023 **

** $p < 0.01$.

4.2.2. Acceptance Analysis for the Two Groups—Perceived Ease of Use

Table 12 shows the results of the perceived ease of use of the two groups using a paired sample *t*-test; both groups show significant differences in the perceived ease of use score in the post-test; t (50) = −2.696, p = 0.010. The post-test of the control group (M = 3.68, *SD* = 0.645) and the post-test of the experimental group (M = 4.09, *SD* = 0.447) are significantly different, and the significance of the two is 0.010 < 0.05, which implied that there were significant differences between the two groups. The result showed that the mean value for the two groups was higher than the median of 3, indicating that both groups agree that learning during play makes it easy to understand and operate. However, it can be seen that in the experimental group, playing AR in board games, the feelings of the testees are more obvious.

Table 12. Independent sample *t*-test of acceptability of cognitive ease of use.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (*n* = 25)	**Experimental Group (*n* = 27)**			
Perceived Ease of Use	3.68 (0.645)	4.09 (0.447)	50	−2.696	0.010 **

** $p < 0.01$.

4.2.3. Acceptance Analysis for the Two Groups—Game Elements

Table 13 shows the results of the game elements of the two groups using a paired sample *t*-test; both groups show significant differences in the game elements score in the post-test; t (50) = −2.892, p = 0.006. The post-test of the control group (M = 3.58, *SD* = 0.586) and the post-test of the experimental group (M = 4.02, *SD* = 0.506) are significantly different, and the significance of the two is 0.006 < 0.05, which implied that there were significant differences between the two groups. The result showed that the mean value for the two groups was higher than the median of 3, indicating the game is entertaining, challenging, and adventurous for both groups. However, it can be seen that in the experimental group, playing AR in board games, the feelings of the testees are more obvious.

Table 13. Independent sample *t*-test of game elements of acceptance.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (*n* = 25)	**Experimental Group (*n* = 27)**			
Game Elements	3.58 (0.586)	4.02 (0.506)	50	−2.892	0.006 **

** $p < 0.01$.

4.2.4. Acceptance Analysis for the Two Groups—Overall Acceptance

Table 14 shows the results of the post-test acceptance analysis of the two groups in gameplay using a paired sample *t*-test; there were significant differences in the post-test acceptance score between the experimental group and the control group, t (50) = −2.956, p = 0.005. There were significant differences between the post-test acceptance score (M = 3.67, *SD* = 0.578) of the control group and the post-test acceptance score (M = 4.08, *SD* = 0.412) of the experimental group, with a significance of 0.006 < 0.05 between the two, which implied that there were significant differences between the two groups. The result showed that the mean value for the two groups was higher than the median of 3, which indicated that both groups had relatively good acceptance of the board game, although the test subjects from the experimental group, who experienced AR in the board game, exhibited more evident feelings.

Table 14. Independent sample *t*-test for the overall acceptance.

	Mean (*SD*)		*df*	*t*	*p*
	Control Group (n = 25)	Experimental Group (n = 27)			
Overall Acceptance	3.67 (0.578)	4.08 (0.412)	50	−2.956	0.005 **

** $p < 0.01$.

5. Conclusions and Discussion

This study designs a board game assimilated augmented reality (AR) into health education. AR can guide students through contextual learning to allow students to experience the context of their desired learning field. Combining AR with games can solve the lack of connection between health education courses and daily life scenarios. Board games cannot substitute traditional teaching, but they can particularly help students master difficult concepts [38]. The application of board games to teaching can bring good results, and it can also enable learners to actively participate and learn, which can also enhance learning motivation.

The purpose of this research is to design a set of educational games using AR in board games and apply them to health education. Another purpose is to introduce a simple card gamification teaching model and explore the differences in learning motivation from four textbook-oriented motivations in the case of using or not using AR in the health education board game. The differences in terms of acceptance are then analyzed. According to this study, two research questions were raised. The results of the study found that whether board games are combined with AR, there are the following differences:

1. There is a significant difference in the acceptance of combining AR to health education board games. Incorporating AR into the board game can help learners to increase their acceptance more effectively. The results confirm those of previous studies, in which AR has been shown to enhance acceptance [39–41]. Therefore, it can be speculated that the use of AR board games as learning tools can produce a certain attraction for the learners. Moreover, the use of AR board games allows learners to enter the games quickly, which helps achieve effective learning.
2. Combining AR to health education board games has significant differences in learning motivation. Integrating AR into board game can be more effective in helping learners to enhance their motivation. Such results can echo past research findings that AR can enhance learning motivation [42–44]. Therefore, this research speculates that this teaching tool can be autonomous for learners and can be known to interact well with them. Using AR board games can be more resonant and more motivating for learning.

The AR images of this system are only used in 2D, which is not easy to understand and observe in terms of organ structure. Therefore, 3D models are recommended to represent the structure and physiological organs of the human body in future research. It allows learners to observe in a 360-degree manner, which can increase the accuracy and increase the interactive effect. This presentation method can also allow learners to learn what the human body's structural organs are. It adds interactive functions to the system and increases its interest and appeal. It can also combine AR with different types of board games to increase its variability to learn new knowledge. Additionally, are the participants of the experiment, students from a high school located in southern Taiwan with fewer students. Only 52 people were used as the sample size. In the future, the sample size can be expanded to obtain more complete statistical data. It can also be used in local schools in the urban area to compare the differences between rural and urban students in this teaching tool.

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