DEVELOPMENT OF ELECTRONIC BOARD GAME TO ENHANCE DIGITAL MEDIA LITERACY AMONG THE ELDERLY IN CHANTHABURI PROVINCE

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ABSTRACT

This research was an application of microcontroller technology in collaboration with board game mechanics by building interactions through light, color and sound. Gameplay mechanics were designed based on a random reward system in order to motivate learning. The players would get moving on the board when answering the questions correctly. There were also other various auxiliary components to increase challenge and interest throughout the game. These mechanics aimed at creating positive interactions and enhancing digital media literacy absorption among the elderly. The sample used in this research was a group of 30 elderly from Elderly School, Plap Phla subdistrict, Mueang district, Chanthaburi province gaining from simple random sampling. The research instruments included a set of an electronic board game, a digital media literacy test and a satisfaction questionnaire with 15 items. Statistics consisted of mean, standard deviation, percentage and statistical hypothesis testing (t-test). The results found that: 1) the quality of the electronic board game as a whole was at the excellence level ($\bar{x}$ = 4.84, SD = 0.93), 2) the elderly's digital media literacy test score after playing the game was higher than before playing the game with statistical significance at the .05 level, and 3) the elderly's satisfaction towards the electronic board game to enhancing digital media literacy was at the highest level ($\bar{x}$ = 4.53, SD = 0.55). The results of the study can be summarized that the electronic board game is an effective instrument to enhance digital media literacy for the elderly.

Keywords: Electronic board game, Elderly, Digital media literacy

I. INTRODUCTION

Thailand entered an aged society in 2022, by which the elderly aged 60 years and over were accounted for 18.3% of the total population (Uton, 2023, Online). Entering an aged society has an impact on the caregiver burden, health expenses and a decrease in the number of workforce. Therefore, the government needs to promote the elderly's health, self-reliance and participation. One of the popular ways is the usage of social media, such as Line and Facebook, to communicate and follow the news. Though the elderly can access to the online media well, their media literacy is still needed to develop. This is because data analysis and data authentication on social media require specific skills which decreased with age Rachpiboon (2021, pp. 67-68). The development of these skills will help the elderly live in the digital society safely and happily.

Research indicates that Thai elderly individuals continuously use digital media in their daily lives, primarily focusing on communication and receiving information through online channels such as Line, Facebook, and YouTube. However, the level of media literacy among this demographic remains moderate, and they often lack in-depth critical thinking skills; as a result, they are at risk of receiving inaccurate or false information. Personal factors including gender, education level, occupation, income, and technological experience all have a statistically significant impact on their digital media proficiency (Rueangyot, 2020, p. 74; Pakdeemualchon and Rattanasimakul (2022, pp. 21-24). Furthermore, empirical evidence shows that participatory activities, especially board games, play a crucial role in developing media literacy skills. These activities enhance comprehension, practical application, and motivation for continuous learning, serving as an effective strategy to reduce the risk of misinformation and promote overall media literacy among the elderly (Yingprathanporn et al., 2024, pp. 374-376; Piboonpanuwat et al., 2020, p. 174).

Currently, board games, which are games playing on boards with accessories, are used in education by designing them in consistent with the contents to create both enjoyment and knowledge acquisition. One of these games is an electronic board game that works in collaboration with a microcontroller that has the duty to control equipment such as LED bulb, push-button switch and dot matrix. Integration of microcontroller helps to increase enjoyable, exciting and novel playing formats, for example, digital output, score report and signals. These playing formats enhance players' planning skill, strategic thinking, problem solving and teamwork.

Therefore, the researchers developed an electronic board game to enhance digital media literacy among the elderly in Chanthaburi province to create happiness and enjoyment as well as to stimulate digital media literacy in order to make the elderly live happily with both physical and mental safety.

II. LITERATURE REVIEW

Previous studies demonstrated that Thai elderly people continuously accessed online media, especially LINE, Facebook, and YouTube (Rueangyot, 2020, p. 74). However, their media literacy was at a moderate level, reflecting the need to enhance analytical and media creation skills. Differences in gender and educational level were found to affect media literacy, with females and highly educated individuals often demonstrating better assessment and information access skills. Similarly, Pakdeemualchon and Rattanasimakul (2022, pp. 21–24) reported that career background, familiarity with technology, and frequency of use influenced Facebook usage and levels of media literacy. In addition, most elderly media use focused more on recreation and self-expression than on business purposes. When these findings are synthesized, they indicate that although the elderly have potential in media use, they still lack in-depth screening and critical evaluation skills. This highlights the importance of educational media design that promotes analytical thinking, content production, and continuous learning motivation. Previous research has also shown that board games can play a significant role in developing media and technology literacy among various target groups. Yingprathanporn et al. (2024, pp. 374–376) demonstrated that board games effectively transferred knowledge about cyber threats while enhancing both understanding and player satisfaction. This finding is consistent with Piboonpanuwat et al. (2020, p. 174), who found that applying the "Stop–Think–Ask–Do" concept alongside the role of wellness communicators improved data screening skills and reduced uncritical media consumption. Overall, this synthesis suggests that both board games and digital media have a significant role in enhancing media literacy, particularly for the elderly who face increasing challenges in a digital society.

The hypothesis of this research was the elderly who played the electronic board game would have the score of digital media literacy test after playing the game higher than before playing the game with statistical significance at the .05 level.

III. RESEARCH METHODOLOGY

This study was a Research and Development (Meesuwann, 2022, pp. 89-90) consisting of conceptual framework, scope of study, research instrument, data collection and data processing and analysis.

3.1 Conceptual Framework

The researchers had determined the conceptual framework of the study as shown in Figure 1 on development of electronic board game to enhance digital media literacy among the elderly in Chanthaburi province as follows:
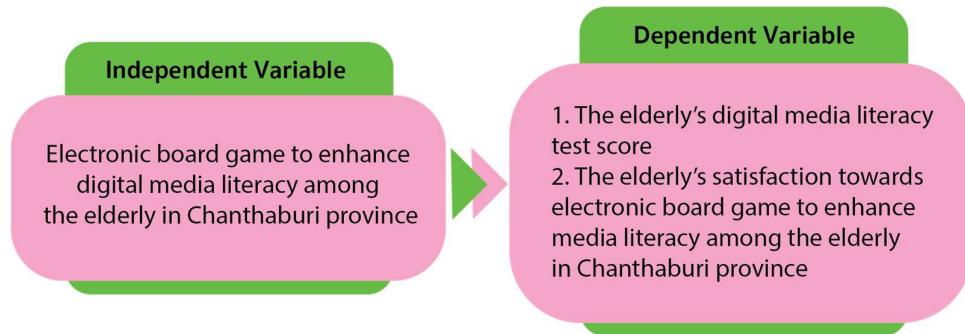
Figure 1: Conceptual Framework

3.2 Scope of Study

Scope of population and sample group: the population used in the research was 992 elderly in Chanthaburi province, and the sample used in the research was a group of 30 elderly from Elderly School, Plap Phla subdistrict, Muang district, Chanthaburi province gaining from simple random sampling, by which the sample size was determined according to the method of Chaiyong Promwong (Brahmawong, 2013, pp. 7-20).

Scope of variables used in the research: an independent variable was the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province, and dependent variables were the elderly's digital media literacy test score and the elderly's satisfaction towards the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province.

Scope of contents on the elderly's digital media literacy: Wuttirangsee (2016, pp. 96-102) mentioned four aspects including media literacy, understanding the contents, media analysis and evaluation, safe interaction and real life application. Assawatinna (2022, pp. 33-35) determined three aspects including assessment, analysis and media access. The researchers, therefore, synthesized these two concepts into four main aspects including data evaluation of correct news and fake news, security and privacy, digital competency, digital law and critical thinking.

3.3 Research Instrument

1. A set of an electronic board game to enhance digital media literacy among the elderly in Chathaburi province was passed the quality assessment by five experts. The instruments consisted of an electronic box, shown in Figure 2, used for random question cards and auxiliaries together with showing LED light and playing sound through a small speaker, a board of game, pieces and 80 question cards according to the question types including: green cards containing questions about correct news and fake news, red cards containing questions about security and privacy, blue cards containing questions about digital competency and yellow cards containing questions about digital law and critical thinking categorized by the contents, and three auxiliary cards including: friend helps friend, change the question card and check the answer then move one more space. The electronic box used microcontroller board Arduino Uno R3 to control 16-LED-ring display, 8 x 8 dot matrix to push the small speaker to play a melody and buttons for randomly selecting questions, auxiliaries and number of space.
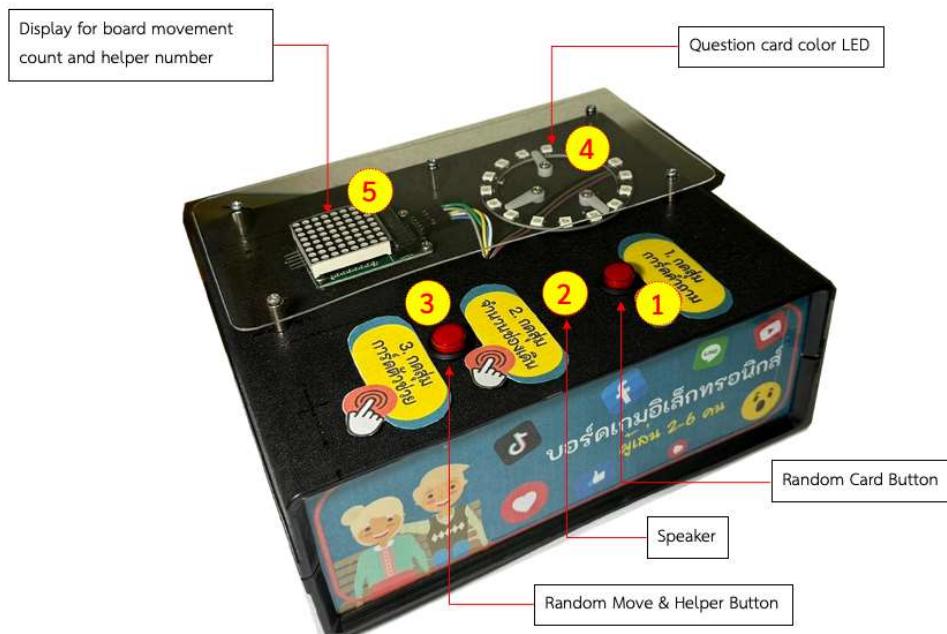
Figure 2: Electronic box

In Figure 3-5, playing method of board game started by having each player choose his own piece. The playing sequence would be repeated until every one had played. The first player pressed the button to randomly select the question card. If he randomly got a question card of any color, the next player had to turn up the card to read the question. If the player could not answer the question by himself, he could use his right to press the button to randomly choose the auxiliary card: ask his friend to help suggest the answer, randomly change the question or has the right to move one free space. In which the player could use one auxiliary per a moving cycle. The player who reached the finish line first would be the winner of that cycle.

2. A 20-item media literacy test with two multiple choices was evaluated its quality by five experts and found that Index of Item-Objective Congruence (IOC) was between 0.80-1.00.

3. A 15-question test of satisfaction towards the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province in the form of rating scale with five-level rating scale according to Likert (Likert scale) had Index of Item-Object Congruence (IOC) for measuring satisfaction behaviors between 0.80-1.00.
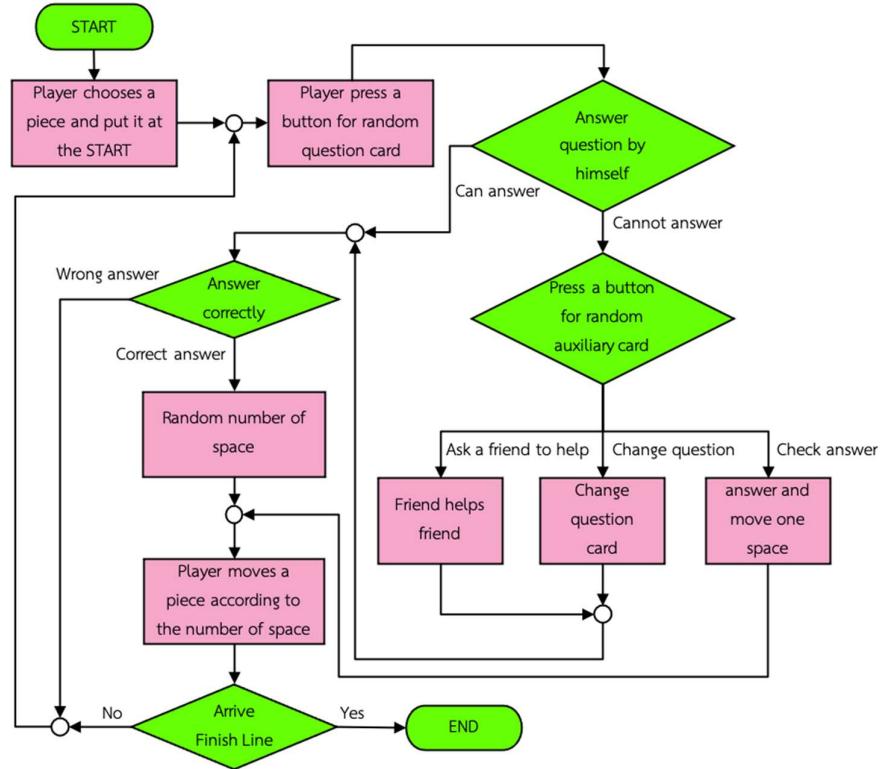
Figure 3: Playing method of electronic board game to enhance digital media literacy among the elderly in Chanthaburi province

Figure 4: Examples of the back side of four-color question cards (left pictures) and the front of the auxiliary cards (right pictures)

Figure 5: A board of the electronic board game

3.4 Data Collection

The sample group of the elderly voluntarily participated in the trial. The researchers explained the operation details and distributed a test on media literacy before using the electronic board game to the elderly who were able to read and write to do the test by themselves. For those who were unable to read and write, the research assistant would read the questions to them and record their answers. The test took about 20 minutes, then collected. The researchers introduced the equipment and playing method as well as divided the players into two-six players each group. The research assistant acted as a game master to facilitate and determine the playing order. After playing, the sample group did the test again to check their scores. Then the results of their pre-test and post-test were comparatively analyzed and evaluated their satisfaction towards playing the electronic board game.

3.5 Data Analysis

Data analysis consisted of quality and satisfaction assessment of the electronic board game by using mean, standard deviation and comparison of pre-and post-digital media literacy test scores by using t-test for dependent samples.

This research received human research ethics approval from Rambhai Barni Rajabhat University, no. IRB-35/2567.

IV. RESULTS

From this research, the researchers summarized the data analysis results with the details as follows:

4.1 The development result and quality examination of one set of the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province passed the quality assessment from five experts at the excellent level ($\bar{x}$ = 4.84, SD = 0.93).

Table 1: The quality assessment result of electronic board game to enhance digital media literacy among the elderly in Chanthaburi province

Evaluation list	$\bar{x}$	SD	Level of quality
1. Clarity of color and light of numbers.	5.00	0.00	Excellent
2. Use beautiful colors and attract attention.	5.00	0.00	Excellent
3. Clarity of instructions in the board game playing rule manual.	5.00	0.00	Excellent
4. Convenience in using board game equipment.	5.00	0.00	Excellent
5. Accuracy of content.	4.80	0.45	Excellent
6. The questions on the cards are appropriate for game players.	4.80	0.45	Excellent
7. Clarity of pictures on the cards.	4.80	0.45	Excellent
8. Size of information on the cards can be seen clearly.	4.80	0.45	Excellent
9. Appropriateness of time spending on playing board game.	4.80	0.45	Excellent
10. Appropriateness of playing method.	4.60	0.55	Excellent
11. Conform to application of board game to enhance digital media literacy among the elderly.	4.60	0.55	Excellent
Total	**4.84**	**0.93**	Excellent

From Table 1, data analysis results of quality assessment of the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province by five experts as a whole was at the excellent level ($\bar{x}$ = 4.84, SD = 0.93). When determined by item found that the first four items had the highest mean including: item 1. Clarity of color and light of number, item 2. Use beautiful colors and attract attention, item 3. Clarity of instructions in the board game playing rule manual and item 4. Convenience in using board game equipment ($\bar{x}$ = 5.00, SD = 0.00).

4.2 Comparison results of digital media literacy test scores before and after playing the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province

Comparison results of test scores before and after playing the electronic board game by comparing the pre-playing score with the post-playing score using t-test had statistical significance at the .05 level as illustrated in Table 2.

Table 2: Comparison results of digital media literacy test scores before and after playing the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province

Assessment	Number (people)	Full Score	$\bar{x}$	SD	t	Sig
Before playing	30	20	15.60	1.48	10.14*	.000
After playing	30	20	17.63	1.50		

* Statistical significance at the .05 level

From Table 2, it was found that test statistic value (t-test) was 10.14. Mean of pre-playing score was 15.60 and standard deviation was 1.48. Mean of post-playing score was 17.63 and standard deviation was 1.50. In conclusion, the result of the elderly's digital media literacy test after playing board game was higher than before playing with statistical significance at the .05 level.

4.3 The results of the elderly's satisfaction towards the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province

Table 3: The results of the elderly's satisfaction towards the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province

Evaluation list	$\bar{x}$	SD	Level of quality
1. Overview towards electronic board game.	4.70	0.47	Highest
2. Enhance digital media literacy among the elderly.	4.67	0.55	Highest
3. The time spent playing is appropriate.	4.63	0.49	Highest
4. The pictures are clear.	4.60	0.50	Highest
5. Have fun and enjoyment.	4.60	0.56	Highest
6. Interaction between the players and the electronic board game.	4.60	0.56	Highest
7. The electronic board game is interesting, exciting and challenging.	4.57	0.50	Highest
8. Fonts are easy to read and clear.	4.53	0.57	Highest
9. The language used in the manual is easy to understand.	4.50	0.57	High
10. Playing method is not complicated.	4.50	0.51	High
11. Improve better understanding of digital media literacy.	4.50	0.51	High
12. The game has colors, lights and sounds.	4.47	0.57	High
13. Rules, regulations and conditions are easy to understand.	4.43	0.63	High
14. Have a clear objective.	4.40	0.62	High
15. Scoring electronic board game playing.	4.30	0.65	High
Total	**4.53**	**0.55**	**Highest**

The analysis results of the elderly's satisfaction towards the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province illustrated in Table 3 found that the data analysis results of the elderly's satisfaction towards the electronic board game to enhance digital media literacy among the elderly in Chanthaburi province as a whole was at the highest level ($\bar{x}$ = 4.53, SD = 0.55). When determined by item found that the first three items with the highest mean included: Item 1. Overview towards electronic board game ($\bar{x}$ = 4.70, SD = 0.47), followed by Item 2. Enhance digital media literacy among the elderly ($\bar{x}$ = 4.67, SD = 0.55) and Item 3. The time spent playing is appropriate ($\bar{x}$= 4.63, SD = 0.49).

V. CONCLUSION AND DISCUSSION

The research results found that the quality of the electronic board game as a whole was at the excellent level ($\bar{x}$ = 4.84, SD = 0.93). The test score of the elderly's digital media literacy after playing the game was higher than before playing the game with statistical significance at the .05 level. In addition, the elderly's satisfaction towards the electronic board game to enhance digital media literacy was at the highest level ($\bar{x}$ = 4.53 , SD= 0.55). These demonstrated that the electronic board game was an effective instrument in enhancing the elderly's digital media literacy.

The results could be discussed as follows : (1) The overall quality of the electronic board game was at the excellent level. This resulted from the game design and development process, which involved assessments by five experts in computer program development, gerontology, public health, measurement and evaluation, and educational technology, followed by improvements based on their suggestions (e.g., enlarging button size, adding a display device protection panel for safety and damage prevention). The playing method featured a clear structure encouraging all players' participation, with key elements including random processes, question-answering, and auxiliaries that made the game challenging and fun, promoting participation, critical thinking, and decision-making across stages via a balance of skill and luck suitable for group activities or education. Research on educational board games shows that random mechanisms (e.g., dice rolling, random cards) enhance challenge and enjoyment (Sousa et al., 2023, p. 5), increasing participation, collaboration, communication, and creative thinking in class. Sato et al. (2020, pp. 13-14) categorized random prize mechanisms that stimulated players' motivation, excitement and satisfaction besides random mechanisms. Other auxiliaries such as easy-to-grip pieces, level skipping on the board or expressing opinion together also helped enhance the playing quality of those elements and support critical thinking, collaboration and comprehensive life skills development. Smith (2024, p. 10) found that usage of a role-playing card and a special score system helped create motivation and casual learning environment. Kinne (2021, Online) insisted that beautiful and actually tangible pieces increased enjoyment and playing experiences. Therefore, random mechanisms and auxiliary elements play a crucial role in enhancing both enjoyment and learning outcomes in board games. (2) The integration of media literacy content into the electronic board game resulted in a statistically significant improvement in elderly participants' media literacy scores. This finding highlights the potential of game-based media to effectively convey applicable real-life knowledge through innovative instructional design that strategically integrates gameplay mechanics with learning objectives, thereby fostering an engaging and participatory learning environment. The present result is consistent with prior studies. Tsai et al. (2024, p. 212) reported that board game–based interventions significantly enhanced elderly individuals' knowledge and osteoporosis-preventive behaviors, while Moontienthong et al. (2023, pp. 280–281) demonstrated that board games stimulate cognitive activity and support cognitive development among older adults. These findings collectively suggest that the integration of play mechanisms with learning acquisition represents an effective form of innovative design that promotes enjoyment and participatory learning. Consequently, the electronic board game can be considered a valuable educational tool for skill development and for enhancing the quality of life of elderly populations. (3) Elderly participants reported the highest satisfaction with the electronic board game.

This stems from mechanism designs emphasizing fun, participation, and fairness, which create efficient learning experiences; key elements like piece selection, random questions, and auxiliary cards reduce pressure while maintaining challenge and balance, fostering motivation and continued play. The results align with Guardabassi et al. (2024, p. 4), who reported that increasing game difficulty raised elderly satisfaction significantly, and Chen and Tsai (2022, p. 10), who found board games strengthen confidence, communication, and reduce loneliness sustainably. These trends highlight the electronic board game's potential not only for entertainment but also for promoting health and comprehensive learning among the elderly.

SUGGESTION

1) Suggestions for the application of research results: The electronic board game developed to enhance digital media literacy among the elderly in Chanthaburi Province was found to effectively improve participants' knowledge and their ability to appropriately apply this knowledge in daily life. To further increase the effectiveness of the activities, it is recommended that the activity design incorporate regular rotation of group members. Such rotation would provide greater opportunities for knowledge sharing, enhance social interaction among the elderly, and promote collaborative communication skills. Additionally, facilitators should encourage active participation and discussion during gameplay to maximize learning outcomes and engagement. 2) Suggestions for future research should explore the effectiveness of the electronic board game among larger and more diverse samples of elderly participants across different geographical areas in order to enhance the generalizability of the findings. Further studies may also examine the long-term impact of the game on digital media literacy and actual technology usage behaviors in daily life. Moreover, comparative studies involving different types of digital or non-digital learning media could provide deeper insights into the most effective approaches for promoting digital media literacy among the elderly.

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