

REPORT OF RESEARCH RESULTS

The Board Game Development to Raise an Awareness in Traffic Safety among Elementary School Student

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Summary

Road accident is one of the causes of fatalities in Thailand each year. World Health Organization (WHO, 2022) indicated that road traffic injuries are the leading cause of death for children and young adults aged 5-29 years. There were about 1.3 million deaths each year from road traffic crashes, which more than half are pedestrians, cyclists, and motorcyclists. This information complies with the findings of ThaiRSC (2021), which revealed that children and youth aged 1–24 years constitute one-third of the injured and fatalities resulting from road accidents. Basic Education for elementary school does not include traffic safety and discipline issues in the core curriculum (Ministry of Education, 2022), only Extra-curricular activities management manual was created (Office of the Basic Education Commission, 2019) which serves as an optional resource for local or school-specific curricula. Therefore, to address this gap, the board game titled “*The Legend of Road Safety*” was developed as a tool to support learning on road safety. This tool aims to enhance understanding of road safety through four main steps: 1) **Analysis:** Reviewing topics related to road safety and accidents, and the learning processes of elementary school students, 2) **Board Game Design:** Developing the game design through a review of existing literature and brainstorming of research team, 3) **Development and Validation:** The board game was designed and validated with input from subject-related experts. The overall Item Objective Congruence (IOC) score was 0.91, with all individual items scoring above 0.5, demonstrating strong alignment between the game content and its intended learning objectives. Validation was conducted through two rounds of Delphi analysis, which confirmed the accuracy of the content and its alignment with both the project objectives and student learning outcomes. 4) **Implementation:** Piloting the board game in four elementary schools with varying physical, socioeconomic, and lifestyle characteristics. The findings demonstrated a statistically significant improvement in awareness and knowledge at the .05 level. Additionally, overall satisfaction with the use of the board game as a learning tool was rated at the highest level (Mean = 4.37, S.D. = 0.187). From a practical perspective, schools, including teachers, students, and parents, expressed interest in adopting this board game as a tool for self-directed learning.

Aim of Research

This research is practical, and its objectives are 1) to develop the board game for elementary school students to learn about traffic safety, including traffic discipline and to raise an awareness in traffic safety to safe traffic behaviors, and 2) to study the results of using the board game to learn and raise an awareness in traffic safety behavior.

Research Methodology and Progression

This research project is categorized as Research and Development (R&D), incorporating a participatory data collection process. The scope of the study is defined according to the research objectives as follows:

1. To develop the board game for elementary school students to learn about traffic safety, including traffic discipline and to raise an awareness in traffic safety to safe traffic behaviors

The research in this phase employs a qualitative approach, beginning with a literature review on road safety, traffic behavior, traffic safety education in Thailand and other countries, as well as age-appropriate learning methodologies.

Target Groups

The target groups in this phase include traffic police, school administrators, principals, teachers from relevant subjects such as Maths, Science, Health Education, Thai Language, Arts, and Administrative, as well as elementary school students from various grade levels for pilot testing of the board game before implementation.

Research Instruments

- 1) Observation forms for field study of road usage behaviors by students and parents.
- 2) Unstructured interview forms to gather insights on learning methods, language use, and traffic behavior among elementary school students.
- 3) A prototype board game developed by the research team.
- 4) IOC assessment forms for validation by subject-matter experts.
- 5) Delphi technique question guidelines for evaluation.

Content Scope

The content of the board game focuses on fostering learning behaviors in two key areas:

- 1) **Knowledge (K):** Pertaining to road safety, including traffic signs/symbols, traffic regulations, collective consciousness on safety road use, essential knowledge/guidelines, and appropriate practices through the stimulation on daily real-life of elementary school students’ journey between home and school.
- 2) **Attitude (A):** Promoting positive attitudes toward road usage, including consideration for other road users, perspectives on safety, and a sense of responsibility for one’s own life and property as well as that of others.

Data Analysis

Content analysis is employed to extract key knowledge and attitudes toward road usage that elementary school students should recognize.

2. To study the results of using the board game to learn and raise an awareness in traffic safety behavior

This phase involves the implementation and evaluation of knowledge and attitudes regarding road safety after playing the board game as follows.

Target Groups

The target population for this phase includes elementary school students from Grades 3 to 6, who already possess reading and interpretation skills. Schools are selected based on diverse physical characteristics of area, socioeconomic, and parental occupational

characteristics influencing students' travel modes. The sample comprises four types of schools: one private school, one demonstration school, and two schools under the Office of the Basic Education Commission (OBEC).

Research Instruments

- 1) The developed board game “The Legend of Road Safety”
- 2) Pre-test and post-test of knowledge and attitude on road safety before and after playing the board game
- 3) Satisfaction survey with the board game, with Likert scale

Content Scope

The board game content includes age-appropriate learning topics derived from a review of educational curricula in Thailand and abroad, as well as interviews with relevant stakeholders. The satisfaction assessment of the board game covers four main areas: content, activities, learners, and the quality of the board game.

Data Analysis

The analysis employs both quantitative and qualitative methods. Statistical analysis includes descriptive statistics, for example, mean and standard deviation, and inferential statistics, specifically the paired sample t-test, with a significance level of .05. Qualitative data analysis, through content analysis, is also used to support the interpretation and discussion of results.

Research Results

1. To Develop the board game for elementary school students to learn about traffic safety, including traffic discipline and to raise an awareness in traffic safety to safe traffic behaviors

1.1 Review of Literature and Interviews on Road Safety and Traffic Accidents in Thailand Involving Elementary School

Students: there are 11 identified key risk behaviors related to road safety among elementary school students, as follows: (1) Not wearing a seatbelt or helmet while riding in a vehicle, (2) Crossing the street without waiting for vehicles and traffic signals, (3) Walking off the sidewalk unsafely, (4) Playing or running on the road without regard for oncoming traffic, (5) Throwing objects or extending parts of body outside the vehicle, (6) Riding bicycles or scooters without caution, (7) Interrupting the driver while driving, (8) Running after moving vehicles, (9) Walking or running behind reversing vehicles, (10) Engaging in reckless behavior while on the road, and (11) Failing to remain seated while in the vehicle. (North Yorkshire County Council, 2015; Foundation for Community Health, 2004)

1.2 Review of Literature on Learning Approaches for Elementary School Students: it is revealed that effective learning for elementary school students should relate to their daily lives or environments they frequently encounter. Learning should be straightforward, with clear and direct communication, emphasizing initial analysis and synthesis without complex interpretation. Educational materials should prioritize visual aids and concise key messages. Group-based learning processes are encouraged to foster social interactions, social responsibility and collaborative learning. (Happy Numbers, 2025; NSW Government, 2024; Queensland Government, 2023; Prathana Hanmathee, 2021, School Drug Education and Road Aware, n.d.)

1.3 Review of Literature on Board Game Development: it is identified the following considerations for board game development as follows: (1) Portability as its **size** is portable, not too large or too small, and easy to store and maintain, (2) Its **design** should be visually appealing and vibrant colours, with clear and bright tones. Text and images must be easily visible and legible, (3) The game should emphasize **group-based learning** and collaborative activities, fostering social skills and highlighting how individual actions impact the community, (4) The board game aims to serve as an innovative tool for learning road safety. Its objectives focus on fostering **knowledge (K)**, **attitude (A)**, and awareness, ultimately leading to appropriate and responsible road-use behavior (**skills: S**). The game employs **virtual learning** by simulating daily real-life journey from home to school and vice versa.

1.4 Development and Design of the Board Game: The board game, titled “**The Legend of Road Safety**”, symbolizes a journey filled with lessons on road safety. The development process of this board game was informed by a review of board game design principles, with the following main objectives: (1) Self-directed Learning: the board game is designed to facilitate self-directed learning, meaning that players gain knowledge through gameplay without the need for a coach or teacher. This learning process is intended to be continuous and accessible at any time, (2) Motivation through Enjoyment: the game emphasizes creating motivation for players by offering an enjoyable experience. This is achieved through competitive gameplay that includes winners and losers, fostering engagement and sustained interest, (3) Focus on Road Safety Content: the primary objective of the board game is to deliver road safety content tailored to the developmental needs of elementary school students. The content is designed to be age-appropriate and effectively foster understanding and awareness of safe road behaviours, (4) Social Interaction and Shared Responsibility: the game targets collaborative activities enhancing social learning among students.

- 1.4.1 **Road Safety Content:** It is categorized the modes of transportation relating to elementary school students in Thailand into five main types which are by walk, by bicycles, by motorcycles, by car, and by bus/school bus/others
- 1.4.2 **Concept and Design:** The game is a strategic board game that demonstrates how each player’s movement affects the progress of other players. It simulates scenarios likely encountered during students’ commutes between home and school. The design features vibrant colours such as green, yellow, pink, purple, and blue to appeal to children.
- 1.4.3 **Players:** It is designed for 2 to 4 players, aged 7 years and above, which is suitable for elementary school students in Grades 3 to 6 (P3 – P6), who generally have proficient reading skills.
- 1.4.4 **Game Mechanics:** The game uses only a single **token**, and **cards, called “Drive Card (DC)”** as the significant mechanic for gameplay, determining movement, winner and loser. Additionally, chance cards, called “**Event Card (EC)”** serve as a key element to add excitement and unpredictability to the game with the content of appropriated and safe road behaviours.
- 1.4.5 **Playtime:** Each game round takes approximately 10 to 30 minutes.
- 1.4.6 **Game Components:** There are 6 components of the game as follows: (1) Game board, (2) Token, and 3 types of cards, which are (3) Drive Card (DC) as a movement card (40 cards), (4) Event Card (EC) as a fortune or chance card (40 cards), (5) Question Card (QC) as a knowledge question card (30 cards), and (6) Game manual.



Board game



Token



3 types of cards (Drive Card, Event Card, Question Card)



Game Manual

1.5 Effectiveness Testing of the Board Game: The effectiveness of the board game was evaluated by relevant experts, including professionals in elementary education and traffic police officers. The test involved an analysis of the Item-Objective Congruence (IOC) index. Out of 30 test items, the overall IOC was found to be 0.91, indicating that the overall test items were acceptable, with each item having an IOC greater than or equal to 0.5. Upon closer examination, three items had an IOC value below 0.7, two items scored an IOC of 0.5, and one item scored an IOC of 0.625. The research teams revised these items based on feedback from the experts. Subsequently, the Delphi technique was applied in two rounds to refine the board game. After creating the prototype board game, a pilot test was conducted with elementary school students in Grades 1, 2, and 5. The results demonstrated that students at all grade levels understood the rules and were able to play the game. However, some younger students in Grades 1 and 2 faced limitations in reading ability, requiring assistance from peers or older students during gameplay.

2. To study the results of using the board game to learn and raise an awareness in traffic safety behavior

After piloting the board game with elementary school students, the game was subsequently implemented in four elementary schools with diverse characteristics and contexts. A total of 180 students participated in this implementation. The evaluation process included two primary components. The first component is a questionnaire on road safety knowledge, this questionnaire was applied both before and after playing the board game to assess changes in students' knowledge about road safety. Another component is a questionnaire on satisfaction with the board game, this questionnaire was designed to gather feedback on students' satisfaction with the board game experience with the details below.

2.1 General Information of Participants

Table 1 presents general information on the participation of 180 students from four schools, representing a diverse range of grade levels and board game experience. The participants were distributed across different elementary school grades, with 25.6% in Grade 3, 23.1% in Grade 4, 19.4% in Grade 5, and 28.1% in Grade 6. Additionally, 3.8% of the participants were from other grade levels, Grades 1 and 2. Regarding board game experience, the distribution was relatively balanced, with a slight majority (51.7%) having no prior experience with board games, while approximately 48% had played board games before.

Table 1: General Information of Participants

Items	Percent
Level	
Grade 3 (P3)	25.6
Grade 4 (P4)	23.1
Grade 5 (P5)	19.4
Grade 6 (P6)	28.1
Other	3.8
Overall	100.0
Have you ever played board game before?	
Yes	48.3
No	51.7
Overall	100.0

2.2 Pre- and Post-Board Game Knowledge Assessment

The use of board games as a learning tool for road safety education was assessed through a series of gameplay sessions, each takes approximately 10 – 20 minutes, conducted 2 – 3 rounds. The results indicate that elementary school students in Grades 3 to 6 demonstrated a statistically significant improvement in knowledge at the .05 level, as determined by a Paired Sample T-Test. Moreover, the result revealed that students from Schools 1, 2, and 4 showed a statistically significant increase in knowledge after playing the board game ($p < .05$). However, while students from School 3 showed a slight increase in mean knowledge scores, the improvement was not statistically significant. This outcome may be attributed to the unique socioeconomic background of the students' families, as the majority relied on motorcycles as their primary mode of transportation. Additionally, because the school is located near students' homes, their experiences in other modes of travel, particularly cars and public transportation, are limited. These findings suggest that while board games can serve as an effective tool for road safety education, they should be a diversified learning strategy, incorporating multiple educational methods and integrating road safety education into the local curriculum. It would be more effective in enhancing students' understanding of traffic situations.

Table 2: Pre- and Post-Board Game Knowledge Assessment

	N	Mean	SD	T	Sig
Overall					
Pre-test	166	16.66	3.458	-3.970	<.001*
Post-test	166	17.28	3.425		
School 1					
Pre-test	32	19.09	1.445	-2.347	.013*
Post-test	32	19.50	.803		
School 2					
Pre-test	40	15.95	3.700	-1.902	.032*
Post-test	40	16.73	3.942		
School 3					
Pre-test	37	17.62	2.046	-.876	.194
Post-test	37	17.86	2.771		
School 4					
Pre-test	57	15.18	3.906	-3.038	.002*
Post-test	57	16.05	3.696		

2.3 Satisfaction Survey of the Board Game

To evaluate students' opinions and satisfaction with the board game, the assessment was divided into four key dimensions: Quality of Content (2 items), Activity Performance (3 items), Learning Progression (3 items), and Quality of the Board Game (Instrument) (2 items). The overall satisfaction level was rated at the highest level, with Learning Progression receiving the highest score of 4.45. Similarly, students from Schools 3 and 4 recognized the benefits of learning about road safety through the board game. In contrast, students from Schools 1 and 2 expressed the highest satisfaction with the game's activities, highlighting its potential as a recreational activity.

Regarding the game's content, students found the questions to be straightforward and lacking complexity, making them relatively easy for those in Grades 5 and 6. However, despite perceiving the questions as overly simple, further inquiries into students' knowledge of essential road safety practices revealed several misconceptions, particularly regarding helmet use and motorcycle passenger safety. This underscores the necessity of reinforcing road safety education through diverse learning approaches to ensure students acquire accurate and appropriate knowledge.

Based on the results, acquiring accurate knowledge and fostering a positive attitude toward road safety contribute to the development of desirable safety skills and behaviors.

Table 3: Satisfaction Score of the Board Game

Factors	Overall	School 1	School 2	School 3	School 4
Quality of Content	4.32	4.11	4.05	4.61	4.40
	.679	.528	.829	.536	.653
	Highest	High	High	Highest	Highest
Activity Performance	4.43	4.54	4.21	4.57	4.42
	.555	.409	.689	.372	.599
	Highest	Highest	Highest	Highest	Highest
Learning Progression	4.45	4.50	4.14	4.65	4.48
	.678	.587	.810	.498	.688
	Highest	Highest	High	Highest	Highest
Board Game Quality	4.24	4.28	3.90	4.32	4.36
	.806	.729	1.006	.689	.742
	Highest	Highest	High	Highest	Highest

Future Areas to Take Note of, and Going Forward

Implementation	1) Promote the board game as mass production to ensure easy accessibility for parents and communities and schools, in terms of reasonable price and quality. 2) Develop and innovate board games or alternative learning tools to children with special educational needs or groups with specific requirements.
Education	1) Supporting the use of board games as an alternative learning tool for promoting safety in schools. 2) Integrating road safety education into the mandatory curriculum.
Regulations and Law Enforcement	Regulations and enforcement should be standardized and unified, with additional communication channels to ensure accessibility and awareness across all age groups. For example, requiring both drivers and passengers to wear helmets and limiting the number of passengers to no more than two.

Public Communication

- 1) The success of this board game at the National Children's Day event, as evidenced by the participation of over 400 students and the recognition from Chulalongkorn University through receiving certification, highlights the potential of using games for educational purposes.



- 2) This board game, granted by the MSIWF 2023, is currently undergoing the patent application process with Chulalongkorn University Intellectual Property Institute (CUIP).
- 3) As this board game is currently undergoing the patent process, it will be delivered to schools in Northeastern Thailand upon completion of the patent registration.
- 4) Collaboration with Rotary Thailand to support road safety in Thailand.

Means of Official Announcement of Research Results

- 1) Aired on Chula Radio Plus FM 101.5 (in Thai language) on 22 December 2021, titled "Learning road safety through board games".



- 2) Research articles in academic journals, in Thai (TCI tier 3) and English (Scopus Index) versions are in progress.
- 3) Road Safety Talk, held in February 2025 at Chulalongkorn University Social Research Institute.