



Development of Health Harmony Board Game Innovation to Promote Health Literacy in Preventing Non-Communicable Diseases (NCDs) for Youth

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Abstract

The rising incidence of Non-Communicable Diseases (NCDs) among youth, driven by inappropriate lifestyle behaviors, constitutes a major contemporary public health challenge. However, traditional health education formats often fail to effectively stimulate interest and engagement among younger generations.

This research aimed to develop the "Health Harmony" board game as an educational innovation, evaluate its effectiveness in promoting health literacy for NCD prevention, assess shifts in attitudes and health behaviors among youth, and measure participant satisfaction. The study employed a Research and Development (R&D) methodology integrated with a mixed-methods approach. The game underwent rigorous needs assessment, expert validity verification, and operational trials. The experimental sample consisted of 45 youth selected through purposive sampling. Research instruments included pre- and post-intervention health literacy assessments, behavioral evaluation forms, and satisfaction questionnaires. Data were analyzed using descriptive statistics and a paired-samples t-test.

The findings revealed that post-intervention health literacy scores concerning NCD prevention were significantly higher than pre-intervention scores ($p < .05$). Participants demonstrated enhanced critical thinking skills, exhibited positive attitudes toward self-care, and showed high enthusiasm for modifying their lifestyle behaviors. Furthermore, participant satisfaction across all dimensions (visual art design, game mechanics, and educational value)

was rated at the highest level. The "Health Harmony" board game serves as a highly effective active learning innovation. It can be utilized as a modern alternative to traditional public health instruction, tangibly promoting sustainable health literacy and fostering social collaboration among youth.

Keywords: Board Game, Health Innovation, Health Literacy, Non-Communicable Diseases (NCDs), Youth

Introduction

In the 21st century, the global public health system is confronting a complex crisis driven by the rapid proliferation of Non-Communicable Diseases (NCDs), including cardiovascular diseases, stroke, diabetes, hypertension, and metabolic syndrome. These diseases not only severely degrade the quality of life for the global population but also impose catastrophic socio-economic burdens due to the high and chronic costs of long-term medical care. Current epidemiological reports reveal an alarming demographic shift: the incidence of NCDs is increasingly affecting younger demographics, particularly children, adolescents, and youth, who represent the foundational workforce for future national development.

The primary catalyst for this crisis stems from modern unhealthy lifestyles prevalent in the digital era. A significant portion of the youth population exhibits sedentary behavior resulting from prolonged use of technology and social media, coupled with a distinct lack of standardized physical activity. Furthermore, dietary behaviors have shifted aggressively in response to globalization, characterized by the heavy consumption of fast food containing high levels of sugar, sodium, and saturated fats. When combined with accumulated stress from intense academic competition, these risk factors—if not addressed or made a subject of early awareness—act as profound accelerators for the premature onset of NCDs.

The core strategy for building a sustainable defense against NCDs lies in elevating "**Health Literacy**," defined as an individual's capacity to access, understand, appraise, and apply health information to make informed decisions and modify health behaviors correctly. However, traditional health education systems heavily rely on passive learning processes, such as classroom lectures, printed handouts, or public relations brochures. These conventional methodologies fail to

adequately capture the attention of today's digital natives. A critical limitation of this approach is that while students may memorize content to pass examinations, they are largely unable to translate that theoretical knowledge into practical decision-making skills and authentic health behaviors in their daily lives.

Consequently, the research and development of **Active Learning Innovations** are an absolute necessity. **Game-Based Learning (GBL)**, integrated with Experiential Learning Theory, is internationally recognized as a highly effective pedagogical tool. Specifically, the "Board Game" format offers a highly dynamic medium capable of simplifying complex scenarios through rule systems, game mechanics, and face-to-face interaction. This process allows learners to experience enjoyment while simultaneously practicing critical thinking, communication, and teamwork.

Therefore, the researcher has studied and developed the "Health Harmony" board game as an innovation to enhance health literacy and prevent NCDs among youth. The ultimate goal is to transform health education into an engaging, accessible process that leads to sustainable behavioral modification, with the potential for widespread application across educational institutions, healthcare facilities, and communities.

Research Objectives

1. To develop and assess the quality of the "Health Harmony" board game innovation in promoting health literacy for NCD prevention among youth, ensuring it meets standardized criteria.
2. To compare the health literacy regarding NCD prevention among youth before and after participating in the "Health Harmony" board game learning activity.
3. To study the attitudes and behavioral intentions toward practicing health-promoting behaviors for NCD prevention among youth following the use of the "Health Harmony" board game.

Research Conceptual Framework

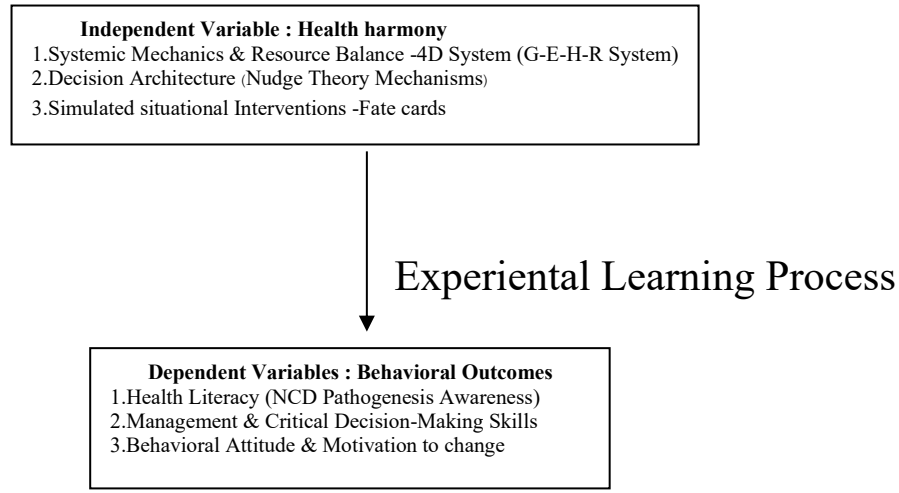


Figure 1

Conceptual Framework

Research Methodology

1.Research Phases

Phase 1: Contextual and Problem Analysis: Study the context, analyze risky behaviors among adolescents, and review the literature on Health Literacy.

Phase 2: Design and Prototype Development: Design the board game system, create the rulebook, and develop assessment tools.

Phase 3: Quality Assessment and Pilot Testing: Present the instruments to 3 experts to evaluate content validity, yielding an Index of Item Objective Congruence (IOC) between 0.83 - 1.00. Subsequently, conduct a pilot test with 10 youths to adjust the timing and rules.

Phase 4: Actual Experiment and Evaluation: Conduct the experiment with a sample of 45 youths. The process includes a Pre-test (15 minutes), board game session (45 minutes), and a Post-test along with a satisfaction questionnaire (15 minutes).

2. Population and Sample

Population: Youths aged 15–22 residing in the Bangkok Metropolitan Region.

Sample: 45 youths aged 15–22, selected via Purposive Sampling from individuals who voluntarily participated in the practical health workshop and could attend the entire process.

3. Research Instruments and Their Quality

- "Health

Harmony" Board Game: A 30-day life simulation learning media where players must select health behaviors to maintain their body's balance.

- **Health Literacy Test:** A 20-item, 4-choice multiple-choice test. It has a difficulty index (p) ranging from 0.20 - 0.80, a discrimination index (r) of 0.20 and above, and a reliability coefficient (KR-20) of 0.84.

Health Attitudes and Behaviors Assessment: A 10-item, 5-level rating scale (Likert Scale).

- **Satisfaction Questionnaire:** A 15-item, 5-level rating scale covering art, rules, interaction, and knowledge, with a reliability coefficient (Cronbach's Alpha) of 0.87

4. Protection of Human Subjects

The

researcher strictly adhered to the principles of human research ethics (Declaration of Helsinki). This involved clarifying the objectives, informing participants of their right to withdraw, obtaining written Informed Consent, and maintaining the confidentiality of personal data by presenting the results strictly as a statistical overview.

Research Results

1. Quality Assessment of the Board Game Innovation

The expert evaluation revealed that the "Health Harmony" board game demonstrates excellent congruence in content, rules, and educational theory (IOC > 0.80). Experts unanimously agreed that the game mechanics realistically simulate the impacts of Non-Communicable Diseases (NCDs).

2. Comparison of Health Literacy

The comparative analysis of health literacy scores regarding the prevention of Non-Communicable Diseases (NCDs) among the target group before and after participating in the Health Harmony board game activity revealed that the 40 youths in the sample had an average pre-activity score of 13.53 (S.D. = 3.01), and following the activity, the average score increased to 25.50 (S.D. = 2.15). Testing the mean difference using a Dependent Samples t-test revealed that the post-experiment health literacy scores were significantly higher than the pre-experiment scores at the .05\$ statistical level ($t = 19.07$, $p < .001$), conforming to the established hypothesis. Details are shown in Table 1.

Table 1

Comparison of Average Health Literacy Scores Before and After Playing the Board Game (n = 45)

Assessment Phase	Total Score	Mean (M)	Standard Deviation (SD)	t-value	p-value
Pre-test	20	12.45	2.12	-19.40	.000
Post-test	20	17.82	1.34		

From Table 1, the comparative analysis of health literacy scores regarding NCD prevention among the sample of 45 youths showed that the average post-activity score ($M = 17.82$, $SD = 1.34$) was significantly higher than the pre-activity score ($M = 12.45$, $SD = 2.12$) at the .05 statistical level ($t(44) = -19.40$, $p < .001$). This indicates that the "Health Harmony" board game innovation can effectively and distinctly enhance the health literacy of the target group.

3. Attitudes and Satisfaction of the Sample

The processing of the satisfaction questionnaire scores from the youth sample regarding the "Health Harmony" board game innovation yielded the results shown in Table 2.

Table 2

Satisfaction Levels of Research Participants Towards the "Health Harmony" Board Game Innovation (N = 45)

Dimensions and Assessment Criteria	Mean (M)	Standard Deviation (SD)	Satisfaction Level
1. Aesthetics, Visual Arts, and Graphic Design	4.68	0.47	high
2. System, Rules, and Gameplay Mechanics	4.52	0.55	high
3. Social Interaction and Group Collaboration	4.81	0.39	high
4. Educational Value and NCDs Health Literacy	4.74	0.44	high
Overall Average	4.69	0.46	high

From Table 2, it was found that the overall satisfaction of the youth sample toward the "Health Harmony" board game was at the highest level ($M = 4.69$, $SD = 0.46$). When considering individual aspects, the highest-rated item was interaction and group collaboration ($M = 4.81$, $SD = 0.39$), followed by educational value and NCD knowledge ($M = 4.74$, $SD = 0.44$). Regarding the qualitative data from the focus group discussion, the majority of youths reflected that the board game helped them understand the connection between risky behaviors and NCDs much more clearly than reading textbooks. For example, one youth representative stated, *"At first, I thought drinking bubble tea every day was fine. But after losing life points in the game until I lost, I realized that in real life, we are probably accumulating risks in the same way."* It was also found that the youths developed a proactive attitude and intended to reduce their consumption of strongly flavored foods while increasing physical activity.

Conclusion

The empirical findings of this research and development conclude that the "Health Harmony" board game innovation is an active learning media of high quality and international standards. The game successfully integrates preventive medicine and public health knowledge regarding NCDs with highly enjoyable mechanics in a unified manner. Experimental results clearly proved that this innovation can significantly elevate youths' health literacy and foster positive attitudes toward self-care. The board game generates the highest level of user satisfaction, can effectively replace traditional lecture-based teaching, successfully captures adolescents' attention, and transforms the health education learning process into an effective space for communication and collaborative problem-solving.

Discussion

The results of the "Health Harmony" board game research and development lead to key points that can be academically discussed based on health education and behavioral science principles and theories as follows:

Point 1: Effectiveness of Game-Based Learning in Enhancing Health Literacy via a Life Status Balance Management System

The significant increase in the youths' average health literacy scores from 12.45 to 17.82 at the .05 level ($t(44) = -19.40, p < .001$) strongly aligns with Kolb's (1984) Experiential Learning Theory. This theory explains that effective and sustainable learning stems from a cycle of concrete experiences crystallizing into abstract conceptualization. This board game innovation succeeded in transforming complex NCD knowledge into a tangible real-life simulation system through 4 key status dimensions: Money, Energy, Happiness, and Risk. The game system does not rely on luck or dice rolling but is driven entirely by the players' strategic decision-making processes.

The design of these 4 status dimensions significantly corresponds with the daily lifestyles and behavioral science of youths in the real world. When players draw scenario cards, they face dilemmas requiring them to trade limited resources. For instance, deciding to consume fast food or highly sweetened drinks yields immediate positive results in the game by saving money and

increasing short-term happiness, but it comes at the cost of accumulating Risk points and reducing the character's Energy.

Observing the progressively rising Risk values and dropping Energy levels through the game's display acts as an immediate feedback system. This stimulates youths to reflect and connect the dots that behaviors bringing temporary happiness in real life are unknowingly building up cumulative risks for NCDs. Consequently, this creates a new cognitive structure, translating into distinctly higher health literacy scores in the dimensions of understanding and critical evaluation. This is consistent with the research by Connolly et al. (2012), which stated that games focusing on managing conflicting resources best develop learners' systems thinking skills.

Point 2: Transforming Attitudes and Confidence Through Risk Management Mechanisms in a Safe Space

The qualitative findings indicating that youths developed positive attitudes and motivation to change health behaviors can be explained by Bandura's (1997) Self-Efficacy Theory and Becker's (1974) Health Belief Model. This board game serves as a safe space for encountering risks. By nature, teenagers tend to exhibit rebellious or dismissive behaviors if directly forbidden from engaging in risky activities, but the "Health Harmony" board game grants complete freedom to the players to control and choose their character's lifestyle themselves.

When players begin to realize that excessively high Risk values in the game lead to illness, disability, or a loss of strategic maneuverability, they start adjusting their in-game behavior by planning the use of Money and Energy on health-promoting activities to lower Risk values and restore their life balance to an optimal point.

The fact that players can successfully plan, manage, and reduce risk levels using their own intellect in the game helps build a sense of satisfaction. This evolves into a belief in their own potential—that they also possess the capability to control, allocate time, and resist stimuli to manage these variables in real life. This attitude is therefore a crucial driving force leading to actual health behavior modifications in their daily routines.

Point 3: Building Social Capital and Interaction Dimensions Among Youths Through Life Status Debriefing

The highest-ranked satisfaction score of \$4.81\$ in the aspect of interaction and group collaboration supports the Cooperative Learning concept by Johnson and Johnson (1999). Because

the game lacks dice, tabletop dynamics emerge from sitting in a circle and observing fellow players' status levels. Youths compare and analyze each other's situations, sparking conversations, recommendations, or warnings when they notice a teammate's Risk value climbing too high.

Furthermore, the knowledge challenge cards serve as an auxiliary mechanism that gives players the opportunity to apply their knowledge of NCDs to salvage their life status or manage resources more efficiently. This face-to-face cooperation and interaction align with the highest level of health literacy according to Nutbeam's (2000) concept: Critical Health Literacy. Thus, this board game does not merely disseminate medical knowledge but acts as a behavioral and social science tool that transforms tedious health education into a unified collaborative decoding of life's balance among youths, adhering to Kapp's (2012) gamification concepts.

Recommendations for Applying Research Findings

1.Integration into School Curricula: Health and Physical Education teachers should adopt the "Health Harmony" board game as a primary tool for active learning management in units concerning NCDs and self-care. It should be used to replace traditional lectures to stimulate student interest and alertness.

2.Expansion into Community Public Health Work: Sub-district Health Promoting Hospitals and community public health centers should utilize this board game innovation in youth leadership camps or young village health volunteer training. This allows these youths to pass on knowledge and enjoyment to their peers in the community through a peer-to-peer education approach.

3.Promoting Informal Learning Environments: Educational institutions and community libraries should allocate budgets to establish "Creative Health Board Game Corners." This provides youths and interested individuals the opportunity to access and learn through play during their free time, thereby concretely reducing sedentary behaviors and computer or mobile phone addiction among youths.

Recommendations for Future Research

1.Long-term Follow-up Studies: Future research should feature experimental designs that track the health behaviors of the youth sample over a long term (e.g., 6 months to 1 year). This would

assess the retention of knowledge and determine the extent to which the health literacy gained during gameplay translates into permanent dietary and physical activity behaviors in real life.

2.Expanding Content Scope Based on New Emerging Contexts: Expansion sets of game cards should be developed to accommodate additional contemporary adolescent health issues, such as the prevention and dangers of e-cigarettes, mental health and depression among adolescents, as well as online gaming addiction behaviors.

3.Development towards Hybrid Digital Innovations: Studies and research should be conducted to integrate modern technology with the board game. For example, utilizing an application combined with QR code scanning on game cards to record scores and player decisions on a cloud network. This would enable educators or researchers to analyze the health behavior trends of youths more accurately using big data characteristics.

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