Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students

Zhang Jiayang[1], Sukol Ariyasajsiskul[2] and Wisute Tongdecharoen[3]
Faculty of Sports Science and Technology, Bangkokthonburi University, Thailand
[1]E-mail: 1771434302@qq.com, ORCID ID: https://orcid.org/0009-0005-3213-1683
[2]E-mail: sukolariya@gmail.com, ORCID ID: https://orcid.org/0009-0007-0203-9581
[3]E-mail: wisute.ton@bkkthon.ac.th, ORCID ID: https://orcid.org/0009-0008-5233-7533
Received 10/05/2026 Revised 02/06/2026 Accepted 30/06/2026

Abstract

Background and Aim: Drowning has become the leading cause of accidental death among adolescents aged 1–14 in China. Traditional swimming education focuses heavily on stroke techniques and endurance, while ignoring situational decision-making, panic management, and safe non-contact rescue skills. This study aimed to develop and verify a Scenario-Based Integrated Learning (SBIL) program integrated with cognitive load management to improve drowning survival and rescue skills among secondary school students aged 12–15.

Methodology: A one-group repeated-measures quasi-experimental design was employed. Participants were 45 middle school students in Zhanjiang. To test the adaptability of the teaching plan for students with different learning paces and ensure teaching safety, the participants were first divided into three sequential batches for pilot implementation of the intervention: 5 students, 10 students, and 30 students. All 45 students received the identical 10-week SBIL program with 20 sessions (60 minutes per session) and were included as a unified sample in the formal experimental analysis.

Results: Post-test skill scores were significantly higher than pre-test scores ($p < 0.001$). Instructional efficiency reached E_1 = 82.07% and E_2 = 84.45%, which met the 80/80 standard. One-month follow-up scores remained significantly higher than pre-test scores, confirming good skill retention. Cognitive load was maintained at a moderate, optimal level, and scenario immersion was high across all batches.

Conclusion: The SBIL program with cognitive load management effectively improves secondary school students' drowning survival and rescue skills, with high instructional efficiency and good long-term skill retention. It provides a scientific, safe, and replicable water safety education model for schools and sports clubs.

Keywords: Scenario-Based Integrated Learning Program; Drowning Survival; Rescue Skills; Secondary School Students

Citation: Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

Introduction

Drowning is a major global public health problem and the third leading cause of unintentional injury death worldwide (World Health Organization [WHO], 2020). Globally, hundreds of thousands of people die from drowning every year, and children and adolescents bear the heaviest burden across all regions, income levels, and cultural backgrounds. This global crisis highlights the urgent need for effective, scalable, and age-appropriate water safety education interventions. In China, drowning has long been the leading cause of accidental death among children and adolescents aged 1–14 years (World Health Organization [WHO], 2020). While this study is rooted in the Chinese educational context, it addresses a common global challenge in water safety education: traditional teaching overemphasizes swimming stroke techniques and physical endurance while seriously neglecting situational decision-making, panic management, emotional regulation, and safe non-contact rescue skills.

With swimming included in the Senior High School Entrance Examination in Guangdong Province and other regions, the number of adolescents participating in swimming training has increased rapidly. However, growing participation in swimming activities has not been accompanied by a corresponding decline in drowning risk, because basic swimming ability does not equal water safety competence. This phenomenon is not unique to China but has been widely reported in international epidemiological studies, indicating that conventional training models are insufficient to address the real cognitive and behavioral challenges in water emergencies. Adolescents aged 12–15 share highly similar developmental characteristics worldwide, including strong curiosity, insufficient risk awareness, incomplete cognitive control, and weak emergency coping abilities, making this age group a key and universal target for drowning prevention education.

Traditional water safety education relies heavily on lectures, posters, video learning, and mechanical repetitive drills, which lead to poor skill transfer and low long-term retention. Students often perform well in standardized tests but fail to respond correctly in real crisis situations. Scenario-Based Integrated Learning (SBIL), combined with scientific cognitive load management, provides an innovative and evidence-based solution to this global educational gap. By integrating immersive simulation, interactive practice, cognitive optimization, and reflective summary, SBIL helps learners master practical survival and rescue skills in realistic environments. To fill this international research gap and respond to the global demand for effective adolescent water safety education, this study developed and verified an SBIL program integrated with cognitive load management, aiming to build a scientific, replicable, and globally adaptable teaching model for adolescents worldwide.

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

Objective

To develop and verify a scenario-based integrated learning (SBIL) program with cognitive load management to improve drowning survival and rescue skills, instructional efficiency, and one-month skill retention among secondary school students aged 12–15.

Literature Review

1. Drowning Risk and Water Safety Education

Drowning is a persistent global public health crisis and the third leading cause of unintentional injury death across the world (WHO, 2020). Although national surveillance data from China confirm the severe local burden of drowning among children and adolescents, the core defects of traditional water safety education revealed in this study are shared by numerous countries and regions across Asia, Europe, Africa, and the Americas. Overemphasis on swimming techniques and physical endurance, lack of realistic scenario simulation, insufficient training in panic management and emotional regulation, weak emphasis on non-contact rescue procedures, and poor long-term skill retention are common problems in school-based water safety education worldwide.

The World Health Organization (2020) has issued clear global guidelines that strongly recommend learner-centered, experiential, scenario-integrated, and cognitively appropriate instructional strategies to improve real-world emergency response capabilities, rather than rote skill drilling and passive learning. This international consensus provides a cross-cultural theoretical foundation and practical reference for designing, implementing, and verifying the SBIL model. The present study connects local educational practice with global public health goals, attempting to develop a water safety education model that is not only effective in the Chinese context but also transferable and adaptable to other cultural and institutional settings globally.

Core drowning survival skills include stable floating posture, controlled breathing, cramp relief, energy conservation, and emotional stability (Zhang et al., 2024). International best practice and WHO guidelines strongly recommend that untrained adolescents use non-contact rescue following the sequence: Shout – Call – Reach – Throw – Don’t Go, to avoid putting themselves at risk (WHO, 2020). However, most domestic school-based water safety programs do not systematically teach these non-contact rescue procedures or embed them in realistic scenarios.

Students aged 12–15 are in a critical developmental period with active behavior, strong curiosity, weak risk awareness, and incomplete cognitive and impulse control functions, making them especially vulnerable to water accidents (Yang, 2025). This highlights an urgent need for targeted, age-appropriate water safety education that combines skill mastery, decision-making, and panic management.

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

2. Scenario-Based Integrated Learning (SBIL)

Scenario-Based Integrated Learning (SBIL) is an experience-centered, learner-driven instructional model that situates knowledge and skill acquisition in realistic, task-oriented situations (Gao, 2001). It creates immersive environments that simulate real emergencies, allowing learners to participate interactively, make judgments under pressure, cooperate with peers, and reflect on performance, thereby transforming passive reception into active construction (Wei, 2025). A complete SBIL process typically includes four standardized steps: (1) Scenario creation: Design realistic, age-appropriate emergencies; (2) Task clarification: Define learning objectives, roles, and operational rules; (3) Interactive practice: Conduct role-playing, cooperative problem-solving, and repeated operation; and (4) Reflection summary: Debrief errors, optimize strategies, and consolidate behavioral memory (Yang, 2025).

Empirical studies confirm that SBIL significantly enhances learning motivation, situational awareness, skill application, and emergency response performance compared with traditional instruction (Zhang et al., 2024; Sun et al., 2023). By simulating pressure and uncertainty, SBIL helps learners maintain calm, make reasonable decisions, and perform correct actions in real crises, key qualities for drowning survival and safe rescue.

In water safety education, scenario-based simulation helps students experience panic, physical discomfort, and decision pressure in a controlled, safe environment, thus reducing real-world fear and improving adaptive response capacity (Smith and Jones, 2018). SBIL thus provides a feasible framework to address the weaknesses of traditional swimming education.

3. Cognitive Load Theory

Cognitive Load Theory (CLT), established by Sweller (1988), holds that human working memory capacity is limited; excessive cognitive load impairs learning, while appropriate load promotes deep processing and retention. Effective instructional design must manage three types of cognitive load:

Intrinsic cognitive load: Determined by the complexity of the learning content itself.

Extraneous cognitive load: Generated by inappropriate instructional formats and unnecessary information.

Germane cognitive load: Constructive load devoted to schema acquisition and automation.

The core goal of cognitive load management is to reduce extraneous load, optimize intrinsic load, and promote germane load to maintain overall load at a moderate optimal level (Sweller, 2010; Sweller et al., 1998). Moderate cognitive challenge supports skill acquisition and long-term memory, while overload causes fatigue, confusion, and poor performance (Van Merriënboer and Sweller, 2005).

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

For adolescents aged 12–15, cognitive functions are still developing; their attention control and information processing capacity are relatively limited (Yang, 2025). Scenario complexity, task difficulty, and information density must be carefully controlled to avoid overload. When SBIL is combined with cognitive load management, such as step-by-step scenario progression, clear guidance, and appropriate repetition, learning efficiency and skill retention can be significantly improved (Van Merriënboer and Sweller, 2005).

4. Skill Retention and Experiential Learning

Skill retention refers to the degree to which learners maintain and can correctly apply learned skills over time after formal instruction ends. It is a key indicator of effective safety training, as skills must be retrievable in real emergencies (Schmidt and Bjork, 1992).

Experiential Learning Theory (Kolb, 1984) proposes a four-stage cycle: (1) Concrete experience; (2) Reflective observation; (3) Abstract conceptualization; and (4) Active experimentation. This cycle supports the formation of stable motor memory and durable long-term retention (Schmidt and Bjork, 1992). Compared with passive listening or mechanical repetition, experiential and scenario-based practice produces stronger memory traces and better retention (Zhang et al., 2024; Sun et al., 2023).

The Challenge Point Framework (Guadagnoli and Lee, 2004) further suggests that optimal retention occurs when the difficulty of practice matches the learner's ability. For adolescent water safety training, appropriately challenging scenario practice with timely feedback and reflection helps automate survival and rescue skills, ensuring they can be performed under stress even weeks after training.

5. Summary

Overall, existing studies and practical water safety education have not yet formed a systematic and targeted teaching system for adolescent drowning prevention. On the one hand, most water safety training programs still adopt traditional lecture and drill modes, lacking immersive scenario practice and scientific cognitive load control design, and fail to effectively combine Scenario-Based Integrated Learning with cognitive load management to improve learning effects. On the other hand, current evaluation focuses more on short-term skill mastery after training, with rare long-term retention tracking such as one-month follow-up tests, and there is also a shortage of standardized and reliable evaluation tools suitable for scenario-based water safety skill assessment. In addition, few studies have developed and verified a complete, replicable water safety teaching model specifically for middle school students aged 12–15, which cannot fully meet the cognitive characteristics and actual learning needs of this age group. These deficiencies restrict the improvement of adolescents' drowning survival and rescue abilities in real

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

emergencies and also create an obvious research gap that this study intends to supplement and perfect.

Conceptual Framework

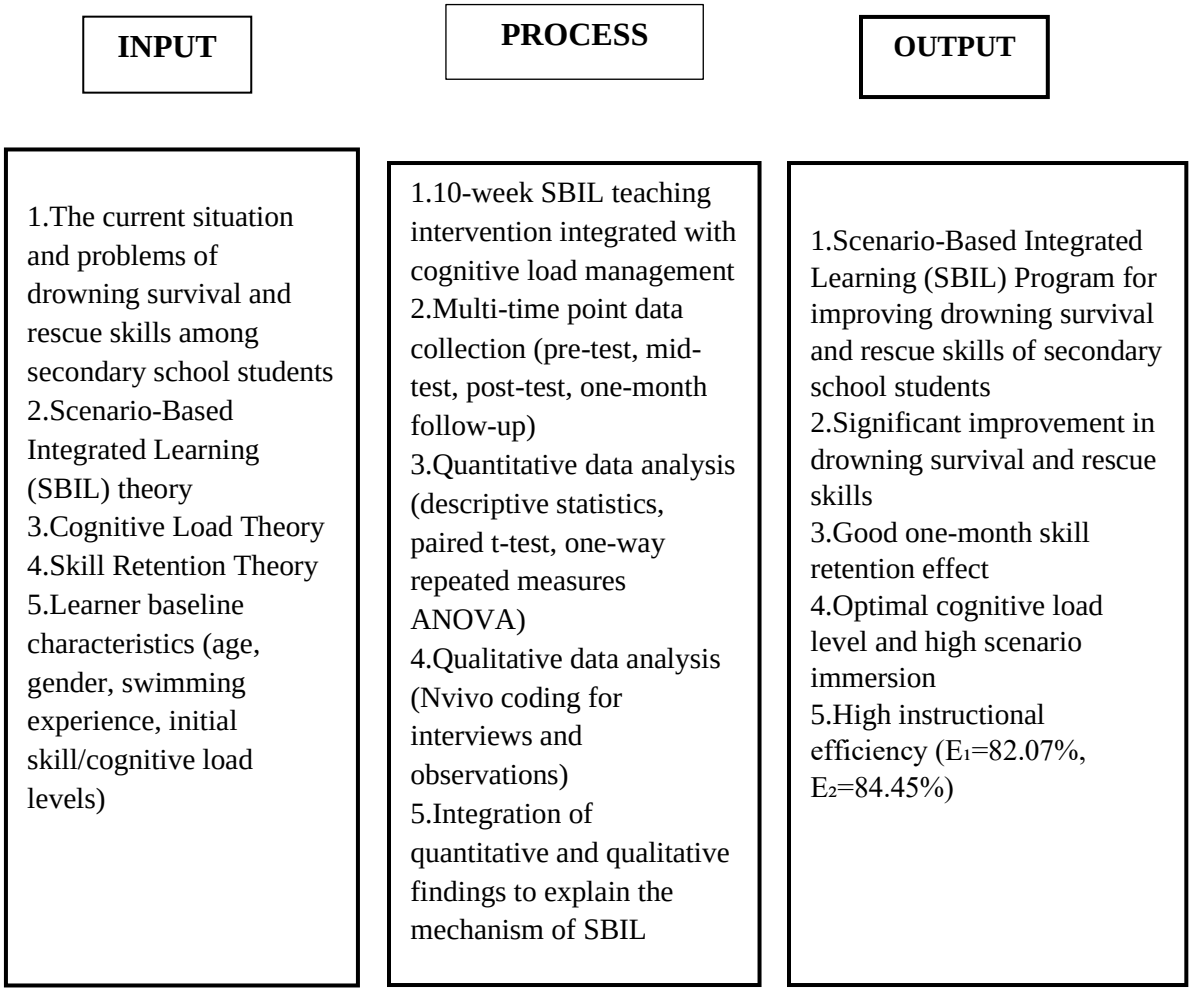


Figure 1 Conceptual framework

Methodology

1. Research Design

This study used a one-group repeated-measures quasi-experimental design. Measurement time points included T_1 (pre-test), T_2 (mid-test), T_3 (post-test), and T_4 (one-month follow-up). This design enables continuous observation of skill acquisition, cognitive load changes, and long-term retention within the same group of participants, which is particularly suitable for exploratory intervention research in educational settings. This study employs a quantitative research

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

methodology utilizing a quasi-experimental design due to practical limitations in authentic teaching and learning contexts where complete control of confounding variables cannot be fully achieved. Nevertheless, the researcher established a rigorous repeated-measures structure to continuously monitor skill development, cognitive load changes, and long-term retention throughout the SBIL intervention process.

2. Population and Sample

The target population of this study was lower secondary school students aged 12–15 years in Zhanjiang, Guangdong Province, China, a high-risk group for drowning with incomplete cognitive and risk awareness development. A total of 45 students who met the inclusion criteria (aged 12–15 years, able to swim 50 meters continuously, no prior water rescue training, good health, and voluntary participation with parental consent) were selected as the research sample. A mixed sampling strategy was adopted: first, purposive sampling was used to select Zhanjiang Diving School as the research site; second, stratified sampling by grade (Grade 7, 8, 9) was conducted to ensure balanced representation; finally, simple random sampling (lottery method) was applied within each grade stratum to recruit participants.

To test the adaptability of the SBIL teaching plan for students with different learning abilities and paces, and to ensure teaching safety during the implementation of scenario-based training, the 45 participants were first divided into three sequential batches for pilot implementation of the intervention (Batch 1: 5 students; Batch 2: 10 students; Batch 3: 30 students). This gradual scaling approach allowed instructors to verify the rationality of the teaching content, adjust the difficulty progression of scenarios, optimize the guidance methods, and standardize the safety control procedures before full implementation. All 45 participants received the identical SBIL intervention, assessment tools, scoring criteria, and instructor arrangement. The three batches were organized solely for the purpose of testing the teaching plan's adaptability and ensuring teaching safety, and did not constitute separate experimental groups. All inferential statistical analyses were conducted using the unified participant cohort (N = 45) to ensure consistency in repeated-measures analysis and instructional efficiency evaluation.

3. Research Instruments

1. General Background Information Form: Used to collect age, gender, grade, swimming ability, prior training, and health status. Administered at pre-test (T1) to establish participant baseline.

2. Simulated Water Safety Skill Application Checklist: 60 points, 3 dimensions (Decision Making, Action Accuracy, Efficiency and Speed). Used at pre-test (T1) and post-test (T3). Validity: IOC = 0.67–1.00; Inter-rater reliability: ICC = 0.87.

3. Skill Retention Checklist: Identical structure to the skill application checklist. Used at

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

one-month follow-up (T4) to measure long-term skill retention. Same validity and reliability as the original checklist.

4. Cognitive Load and Scenario Immersion Questionnaire: Includes a 7-point cognitive load scale and 5-point immersion scale. Completed after each session to monitor load and engagement. Reliability: Cronbach's α = 0.89.

5. Instructional Efficiency Recording Form (E_1/E_2): Used to calculate process efficiency (E_1) and product efficiency (E_2). Criterion: E_1 ≥ 80% and E_2 ≥ 80% = highly efficient.

4. Data Collection

1. Pre-test data collection (T1, Week 1). Collected baseline skill scores, cognitive load, and background information. Used the Simulated Water Safety Skill Application Checklist and background form.

2. Intervention and process data collection (Weeks 2–11). Conducted a 10-week SBIL program (20 sessions, 60 mins each). Monitored cognitive load and scenario immersion after each session. Collected formative scores for process efficiency (E_1).

3. Post-test data collection (T3, End of Week 11). Measured post-intervention skill performance and final cognitive load. Used the same skill checklist and questionnaire; collected data for E_2 calculation.

4. One-month follow-up data collection (T4, Week 15). Assessed skill retention without extra training. Used the Skill Retention Checklist with identical scoring rubrics.

5. Quality control. Checked data completeness; double-entered into SPSS 26.0 to ensure accuracy.

5. Data Analysis

1. Descriptive statistics. Calculated mean (M) and standard deviation (SD) for skill scores, cognitive load, and immersion. Used frequency and percentage for demographic characteristics.

2. Paired samples t-test. Compared pre-test vs. post-test scores to test skill improvement. Compared post-test vs. follow-up scores to examine retention.

3. One-way repeated measures ANOVA. When significant main effects were identified, Bonferroni-adjusted pairwise comparisons were conducted to determine specific differences between measurement phases while minimizing Type I error inflation associated with multiple comparisons. Analyzed skill changes across T1, T2, T3, and T4. Used Bonferroni post-hoc test; Greenhouse–Geisser correction when sphericity was violated. Effect sizes were interpreted using Cohen's d and partial eta squared (ηp^2) to determine the magnitude of intervention effects.

4. Instructional efficiency analysis. Calculated E_1 = (Formative score / Max score) × 100%. Calculated E_2 = (Post-test score / Max score) × 100%. Evaluated against the 80/80 efficiency

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

standard.

5. Cognitive load and immersion analysis. Verified cognitive load remained in the optimal range (3–5 points). Confirmed high scenario immersion across all batches.

6. Validity and reliability analysis. Reported IOC for content validity, ICC for inter-rater reliability, and Cronbach's α for internal consistency.

6. Ethical Consideration

This research obtained ethical approval from the Ethics Committee of Bangkokthonburi University, certificate No. 2569/144(7), issued on February 8, 2026.

Results

Part 1: General Information of Participants

The sample included 45 students, 24 males (53.33%) and 21 females (46.67%), aged 12–15. All participants could swim 50 meters continuously and had no prior water rescue training.

Part 2: Pre-test and Post-test Skill Comparison

Table 1 Comparison of water safety skill scores before and after intervention (n=45).

Dimension	Pre-test (Mean±SD)	Post-test (Mean±SD)	t	p
Decision Making	11.05±1.82	16.92±1.55	16.45	0.001*
Action Accuracy	10.82±1.95	16.85±1.48	17.12	0.001*
Efficiency and Speed	10.97±1.78	16.90±1.62	16.88	0.001*
Total Score	32.84±5.12	50.67±4.38	18.92	0.001*

$p < 0.05$

Interpretation: Repeated Measures ANOVA revealed a statistically significant main effect of time on drowning survival and rescue skill performance. Post-test scores were significantly higher than pre-test scores ($p < .001$), indicating strong improvement in decision-making, action accuracy, and emergency response efficiency following the SBIL intervention. The intervention effect size was exceptionally large (Cohen's $d = 2.82$; $\eta p^2 = .912$), demonstrating strong practical significance. The repeated-measures analysis further indicated that the SBIL intervention accounted for a substantial proportion of the variance in drowning survival and rescue skill improvement.

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

Part 3: Skill Retention at One-Month Follow-Up

Table 2 Skill retention comparison at pre-test, post-test, and follow-up (n=45).

Measurement	Mean±SD	t	p
Post-test	50.67±4.38	2.14	0.05*
1-Month Follow-up	48.92±4.65		
Pre-test	32.84±5.12	15.63	0.001*
1-Month Follow-up	48.92±4.65		

$p < 0.05$

Interpretation: Although follow-up scores showed a slight decrease compared with immediate post-test performance, the scores remained significantly higher than pre-test levels ($p < .001$), confirming good long-term retention of drowning survival and rescue skills.

Part 4: Cognitive Load and Scenario Immersion

Table 3 Cognitive load and scenario immersion levels (n=45).

Variable	Mean±SD	Level
Overall Cognitive Load	4.12±0.76	Optimal
Overall Scenario Immersion	4.41±0.52	High

Interpretation: The cognitive load results indicated that the SBIL instructional design successfully maintained learner processing demands within an optimal range, avoiding cognitive overload while sustaining high scenario immersion and active engagement throughout the intervention.

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

Part 5: Instructional Efficiency (E_1/E_2)

Table 4 Instructional Efficiency of the SBIL Program by Module and Overall (N = 45).

Efficiency Type	Assessment Module	Maximum Module Score	Actual Mean Score (Mean±SD)	Efficiency Percentage (%)	Compliance with 80/80 Criterion
Process Efficiency (E_1)	Module 1: Peer Drowning Rescue	60	48.50±3.21	80.83	Met
	Module 2: Self-Cramping Survival & Assistance	60	49.20±2.98	82.00	Met
	Module 3: Lost Companion & Water Orientation	60	49.50±2.87	82.50	Met
	Module 4: Safe Entry/Exit & Risk Prevention	60	49.80±2.75	83.00	Met
	Module 5: Emergency Communication & Integrated Drills	60	49.22±3.05	82.03	Met
	Total Process Efficiency (E_1)	300	246.22±14.86	82.07	Met
Product Efficiency (E_2)	Comprehensive Simulated Scenario Post-test	60	50.67±4.38	84.45	Met

Interpretation: The SBIL program achieved process efficiency above 80% in the formative assessments of all 5 teaching modules. The efficiency variation across modules was minimal (only 2.17%), indicating a well-designed instructional progression and consistent student mastery of core skills in each module. The overall process efficiency reached 82.07%, and the product efficiency reached 84.45%. Both indicators significantly exceeded the 80/80 benchmark for highly effective instruction, demonstrating that the program not only delivers excellent progressive instructional effects during the learning process but also achieves high-quality final skill transfer, making it suitable for large-scale implementation in secondary school water safety education.

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Conclusion

The findings of this study demonstrate that the Scenario-Based Integrated Learning (SBIL) program integrated with cognitive load management effectively improves secondary school students' drowning survival and rescue skills. Significant improvements were observed in decision-making, action accuracy, and emergency response efficiency following the 10-week intervention, while instructional efficiency indices exceeded the established 80/80 standard. In addition, one-month follow-up results confirmed good long-term skill retention.

The study further indicates that appropriate cognitive load regulation and immersive scenario practice can enhance experiential learning without causing learner overload. These findings support the integration of scenario-based instruction, cognitive load management, and skill-retention principles within adolescent water safety education.

This study contributes empirical evidence and a practical instructional framework that may support future curriculum development for schools, swimming institutions, and community drowning-prevention programs.

Discussion

The results confirmed that the SBIL program integrated with cognitive load management significantly improved students' drowning survival and rescue skills, including decision-making, action accuracy, and response efficiency. These findings are consistent with a large body of international educational psychology research, which suggests that scenario-based, experiential, and learner-centered instruction significantly enhances situational awareness, emotional regulation, and emergency response performance compared with traditional drill-based teaching. The moderate cognitive load scores further suggest that the instructional design successfully balanced task complexity and learner processing capacity, which is consistent with the principles of Cognitive Load Theory proposed by Sweller (1988). By simulating real water emergencies in a safe and controlled environment, SBIL helps students transform passive knowledge reception into active behavioral construction, thereby improving their ability to cope with crises. The findings support Constructivist Learning Theory and Experiential Learning Theory, both of which emphasize that practical competence is more effectively acquired through immersive participation, contextualized problem solving, and reflective practice rather than passive instruction alone.

Cognitive load remained at a moderate optimal level throughout the intervention, which provides critical cognitive evidence for the effectiveness of the SBIL design. The program effectively reduced extraneous cognitive load by providing clear instructions, step-by-step scenario progression, visual guidance, and streamlined information input. Meanwhile, it actively promoted germane cognitive load through repeated immersive practice, immediate feedback,

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Interdisciplinary Academic and Research Journal, 6 (6), November-December 2026
Old ISSN 2774-0374: New ISSN 2985-2749
Website: https://so03.tci-thaijo.org/index.php/IARJ/index
Article ID: e301846

reflective summary, and strategy optimization. This balanced cognitive configuration facilitates schema construction, knowledge integration, and skill automation, which directly explains the significant improvement in skills and the good long-term retention observed at the one-month follow-up.

Notably, different skill dimensions exhibited distinct retention trajectories in the follow-up test. Decision-making ability remained relatively stable, mainly because scenario training strengthened high-level cognitive rules and risk judgment strategies rather than simple motor responses. In contrast, action accuracy showed a slight but significant decline, which reflects the natural attenuation of fine motor memory in the absence of continuous practice. These differential changes are highly consistent with skill retention theory, the challenge point framework, and empirical findings from international motor learning research, enriching the theoretical understanding of how safety skills are maintained over time.

When compared with international studies on experiential learning and safety training under stressful conditions, the SBIL model demonstrates consistent and reliable advantages in real-world skill transfer. Traditional water safety education often fails because it separates skill learning from real emergency contexts, resulting in poor adaptability and panic responses. In line with WHO global guidelines, the SBIL program prioritizes non-contact rescue, panic management, rational decision-making, and self-protection, which are core competencies for reducing adolescent drowning worldwide.

This study also has several limitations. First, the one-group quasi-experimental design limits the ability to draw definitive causal conclusions. Second, the sample is limited to one city in southern China, which may reduce generalizability. Third, all assessments were conducted in simulated scenarios rather than real natural water environments. Future research should adopt a randomized controlled trial design, include larger and more geographically diverse samples, extend the follow-up period, and integrate virtual reality (VR) technology to build more realistic emergency environments, thereby further improving the ecological validity and global applicability of the SBIL model.

The strong one-month retention performance may be explained by repeated scenario rehearsal, emotional engagement, and active experiential participation throughout the intervention. These elements likely strengthened long-term memory consolidation and improved students' ability to retrieve survival and rescue procedures under simulated emergency conditions.

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Recommendations

Recommendation for this research

Based on the findings and implementation process of this study, several practical recommendations are proposed to optimize the present SBIL program. To enhance scoring stability and operational consistency, it is necessary to strengthen the standardization of scenario practice duration and assessment rating procedures. In addition, clearer visual guidance and verbal instructions should be provided during scenario-based tasks to further reduce unnecessary extraneous cognitive load and help students focus more on skill learning and emergency decision-making. Meanwhile, adopting more unified group sizes in subsequent teaching implementations can improve the comparability of learning processes and efficiency data across different sessions, thereby further enhancing the overall quality and stability of the program.

Recommendation for further research

For future studies in this field, more in-depth and extensive explorations can be carried out to expand the significance and application scope of this research. It is suggested to conduct a controlled comparative study to directly verify the effectiveness of the SBIL program by comparing it with traditional water safety teaching methods. In addition, expanding the sample size and extending the research scope to include students from rural, suburban and different regional areas will help improve the representativeness and generalizability of the results. Furthermore, introducing advanced technologies such as virtual reality (VR) or augmented reality (AR) can create more realistic and diverse water emergency environments, which will help enhance scenario immersion and further examine the far-transfer effect of drowning survival and rescue skills in real-world situations.

References

Gao, W. (2001). Situated learning and situated cognition. *Educational Development Research*, (8), 30–35. https://doi.org/10.14121/j.cnki.1008-3855.2001.08.066

Guadagnoli, M. A., & Lee, T. D. (2004). Challenge point: A framework for conceptualizing the effects of various practice conditions in motor learning. *Journal of Motor Behavior, 36*(2), 212–224. https://doi.org/10.3200/JMBR.36.2.212-224

Kolb, D. A. (1984). *Experiential learning: Experience as the source of learning and development*. Prentice Hall.

Schmidt, R. A., & Bjork, R. A. (1992). New conceptualizations of practice: Common principles in three paradigms suggest new concepts for training. *Psychological Science, 3*(4), 207–217. https://doi.org/10.1111/j.1467-9280.1992.tb00029.x

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846

Smith, J., & Jones, A. (2018). Story-based scenario training improves water safety skill development and application in adolescents. *Journal of Teaching in Physical Education, 37*(2), 189–196.

Sun, M. Y., Zhang, L., & Wang, L. (2023). The impact of reflection logs on the retention of youth swimming safety skills. *Journal of Beijing Sport University, 46*(8), 112–118.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science, 12*(2), 257–285. https://doi.org/10.1207/s15516709cog1202_4

Sweller, J. (2010). Cognitive load theory: Recent theoretical advances. In J. Plass, R. Moreno, & R. Brünken (Eds.), Cognitive load theory (pp. 29–47). Cambridge University Press.

Van Merriënboer, J. J. G., and Sweller, J. (2005). Cognitive load theory and complex learning: Recent developments and future directions. Educational Psychology Review, 17(2), 147-177. https://doi.org/10.1007/s10648-005-3230-6

Wei, M. (2025). Development and application of scenario-based teaching method in junior high school Chinese classroom teaching. Journal of Chinese Teaching Friends, 44(4), 26-28. https://doi.org/10.16412/j.cnki.1001-8476.2025.04.008

World Health Organization. (2020). Global report on drowning: Preventing a leading killer. https://doi.org/10.1594/WHO.WSH.2020.1

Yang, H. T. (2025). Research on scenario-based teaching of "safety emergency and risk avoidance" in primary school physical education [Master's thesis]. Chengdu University. https://doi.org/10.27917/d.cnki.gcxdy.2025.000223

Zhang, L., Sun, M. Y., and Wang, L. (2024). The effect of multi-scenario simulation training on swimming safety skill retention in adolescents. Journal of Sports Science and Medicine, 23(1), 45-52. https://doi.org/10.12688/jssm.2024.23.1.45

Citation:
Zhang, J., Ariyasajsiskul, S., & Tongdecharoen, W. (2026). Applied Scenario-Based Integrated Learning (SBIL) Program to Improve Drowning Survival and Rescue Skills for Secondary School Students. Interdisciplinary Academic and Research Journal, 6(6), e301846; DOI: https://doi.org/10.60027/iarj.2026.e301846