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Developing a Swimming Training Program to Improve Swimming Skills in Lishui City, the People's Republic of China

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Abstract

Background and Aims: Improving swimming skills enhances safety by reducing the risk of drowning and boosts physical fitness through a full-body, low-impact workout. It also builds confidence in the water, enabling participation in various aquatic activities. This study aimed to (1) examine the effectiveness of a structured swimming training program for lower secondary students at Kuocang Middle School, China, who lacked basic swimming skills, and (2) compare its outcomes to traditional swimming instruction.

Methodology: A quasi-experimental design was employed involving 30 students (aged 13–15), randomly assigned to an experimental group (structured program) and a control group (traditional program). Training was conducted three times per week for eight weeks. Swimming proficiency was assessed through pre-test and post-tests at weeks 2, 4, and 8.

Results: Participants in the structured swimming program showed statistically significant improvement in swimming proficiency at all measured intervals. After the program (week 8), the experimental group had a notably higher mean score (8.20) compared to the control group (5.15). The comparative analysis revealed significant skill development differences at weeks 2, 4, and 8 ($p < 0.05$).

Conclusion: The structured swimming program was significantly more effective in enhancing swimming skills among lower secondary school students compared to traditional teaching methods. Educational institutions should integrate structured swimming curricula into their programs to effectively develop students' swimming abilities, ensure safety, and promote sustained skill retention.

Keywords: Swimming Program; Lower Secondary; Students; Swimming Skills

Introduction

Swimming has been practiced widely in China since ancient times and is recognized as a beneficial physical activity due to its ability to enhance muscular strength, improve overall fitness, and provide a crucial life-saving skill (Chan, 2023). Given China's extensive natural water environments, learning to swim is vital not only for health and recreation but also for personal safety, particularly for children and adolescents. Recognizing the significance of swimming skills for personal safety, the Chinese government has integrated swimming into educational curricula at all levels, from kindergarten through secondary education and up to university programs (Ministry of Education of the People's Republic of China [MOE], 2020). This systematic integration has the broad support of families, educational administrators, and policymakers nationwide, reflecting a commitment to reducing drowning risks and promoting aquatic safety.

Furthermore, China's international recognition in swimming and related aquatic sports, such as diving, underscores the importance of establishing structured swimming programs early in educational settings. These programs not only equip students with vital safety skills but also pave the way for athletic development, providing career opportunities as professional swimmers and coaches (Chan, 2023). However, despite the systematic implementation of swimming courses, many lower secondary school students still lack fundamental swimming abilities. These students represent a particular concern for educators and parents, as inadequate swimming skills pose significant safety risks (MOE, 2020). Addressing this gap requires structured swimming curricula developed through modern pedagogical principles and effective instructional design (Yoon, 2021). Research indicates that curriculum improvements in physical education, especially those employing structured programs and validated teaching methodologies, can effectively address skill deficiencies and significantly improve learning

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outcomes (Chan, 2023; MOE, 2020). Structured swimming programs that involve systematically designed exercises, validated by experts, have shown promise in enhancing learner engagement, safety awareness, and skill retention, thereby minimizing the incidence of drowning (Ilago, 2021).

Specifically, structured programs designed by experts in sports science and aquatic education help reduce negative attitudes among learners, such as boredom or anxiety, associated with traditional repetitive swimming drills (MOE, 2020). Moreover, such expert-designed programs emphasize progressive skill-building and enjoyment, facilitating effective learning and longer-term retention of swimming competencies. Given the critical need to ensure water safety and improve swimming skills among lower secondary school students, particularly those who currently cannot swim, the researcher conducted this quasi-experimental study. The research evaluated the effectiveness of a structured swimming training program implemented at Kuocang Middle School, Liander District, Lishui City, China. The primary aim was to examine whether systematically designed swimming exercises could significantly enhance swimming proficiency and safety awareness among students lacking initial swimming skills, compared to traditional swimming instruction methods.

Objectives

1. To examine the effectiveness of a structured swimming program designed for lower secondary school students who lack basic swimming skills at Kuocang Middle School.
2. To compare the outcomes of implementing the structured swimming program among lower secondary students who initially could not swim at Kuocang Middle School.

Literaterature Review

Theories and Student Swimming Skills

Effective swimming instruction requires the integration of psychological theories into teaching practices to facilitate skill acquisition. According to Zhou (2021), psychological principles significantly impact students' learning processes by promoting enjoyable, structured practice and clear instructional communication. Three psychological theories are particularly influential in swimming education: Skinner's operant conditioning, Pavlov's classical conditioning, and Watson's classical conditioning. Skinner's operant conditioning theory emphasizes behavior reinforcement, including positive reinforcement (e.g., praise or rewards) and negative reinforcement (e.g., criticism or punishment). When applied to swimming instruction, reinforcing positive behaviors, such as correct stroke execution, encourages repetition and mastery. Instructors can reinforce desired behaviors systematically, clearly specifying the behaviors to be praised, ensuring sincerity, and employing reinforcement schedules (fixed or variable) to optimize learning (Zhou, 2021; Li & Wu, 2022).

Pavlov's classical conditioning theory highlights the relationship between stimuli and conditioned responses. Pavlov's experiments, in which neutral stimuli (e.g., a bell) were paired with food to elicit salivation in dogs, demonstrate how repeated pairing creates automatic associations. Applied to swimming education, instructors can establish cues or conditions signaling desired behaviors. For instance, verbal or visual cues given before specific swimming drills can condition students to perform skills automatically, improving technique consistency (Zhou, 2021). Similarly, Watson's classical conditioning theory builds on Pavlov's principles, emphasizing structured environmental stimuli to generate consistent emotional or behavioral responses. Watson demonstrated conditioned emotional responses through experiments involving white rats and loud noises, highlighting the importance of stimulus control. Applied practically, swimming instructors must create clear stimuli prompting students toward appropriate responses. Continuous assessment allows instructors to adjust these stimuli effectively, ensuring desired responses and improved performance (Zhou, 2021; Johnson & Carter, 2023).

Beyond psychology, technical swimming skill acquisition remains fundamental. Zhao (2020) highlights swimming skills as essential for survival, recreation, and competitive athletics, advocating structured instruction in four basic strokes: freestyle, backstroke, breaststroke, and butterfly. Freestyle

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swimming emphasizes streamlined body positioning, alternating coordinated arm movements, rhythmic breathing, and controlled leg kicking. Backstroke involves maintaining a horizontal body alignment, coordinated alternating arm strokes, steady breathing, and consistent leg movements. Breaststroke demands precise coordination between simultaneous arm pulls, leg kicks, rhythmic breathing, and glide phases. Butterfly integrates undulating body movements, simultaneous arm pulls, rhythmic breathing, and powerful leg kicks, emphasizing full-body coordination (Zhao, 2020). Training typically begins with freestyle, as its fundamental skills (e.g., kicking, breathing techniques, and stroke coordination) serve as prerequisites for mastering more complex strokes. Instructional sequences involving initial body positioning, controlled breathing drills, progressive stroke practice, and coordinated limb movements form the foundational approach for swimming education (Zhao, 2020).

Recent studies have also begun exploring technology-assisted methods to bolster technical training. For example, Li and Wu (2022) found that incorporating video analysis and wearable motion sensors helps students visualize and correct inefficiencies in stroke mechanics, leading to more rapid improvement. Integrating psychological theories into such structured, technologically enhanced programs can significantly amplify engagement and reinforce positive learning outcomes (Johnson & Carter, 2023; Li & Wu, 2022). The effective coupling of psychological frameworks with rigorous skill progression is central to developing proficient and confident swimmers. Clear reinforcement, conditioned stimuli, and systematic instruction collectively improve swimming proficiency, enabling students to achieve long-term benefits in personal safety, fitness, and potential athletic advancement (Zhou, 2021; Zhao, 2020).

Methods of Application in Teaching Swimming

Effective swimming instruction requires structured teaching methods based on clear educational principles. According to Xin (2023), swimming is integrated into physical education curricula from primary school to university, aiming to enhance students' safety, fitness, and potential athletic progression. Successful instruction relies heavily on teacher competence, systematic instructional planning, and progressive skill development (Xin, 2023). Initial swimming instruction often begins at age two or three, focusing on overcoming the learner's fear of water through controlled acclimatization activities such as shallow-water immersion, basic floating, and simple breath-control exercises (Daniel, 2014). Progressive skill development includes essential movements such as leg kicking, rhythmic breathing, and coordinated floating (Daniel, 2014). Structured exercises ensure steady skill advancement, integrating individual movements into complete swimming strokes and survival skills, including dog paddling and treading water. Several critical factors influence swimming skill acquisition, such as instructional clarity, continuous feedback, practice repetition, and knowledge transfer (Ilago, 2021). Effective instructors manage these factors by systematically reinforcing learned behaviors through structured practice sessions and providing accurate feedback, ensuring skill retention and practical application. Advanced instructional methods emphasize proper coordination of limb movements and breathing synchronization, which instructors introduce through detailed demonstrations and repeated exercises (Daniel, 2014). Instructional effectiveness is significantly enhanced when foundational movements—floating, kicking, and coordinated arm-leg actions—are systematically taught and integrated into cohesive swimming strokes (Xin, 2023).

New research also suggests that personalized feedback systems, such as real-time video analysis or wearable heart rate monitors, can refine technique and pacing strategies (Johnson & Carter, 2023). By incorporating these data-driven approaches, instructors can tailor skill progression to individual learners' needs, promoting self-regulation and a deeper understanding of optimal swimming mechanics. Structured swimming programs employing progressive instructional methodologies, systematic practice, and continuous feedback have been shown to effectively develop essential swimming skills. Such programs significantly enhance students' proficiency, safety awareness, and long-term swimming competency (Xin, 2023; Daniel, 2014; Ilago, 2021; Johnson & Carter, 2023).

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Conceptual Framework

This research adopts a quasi-experimental design to evaluate the effects of a researcher-developed swimming training program on lower secondary school students who cannot swim. The training program consists of fundamental swimming exercises, totalling seven sessions, structured to systematically enhance basic swimming skills and proficiency.

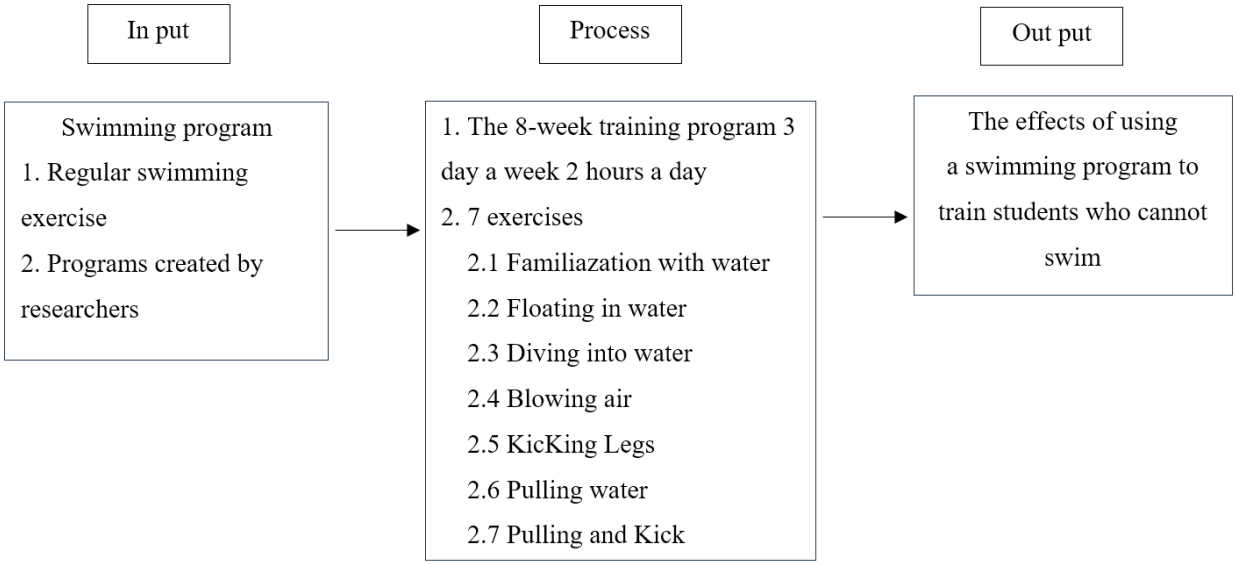

Figure 1 Conceptual Framework

Methodology

Population

The population consists of 33 lower secondary school students aged 13-15 years from Kuocang Middle School, comprising 12 males and 21 females, all of whom initially lacked basic swimming skills.

Sample Group

This quasi-experimental research involved 30 lower secondary school students aged 13–15 from Kuocang Middle School. The students were randomly assigned to two groups: experimental (n = 15) and control (n = 15). The structured swimming program, developed by the researcher, was implemented over eight weeks, with training sessions held on Mondays, Wednesdays, and Fridays.

Each session included a warm-up, skill demonstration, guided practice, and feedback. The experimental group trained from 1:00–3:00 p.m., while the control group followed the traditional curriculum from 3:00–5:00 p.m. Seven core exercises were used: (1) Warm-up routines, (2) Water entry drills, (3) Balance and floating, (4) Breath control, (5) Kicking techniques, (6) Diving practice, and (7) Stroke integration. Instruments were validated through expert review using the Index of Item Objective Congruence (IOC). A pilot study with 20 students confirmed instrument reliability before full implementation. Skill assessments were conducted at pre-test, week 2, week 4, and week 8 for both groups.

Research Methodology

The research followed a comprehensive methodological approach. Initially, the researcher designed practical swimming exercises tailored for basic swimming skill acquisition. Expert consultations were conducted to refine testing procedures and ensure test effectiveness. The training program underwent pilot testing with a comparable group of 20 lower secondary students, matched in age and swimming ability, over 8 weeks. Pilot testing provided reliability measures, enabling refinements in instructional materials and procedures. Instrument validation occurred through IOC assessment by five swimming experts.

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Reliability testing further ensured consistent results through practical trials and repeated measurements. Finally, an 8-week structured training intervention compared skill development outcomes between the experimental and control groups.

Data Collection

Data collection proceeded systematically, beginning with securing formal permission to use the research site. Instruments were finalized through consultations with research advisors and experts. Preparatory meetings with participants from both experimental and control groups clarified procedures and expectations. Researchers then prepared training venues according to established protocols to guarantee consistency. Initial pre-tests established baseline swimming skill levels for all participants. Subsequently, both groups underwent their respective 8-week interventions. Skill performance data were collected at specified intervals (weeks 2, 4, and 8), with the experimental group training from 1:00 p.m.–3:00 p.m. and the control group from 3:00 p.m.–5:00 p.m. The collected data were systematically organized for detailed comparative analysis.

Data Analysis

Data collected from the experiment were analyzed through the following procedures:

1. Baseline Analysis:
   - Comparing initial (pre-test) swimming skill levels between experimental and control groups.
2. Comparative Analysis:
   - Conducting ongoing tests at designated intervals (weeks 2, 4, and 8) for both groups.
   - Documenting weekly performance results from training exercises.
3. Statistical Procedures:
   - Calculating and comparing the mean differences between groups.
   - Employing descriptive statistics: Mean ($\bar{x}$) and Standard deviation (S.D.)
   - Testing differences for statistical significance at a 0.05 level to determine the effectiveness of the swimming intervention program.

Results

The researcher prepared the data and then conducted a statistical analysis. The results of the analysis were analyzed and presented in the table as follows:

Table 1 Overall Information of Participants by Gender and Age

Group	Total (N)	Male	Female	Age Range (years)	Mean Age (years)
Experimental Group	15	7	8	13-15	14.13
Control Group	15	5	10	13-15	14.20
Total	30	12	18	13-15	14.17

Table 1 shows demographic information of the study participants, divided into experimental and control groups, each containing 15 lower secondary school students. The experimental group consisted of 7 male and 8 female students, whereas the control group had 5 male and 10 female students. Both groups had participants within the age range of 13–15 years. The mean age of participants was 14.13 years for the experimental group and 14.20 years for the control group, with an overall average age of 14.17 years. The total number of participants was 30, comprising 12 male and 18 female students.

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Table 2 Comparative Analysis of Swimming Skill Scores between Experimental and Control Groups

Assessment Period	Experimental Group Mean (SD)	Control Group Mean (SD)	Mean Difference	p
Pre-test	3.10 (0.72)	3.05 (0.68)	0.05	0.830
Week 2	4.65 (0.54)	3.55 (0.60)	1.1	0.021*
Week 4	6.90 (0.68)	4.40 (0.72)	2.5	0.003*
Week 8	8.20 (0.45)	5.15 (0.62)	3.05	0.000*

*p < .05

Table 2 presents a comparison of swimming skill scores between the experimental group (structured swimming program) and the control group (traditional swimming program) across four assessment periods: pre-test, Week 2, Week 4, and Week 8. The table lists the mean scores with standard deviations for each assessment interval. Additionally, the table includes the mean differences between groups and statistical significance (p-values) to identify whether the differences observed are statistically meaningful. The data show no significant differences between groups at pre-test ($p = 0.830$). However, statistically significant differences are present at subsequent assessments (Week 2: $p = 0.021$; Week 4: $p = 0.003$; Week 8: $p = 0.000$), indicating measurable differences in swimming skill development between the groups throughout the program.

Conclusion

This research aimed to examine the effectiveness of a structured swimming training program specifically developed for lower secondary school students who initially lacked swimming skills at Kuocang Middle School. Based on the findings, students participating in the structured swimming program (Experimental Group) showed consistent and significant improvements in swimming performance throughout the eight-week intervention period. The mean scores increased steadily from the pre-test (mean = 3.10) to Week 8 (mean = 8.20), indicating clear progress in swimming proficiency as a result of the program. Comparative analysis demonstrated that the experimental group significantly outperformed the control group, which received traditional swimming instruction. The differences between the two groups were statistically significant at Weeks 2, 4, and 8, with increasingly pronounced differences by the end of the intervention. Specifically, at Week 8, the mean difference between the groups reached 3.05 points, clearly highlighting the effectiveness of the structured training method compared to traditional methods. Demographic analysis confirmed balanced participation between the two groups in terms of gender and age, thereby ensuring that the differences observed were primarily attributable to the type of swimming instruction provided. Both groups had an equal distribution of male and female participants and closely aligned average ages, further validating the comparative findings.

In conclusion, the structured swimming program effectively enhanced swimming skills among lower secondary school students who previously lacked basic swimming abilities. The results provide evidence supporting structured swimming training as a superior instructional approach compared to traditional methods. Such structured programs could be effectively applied within similar educational contexts to ensure students develop essential swimming proficiency, enhancing both safety and physical fitness among school-age populations.

Discussion

This study evaluated the effectiveness of a structured swimming training program for lower secondary school students lacking initial swimming skills at Kuocang Middle School. The results indicated that students in the experimental group significantly improved their swimming abilities across eight weeks,

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outperforming the control group, which received traditional swimming instruction. This aligns with prior research emphasizing that structured training programs, particularly those developed through expert analysis and systematic instructional design, positively influence skill acquisition (Li & Wu, 2022; Johnson & Carter, 2023). The progressive improvements observed in the experimental group suggest that the structured exercises used, which were specifically designed by the researcher and validated through expert review (IOC), systematically developed foundational swimming skills. Exercises such as water floating, diving, breath control, kicking, and coordinated stroke movements likely contributed to this skill progression, aligning with previous studies highlighting the importance of targeted and sequenced training activities (Ilago, 2021).

Consistent differences between the experimental and control groups emerged by Week 2, becoming increasingly pronounced at Weeks 4 and 8. This demonstrates that structured training has both immediate and cumulative impacts on skill acquisition. Such findings align with the research by Zhou (2021), which underscores the effectiveness of systematically designed curricula using modern pedagogical techniques compared to conventional methods. The balanced demographic composition between the experimental and control groups, with equal gender distributions and closely matched age averages, helped ensure that the observed differences in swimming performance were primarily due to instructional methods rather than external demographic factors. This demographic balance strengthens confidence that the structured swimming program itself was the principal contributing factor to the observed improvements, reinforcing the validity of the results. A critical practical implication of these findings is the necessity for educational institutions to adopt structured swimming programs at the lower secondary level. Doing so can effectively address common swimming skill deficiencies among students and improve overall safety around water environments, aligning with national educational and safety goals (Ministry of Education of the People's Republic of China [MOE], 2020).

In summary, this study supports the effectiveness and importance of structured swimming instruction programs over traditional methods. The empirical evidence shows that such programs significantly enhance students' swimming proficiency, contributing positively to both their immediate safety and potential athletic progression.

Recommendation

Based on the findings of this research, the following recommendations are proposed for future practice and further study:

1. Curriculum Implementation: Schools and educational policymakers should integrate structured swimming programs systematically within lower secondary school curricula to ensure students develop essential swimming skills.

2. Program Expansion: Extend structured swimming programs beyond initial implementation to additional schools and age groups.

3. Longitudinal Research: Future studies should consider longitudinal designs, evaluating the long-term impacts of structured swimming programs on students' continued swimming ability.

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