Hindawi
Discrete Dynamics in Nature and Society
Volume 2024, Article ID 9813570, 1 page
https://doi.org/10.1155/2024/9813570

*Retraction*

# Retracted: Can Swimming Teaching Prevent Drowning? An Experimental Study of Children in China

**Discrete Dynamics in Nature and Society**

Received 23 January 2024; Accepted 23 January 2024; Published 24 January 2024



This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

(1) Discrepancies in scope

(2) Discrepancies in the description of the research reported

(3) Discrepancies between the availability of data and the research described

(4) Inappropriate citations

(5) Incoherent, meaningless and/or irrelevant content included in the article

(6) Manipulated or compromised peer review

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

## References

[1] S. Zhang, J. Dai, and Z. Nie, "Can Swimming Teaching Prevent Drowning? An Experimental Study of Children in China," *Discrete Dynamics in Nature and Society*, vol. 2022, Article ID 6141342, 8 pages, 2022.

Hindawi
Discrete Dynamics in Nature and Society
Volume 2022, Article ID 6141342, 8 pages
https://doi.org/10.1155/2022/6141342



*Research Article*

# Can Swimming Teaching Prevent Drowning? An Experimental Study of Children in China

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Received 22 March 2022; Revised 11 April 2022; Accepted 15 April 2022; Published 29 April 2022

Academic Editor: Zaoli Yang



*Background*. The drowning death rate of Chinese students ranks among the top three in the world, and drowning has become an urgent problem for the country and society to solve. *Objective*. To test whether traditional swimming teaching can improve students' knowledge and skills of water safety and reduce the probability of drowning in China. *Methods*. A total of 82 second-grade students in elementary school were selected as experimental subjects, and the repeated measures analysis of variance experiment design was used to carry out the research. *Results*. After the experiment, the swimming safety education model significantly increased the scores of swimming safety knowledge and skills and the difference was statistically significant ($t = 4.060$, 5.325, $P < 0.05$); the attitude and behavior scores decreased, and the difference was statistically significant ($t = -4.392$, $-2.201$, $P < 0.05$). After the experiment, the swimming safety education model is more effective in teaching swimming safety knowledge, attitude, and behavior than the traditional swimming teaching, and the difference is statistically significant ($t = 2.699$, 3.852, 4.308, $P < 0.05$). After the experiment, when the traditional swimming teaching model is compared with the control group, the difference in swimming safety skills was statistically significant ($t = 4.704$, $P < 0.05$) and other dimensions were homogeneous. In conclusion, the traditional swimming teaching can only improve student's swimming safety skills but cannot reduce student's drowning injuries. The swimming safety education model is superior to the traditional swimming teaching in terms of swimming safety knowledge, attitudes, and behaviors. *Recommendations*. For beginners in swimming, the teaching content of swimming self-rescue skills and swimming safety knowledge should be added.

## 1. Introduction

Drowning is a public problem that affects the health of children around the world [1], and it is also the second leading cause of death for primary school students after traffic accidents [2, 3]. According to the results of the Global Burden of Disease (GBD) in 2016, the number of drowning deaths in China in 2016 was about 63,724, accounting for 21% of the global drowning deaths [4] and the drowning death rate ranked second in the world [5], while the actual number of drowning deaths may be far more than statistical data [6]. In the prevention of student drowning, some scholars believe that education is one of the most effective means with the least investment [7]. In order to prevent student drowning, the State Council Education Supervision Office issued the first warning in 2019 "Tighten the safety string and resolutely prevent student drowning"; the following year, it issued the first warning of 2020 "Strengthen the work of preventing drowning to ensure safety of students' lives." Child drowning has become a very serious problem in China.

On August 10, 2021, the Ministry of Education, the Ministry of Development and Reform Commission, the Ministry of Finance, the Health Commission, and the State Administration of Market Supervision jointly issued the "Opinions on Comprehensively Strengthening and Improving School Hygiene and Health Education in the New Era" (hereinafter referred to as "Opinions") requirements, the "Opinions" pointed out "Advocate science, respect life, guide students to actively learn and master daily exercise... cardiopulmonary resuscitation, safe avoidance and emergency care and other knowledge and skills; "At the same

time, the "Opinions" also pointed out "Encourage the development and application of high-quality first aid skills education and training curriculum resources, build a team of high-level first aid training lecturers, strengthen first aid training for school-age students, and gradually popularize first aid knowledge and skills among teachers and students." [8] Swimming as a "survival skill" [9], under the development strategy of a healthy China and a strong education country, is one of the effective means to prevent student drowning. However, the current academic research on the field of antidrowning education has the following shortcomings.

On the one hand, although the school organizes antidrowning education activities every year, it is subject to the lack of mandatory requirements and guarantees in terms of class hours, teachers, venues, and equipment [10, 11]. The antidrowning safety courses are usually conducted in the classroom, which emphasizes theory rather than practice [12]. On the other hand, some scholars believe that the best way to prevent drowning is to let students learn to swim [13]. However, in the popularization of swimming teaching in China, swimming ability (competitive ability, completion distance, and completion time) is used as the main teaching content and assessment standard, and the teaching content of water safety knowledge or water safety skills is not involved [14], and swimming distance of 25 meters does not seem to improve students' ability to prevent drowning. Therefore, Petrass, Mccool, and others believe that learning to swim cannot be equated to mastering drowning prevention skills. It is also necessary to educate students on swimming knowledge, attitudes, and behaviors [15, 16]. In view of this, this study adopted two types of swimming training content: one is the traditional swimming training content for children's beginners, and the other is based on the traditional swimming training content, adding water safety knowledge content, drowning self-rescue and rescue skills, drowning self-rescue and rescue scenario simulation and drills, etc. This research aims to achieve three goals through water safety education and teaching practice:

(1) Understand the effects of the traditional swimming teaching on improving students' knowledge and skills of water safety and reducing water safety attitudes and high-risk behaviors

(2) Exploring water safety and the impact of educational intervention on the knowledge, skills, attitudes, and behaviors of water safety in elementary school students

(3) Comparing the differences in water safety knowledge, skills, attitudes, and behaviors between the two teaching methods

Our research hopes to master the actual level of Chinese children's primary swimming teaching and build a set of swimming teaching that can improve children's water safety knowledge and skills, change water safety attitudes, and reduce high-risk behaviors of drowning. This study can not only provide theoretical basis for drowning prevention work but also provide practical support for the formulation of children's swimming training plan. This research can not only provide theoretical basis for drowning prevention work but also provide practical support for the formulation of children's swimming training plans.

## 2. Method

*2.1. Concept Definition.* In this study, based on the theory of "health, knowledge, trust, and action," education of water safety is defined as: a purposeful educational activity that helps individuals predict, analyze, control, and eliminate hazards in a wading environment. It not only includes self-rescue and life-saving water area safety knowledge and water area safety skills to control and eliminate dangers when accidents occur on the water but also covers swimming safety awareness when predicting and preventing water accidents. Water area safety education mainly includes four dimensions of water area safety knowledge, water area safety skills, water area safety attitudes, and water area high-risk behaviors [17]. The higher the water area safety knowledge and water area safety skills, the better the water area safety attitude. The better the water security attitude, the fewer the high-risk behaviors in the water [18].

*2.2. Subjects.* Taking a total of 82 students in the second grade of a primary school as the subjects, one group is randomly selected as the control group of 30 (15 males and 15 females); the other is the experimental group A with 27 people (13 males and 14 females), referred to as "swimming group"; a group of 25 people (13 males and 12 females) in experimental group B, referred to as "teaching group."

*2.3. Experimental Hypothesis.* In previous studies, scholars have found that China's swimming teaching lacks the training or drills of drowning self-rescue and rescue skills [19]. In dealing with accidental drowning emergency response capabilities, most students do not lack the ability to swim, but they lack swimming self-rescue ability [20]. Students' swimming safety awareness is weak [21], and the traditional swimming teaching emphasizes competition and neglects practicality [22]. The increase in swimming distance may not reduce the risk of drowning but will increase the probability of drowning [23], because simple swimming teaching does not include prevention [24] Only by teaching the "prevention of drowning" skills during swimming can students truly "prevent drowning" [25]. In addition, the Australian Life Rescue Association believes that every child should have a high-quality "water safety education program," which includes swimming survival and rescue skills and water safety knowledge [26]. Later, Xia Wen built a KSAP water area safety education model based on the theory of health, knowledge, belief, and behavior and believed that the improvement of water area safety knowledge and water area safety skills will change students' attitudes towards swimming safety, thereby reducing students' high-risk behaviors in water areas [27].

Based on the above research results, this research proposes two hypotheses:

(1) The teaching group can improve students' knowledge and skills of water area safety, change students' attitudes towards water area safety, and reduce high-risk behaviors in water areas

(2) Compared with the swimming group, there is a significant difference in the children's effect on reducing high-risk behavior in the water.

*2.4. Experimental Design.* This experiment uses a repeated measurement mixed experimental design of 3 (control group, swimming group, teaching group) × 2 (male, female) × 2 (pretest, posttest) method. Domestic and foreign research results show that the probability of drowning in men is higher than that in women [28, 29]. In order to obtain better internal validity and avoid the interaction between gender and experimental treatment affect the experimental results, this experiment controls gender as an intervention variable. At the same time, in order to examine the effectiveness of the experimental treatment, the comparison between the control group, the swimming group, and the teaching group was carried out before and after the "KSAP Scale for Primary School Water Safety" experiment using repeated measures analysis of variance.

*2.5. Experimental Materials.* In this study, based on the MORAN "KAB Mode" and TEVFIK "KSAB Mode" [30], Xia Wen compiled a localized "KSAP Scale of Water Safety for Primary School Students" [18], which included 10 questions about water safety knowledge, for example, do you know common swimming safety signs? (1: very clear; 5: very unclear); 9 questions on water safety skills, for example, can you tread water in the water? (1: very familiar; 5: very unfamiliar); 10 questions about swimming safety awareness, for example, go swimming with classmates, it doesn't matter if there are no adults nearby (1: strongly agree; 5: strongly disagree); 10 questions about high-risk behaviors in the water, for example, ran to the pool alone to play (1: always do this; 5: never been). This question and answer survey uses a 5-point Likert scale to score points. Among them, the higher the scores of water safety knowledge and skills, the higher the degree of mastery; the water safety attitude and high-risk behaviors adopt the rhetorical method. The higher the score, the worse the water safety attitude and the higher the incidence of high-risk behaviors in the water. This scale is an advanced scale. Cronbach's $\alpha$ coefficient of the total scale reaches 0.934, and it has been used by many people [31, 32]. The reliability coefficient of Cronbach's $\alpha$ in this study is 0.827.

*2.6. Experimental Procedure*

*2.6.1. Pretest.* Both the control group and the experimental group participated in the pretest, and the content of the test was the KSAP Scale for Water Safety in Primary Schools.

*2.6.2. Experimental Intervention.* The experiment was conducted by a head coach and two assistant coaches (1 male and 1 female). The head coach was responsible for the formulation and implementation of the swimming teaching plan, and the assistant coach followed the arrangements of the head coach to ensure the safety of the students. To prevent the Hawthorne effect, this experiment uses a single-blind design. In order to prevent teachers from mutating the results of the experiment, the experiment is guaranteed to be carried out by the same group of coaches. "Swimming Group" class time is Monday, Wednesday, and Friday (15:30–17:30), "Teaching Group" class time is Tuesday, Thursday, and Saturday. The class time on Tuesday and Thursday is 15:30–17:30 and on Saturday, the class time is 09:00–11:00. The experimental group has 12 classes, which are the same as the traditional children's swimming training class. Each class is 90 minutes, and students have 30 minutes to take a bath and change clothes. The swimming pool is indoor with a constant temperature of 28 degrees. The students are sent to the swimming pool by the school teachers. The specific experiment content and format are as follows: (1) The "control group" normally attends classes without any intervention. (2) The training content of the "swimming group" is the summer traditional breaststroke teaching content. 1–3 lessons are carried out in shallow water areas with breathing, body position, and breaststroke leg training; 4–6 lessons are carried out with buoyancy sticks and back floats in deep water areas in Breaststroke Legs, Breaststroke Hands, and Breaststroke Exercises; after 7 classes, according to the students' mastery, back-off float or buoyancy bar training is carried out. There is no swimming ring during the training process, which is the same as the children's summer swimming teaching content. (3) The "teaching group" will learn about water safety knowledge for 15–25 minutes in each of the first six classes. In addition to the traditional breaststroke hands and legs exercises and cooperation with teaching, they will also perform self-rescue skills such as treading water and prone floating.

The swimming teaching experiment is done for nearly a month; the researchers will arrive at the scene every day to observe the subjects and communicate closely with the coaches during and after class to ensure that the activities are carried out in an orderly manner under safe conditions. In addition, this study distributed a copy of the "Informed Consent" to all parents of the subjects.

*2.6.3. Posttest.* At an average interval of 15 days, both the control group and the experimental group participated in the posttest and the test content was consistent with the pretest.

*2.7. Statistical Methods.* According to the pretest and posttest scores of each student in the "KSAP Water Safety Scale for Primary School Students," Excel 2018 version for data statistics, SPSS 23.0 version for repeated measures analysis of variance, independent sample $t$-test, paired sample $t$-test are used and the differences between before and after intervention are compared.

## 3. Research Results

*3.1. Before and After Score Comparison.* In order to test the effect of the water area safety education teaching model on students, descriptive statistics and repeated measures analysis of variance were performed on the preteaching and postteaching test scores of the control group and the experimental group. See Table 1 for details.

The data in Table 1 show that the main effect of time is statistically significant in the dimensions of safety knowledge and safety skills ($P < 0.05$); the main effect of gender is statistically significant in the dimensions of safety knowledge, safety attitudes, and dangerous behaviors ($P < 0.05$). The main effect of group and the interaction effect of time × group are statistically significant in the dimensions of safety knowledge, safety skills, safety attitudes, and dangerous behaviors ($P < 0.05$).

*3.2. Simple Effect Test of the Interaction between Time and Group.* In order to further explore the interaction between time and group and clarify the experimental treatment effect, a simple effect test was carried out on the interaction effect between time and group in each dimension. The results are shown in Table 2.

The results of the data in Table 2 show that at the first level test (pretest), the differences in the simple effects of each dimension are not statistically significant ($P > 0.05$), indicating that the control group and the experimental group are basically homogeneous; at the second level test (posttest), comparing the control group and the swimming group, the differences in safety knowledge and safety skills were statistically significant ($P < 0.05$) and the differences in safety attitudes and dangerous behaviors were not statistically significant ($P > 0.05$), indicating that the swimming group can improve swimming safety skills. The skill dimension is better than of the control group, and the other dimensions are homogeneous with the control group; the comparison between the control group and the teaching group shows that the differences in each dimension are statistically significant ($P < 0.05$), indicating that each dimension of the teaching group is better than of the control group and swimming group. Compared with the teaching group, differences in safety knowledge, safety attitudes, and dangerous behaviors were statistically significant ($P < 0.05$), indicating that the teaching group is better than the swimming group in the three dimensions of safety knowledge, safety attitudes, and dangerous behaviors.

*3.3. Time Simple Effect Test.* The data results in Table 3 show that the control group has no statistically significant difference in each dimension in the simple effect test of the pretest and posttest time ($P > 0.05$); the swimming group has statistically significant differences in safety skills in the simple effect test of the pretest and posttest time ($P < 0.05$), and the differences in the other three dimensions were not statistically significant ($P > 0.05$); the difference in each dimension of the teaching group was statistically significant in the simple effect test of the pretest and posttest time ($P < 0.05$). This result shows that the teaching group is better than the swimming group and the control group in the dimensions of safety knowledge, attitude towards group safety, and dangerous behaviors.

## 4. Analysis and Discussion

*4.1. Reasons for the Insignificant Difference between Gender before and after Test.* Due to the active nature of boys and their preference for stimulating games, boys are more likely to rate themselves as "excellent" or "very excellent" swimmers than women. Boys will overestimate their swimming ability and are more likely to engage in high-risk behaviors in waters [33]. Generally, the drowning death rate of men is greater than that of women and even three times that of women [34]. In this study, the gender main effect has significant differences in water safety knowledge, water safety attitudes, and high-risk behaviors between men and women. This shows that girls have a higher level of knowledge about water safety than boys and have a stronger attitude towards swimming safety than boys. The risk behavior of engaging in swimming activities is also lower than that of boys. However, in terms of water safety skills, no significant differences between boys and girls were found and boys were even better than girls in terms of water safety skills [35]. In the comparison of the interaction effect of gender and time, it is found that there is no significant difference in the learning ability of male and female students, which is consistent with the research results of Petrass [15], but this contrasts with the research results of Zhang et al. [29]. The reason is that it is related to the biological differences between men and women and changes with age, leading to more and more significant gender differences. For example, in infancy, boys' arousal levels are higher than girls [36]; in childhood, boys' language and body control abilities are lower than girls [37]. During adolescence, boys have higher levels of physical fitness, such as strength, speed, and endurance, than girls. The older you get, the more obvious the difference between boys and girls [38], and their swimming ability will be overestimated. This may be the reason why the gender difference in childhood is not significant, but the gender difference in adolescence is significant.

*4.2. Limitations of the Traditional Swimming Teaching.* Water safety education is considered to impart knowledge and skills of water safety in foreign countries and can form positive attitudes, concepts, and behaviors of water safety in the water environment [39]. In addition, some scholars believe that water safety education should be carried out when children are 6 years old, so that they can engage in activities related to water under the premise of ensuring safety, and we must provide rescue techniques needed to assist others in water emergencies as much as possible and cardiopulmonary resuscitation skills [5]. However, at present, whether it is swimming training in winter or summer or swimming teaching organized by schools, China is less involved in the learning of water safety knowledge and ability and less concerned about students' water safety

Table 1: The test results of descriptive statistics and repeated measures analysis of variance before and after the integration of water safety education for primary school students with swimming teaching.

| Before and after | Group | Gender | Knowledge | Skill | Attitude | Behavior |
|---|---|---|---|---|---|---|
| Before the experiment | Control group | Male | 3.10 ± 0.76 | 2.65 ± 0.72 | 3.62 ± 0.85 | 3.47 ± 1.39 |
| | | Female | 3.36 ± 0.39 | 2.61 ± 1.11 | 2.90 ± 1.12 | 2.90 ± 1.56 |
| | | Overall | 3.23 ± 0.60 | 2.63 ± 0.92 | 3.15 ± 1.28 | 3.17 ± 1.48 |
| | Swimming group | Male | 3.16 ± 0.90 | 2.76 ± 0.71 | 3.53 ± 1.27 | 3.33 ± 1.49 |
| | | Female | 3.40 ± 0.93 | 2.55 ± 0.75 | 3.25 ± 1.71 | 2.90 ± 1.64 |
| | | Overall | 3.27 ± 0.90 | 2.67 ± 0.72 | 3.55 ± 1.49 | 3.14 ± 1.54 |
| | Teaching group | Male | 3.05 ± 1.02 | 2.54 ± 0.82 | 3.69 ± 1.14 | 3.34 ± 1.33 |
| | | Female | 3.36 ± 0.85 | 2.70 ± 1.06 | 3.11 ± 1.23 | 2.96 ± 1.64 |
| | | Overall | 3.20 ± 0.93 | 2.61 ± 0.92 | 3.41 ± 1.49 | 3.16 ± 1.46 |
| After the experiment | Control group | Male | 3.15 ± 1.03 | 2.53 ± 0.88 | 3.43 ± 1.44 | 3.40 ± 1.36 |
| | | Female | 3.39 ± 1.17 | 2.75 ± 1.27 | 2.90 ± 1.12 | 2.98 ± 1.40 |
| | | Overall | 3.27 ± 1.09 | 2.65 ± 1.08 | 3.15 ± 1.28 | 3.18 ± 1.36 |
| | Swimming group | Male | 3.30 ± 0.93 | 3.75 ± 0.23 | 3.81 ± 1.28 | 4.02 ± 0.70 |
| | | Female | 3.92 ± 1.10 | 3.66 ± 0.88 | 3.25 ± 1.71 | 3.22 ± 1.35 |
| | | Overall | 3.59 ± 1.04 | 3.71 ± 0.61 | 3.55 ± 1.49 | 3.65 ± 1.10 |
| | Teaching group | Male | 4.20 ± 0.79 | 3.87 ± 0.52 | 2.47 ± 0.73 | 2.30 ± 1.25 |
| | | Female | 4.46 ± 0.64 | 3.86 ± 0.49 | 1.96 ± 0.68 | 1.96 ± 1.28 |
| | | Overall | 4.32 ± 0.72 | 3.87 ± 0.49 | 2.22 ± 0.74 | 2.14 ± 1.25 |
| Main effect of time (F) | | | 10.953* | 35.349* | 2.641 | 0.512 |
| Gender main effect (F) | | | 3.965* | 0.01 | 7.327* | 4.009* |
| Group main effect (F) | | | 3.151* | 5.701* | 3.334* | 3.195* |
| Time × gender interaction effect (F) | | | 0.113 | 0.84 | 0.001 | 0.016 |
| Time × group interaction effect (F) | | | 4.470* | 8.565* | 3.431* | 3.559* |
| Gender × group interaction effect (F) | | | 0.118 | 0.246 | 0.001 | 0.085 |
| Time × group × gender interaction effect | | | 0.212 | 0.232 | 0.009 | 0.113 |

Table 2: Time and group interaction simple effect test results ($t$-value).

| Group interaction | Knowledge | | Skill | | Attitude | | Behavior | |
|---|---|---|---|---|---|---|---|---|
| | Before | After | Before | After | Before | After | Before | After |
| Comparison between control group and swimming group | −0.163 | −0.987 | −0.147 | −3.397* | 0.068 | −0.970 | 0.066 | −1.293 |
| Comparison between control group and teaching group | 0.157 | −3.671* | 0.055 | −4.704* | −0.213 | 2.852* | 0.021 | 2.565* |
| Comparison between swimming group and teaching group | 0.272 | −2.699* | 0.212 | −0.954 | −0.294 | 3.852* | −0.045 | 4.308* |

*The difference is statistically significant ($P < 0.05$).

Table 3: Time simple effect test.

| Group | Knowledge | | Skill | | Attitude | | Behavior | |
|---|---|---|---|---|---|---|---|---|
| | $t$ | $P$ | $t$ | $P$ | $t$ | $P$ | $t$ | $P$ |
| Control group before and after | −0.174 | 0.864 | −0.064 | 0.949 | 0.452 | 0.656 | −0.025 | 0.980 |
| Before and after swimming group | −1.217 | 0.236 | −5.862 | 0.001 | −0.562 | 0.579 | −1.435 | 0.165 |
| Before and after the teaching group | −4.060 | 0.001 | −5.325 | 0.001 | 4.392 | 0.001 | 2.201 | 0.040 |

attitudes and high-risk behaviors in waters. Through the investigation of this research, it is found that the children's traditional swimming teaching cannot improve students' knowledge of water safety nor can it reduce students' water safety attitudes nor can it reduce students' high-risk behaviors in waters. Although the "swimming group" water area high-risk behavior dimension was not statistically different before and after the measurement, the "swimming group" dangerous behavior dimension had a higher score than the previous measurement, which was consistent with the data collected by Kjendlie and the Canadian Red Cross. Generally, people with higher swimming levels are more likely to engage in water-related hazardous activities, which may increase the risk of drowning [40, 41], which is why 69% of drowning people in Canada is due to swimming [42]. There are two main reasons why "swimmers are prone to drowning": First, the improvement of swimming skills will affect the psychological feelings of experienced swimmers. Faced with the temptation of various water activities, they will overestimate their swimming skills. The ability to control the environment [43] is similar to the effect of overconfidence in driving skills on high-risk behaviors. Individuals with high driving skills and overconfidence are more likely to have high-risk behaviors such as overtaking,

speeding, and even drifting [44]. Swimming ability is the same as driving skills. The higher the swimming ability, the easier it is to make dangerous behaviors in the water. The second is related to the coach's teaching methods and the evaluation standards of swimming teaching. Swimming teaching in our country emphasizes competition and neglects practicality, lacks the theoretical study of water safety knowledge, lacks the evaluation standard of water safety skills, lacks the teaching goal of reducing high-risk behaviors in the waters of students, and even lacks the improvement of water safety knowledge and skills and the reduction of students' attitudes towards water safety.

*4.3. The Effectiveness and Shortcomings of the Water Safety Education Model in China.* Statistics show that the "teaching group" has the best effect on changing students' water safety attitudes and reducing students' high-risk behaviors in waters. The ability to achieve such a teaching effect mainly depends on the effective reference of "healthy knowledge, belief and deeds." In this study, in order to be able to better improve students' knowledge and skills of water safety, one must improve students' attitudes towards water safety and reduce students' high-risk behaviors in waters. Based on the KSAP model [45], the following contents should be included in swimming teaching: ability to launch safely, correct breathing, ability to recognize direction in water, normal swimming ability, ability to safely lift out of water, use of flotation device, ability to adjust direction in water, water area mastery of safety knowledge, and ability to deal with dangers in water [46, 47]. In actual drowning cases, it is not that children's drowning incidents are frequently caused by insufficient swimming skills. More factors are students' lack of knowledge of water area safety, lack of "practical" water area safety skills, improper entry methods, or lack of protection against danger. In addition, water area safety knowledge is considered to be one of the factors that can affect safety attitudes in this model [48], so in the water area safety education model, in addition to adding "practical" water area safety knowledge, theory learning of one hour of water area safety knowledge is also added.

However, this model also has its shortcomings: except for a few outstanding students, most students fail to complete the 25-meter breaststroke without any buoyancy equipment. Although the improvement of swimming ability may increase students' "overconfidence," the 25-meter swimming ability is undoubtedly essential. It is also not good to only teach 25-meter swimming, and it is not good to pay too much attention to swimming self-rescue skills and ignore swimming distance. A more functional explanation is that the ability to swim 25 meters should be regarded as an important content of water safety education [49]. Therefore, in the subsequent swimming training, the teaching time should be increased from the current 8 lessons and 12 lessons to 20 lessons and 25 lessons; in terms of teaching content, the quality of swimming training should be improved and the water area should be increased. Practice and theoretical study of safety knowledge increase swimming self-rescue skills, shore rescue techniques, and cardiopulmonary resuscitation skills; in terms of teaching evaluation, we must build water safety skills evaluation standards, increase government and swimming associations' supervision of swimming training institutions, and ensure that "learn to swim" is equivalent to mastering a survival skill."

## 5. Conclusion

Through the investigation of this study, it is found that traditional Chinese swimming teaching cannot improve students' knowledge of water safety, nor can it change students' attitude towards water safety and reduce students' high-risk behaviors in water. This shows that traditional swimming teaching cannot reduce the risk of drowning but can only increase the students' mastery of swimming distance. The new swimming safety teaching mode combines theory with practice. In terms of teaching content, the theoretical study of water safety knowledge has been added. In terms of teaching methods, the "encouraging" teaching method of coaches is reduced and more emphasis is placed on students' attitudes towards water safety, thereby reducing students' high-risk behaviors in water.

In addition, Shichao Zhang was a professional swimmer. Through the observation of this study, it is found that swimming coaches often use words of encouragement such as "don't be afraid of water" and "you have to overcome it" to help students overcome the fear of bowing their heads and exhaling in the water. But will this language teaching method make it easier for students to make dangerous actions in the water?

This study hopes that follow-up researchers can use the teaching methods of coaches to try whether the coaches can change the language in the teaching process to reduce the risk of drowning of students.

However, there are still shortcomings: the sample size of the study is small, and only students from Yunnan Province, in China, are selected as the survey objects. Follow-up research can try the influence of children's swimming beginner methods in different regions on improving students' water safety knowledge and skills.

## Data Availability

All data, models, and codes generated or used during the study are included within the article.

## Disclosure

This research is continuously improved on the basis of the 2021 International Conference on Health Big Data and Smart Sports (HBDSS) in 2021 based on the following link: https://ieeexplore.ieee.org/document/9681109.

## Conflicts of Interest

The authors declare that they have no conflicts of interest.

## Acknowledgments

The authors would like to thank all the coaches and students who participated in this survey, especially the Panlong Primary School and the Panlong District Sports Bureau in Kunming, Yunnan Province, China, for their support. The authors also thank the Yunnan Provincial Department of Education for providing financial support for this research.

## References

[1] A. Rahman, S. M. Giashuddin, L. Svanström, and F. Rahman, "Drowning—a major but neglected child health problem in rural Bangladesh: implications for low-income countries," *Control Safety Promotion*, vol. 13, pp. 101–105, 2006.

[2] R. C. Franklin, J. King, K. Watt, and P. Aitken, "Media, risk, and prevention-lessons for aquatic safety from newsworthy deaths: precipice for prevention or just good tales?" *International Journal of Aquatic Research and Education*, vol. 8, pp. 182–194, 2014.

[3] World Health Organization, *Global Report on Drowning: Preventing a Leading Killer*, World Health Organization, Geneva, Switzerland, 2014.

[4] N. Mohsen, A. A. Amanuel, and A. Cristiana, "Global, regional, and national age-sex specific mortality for 264 causes of death,1980—2016: a systematic analysis for the Global Burden of Disease Study 2016," *The Lancet*, vol. 390, pp. 1151–1210, 2017.

[5] Y. Zhu, X. Jiang, H. Li, L. Fudong, and C. Jieping, "Mortality among drowning rescuers in China,2013: a review of 225 rescue incidents from the press," *BMC Public Health*, vol. 15, no. 1, p. 631, 2015.

[6] E. Vignac, P. Lebihain, and B. Soulé, "Tracking fatal drownings in public swimming pools: a retro-spective multiscale investigation within France," *International Journal of Aquatic Research and Education*, vol. 9, no. 2, pp. 184–200, 2015.

[7] A. A. Hyder, N. N. Borse, L. Blum, K. Rasheda, E. A. Shams, and H. B. Abdullah, "Childhood drowning in low- and middle-income countries: urgent need for intervention trials," *Journal of Paediatrics and Child Health*, vol. 4, pp. 221–227, 2008.

[8] The Ministry of Education of the People's Republic of China, "Opinions of the Ministry of Education and Other Five Departments on Comprehensively Strengthening and Improving School hygiene and Health Education in the new era," http://www.moe.gov.cn/srcsite/A17/moe_943/moe_946/202108/t20210824_553917.html,2021-08-10/2021-09-18 [EB/OL].

[9] S. Yu, "Analysis of the implementation strategies of ten key points of the "Sports and health teaching Reform guidelines (trial)"," *Journal of Physical Education*, vol. 28, no. 5, pp. 1–13, 2021.

[10] X. Wen, B. Wang, X. Zhang, and L. Zhao, "Investigation of differences in knowledge, beliefs and behaviors of water safety among Chinese primary school students," *Chinese Journal of Safety Science*, vol. 28, pp. 165–170, 2018.

[11] S. Zhang, B. Zhai, and P. Chen, "Teaching method and effect reflection of swimming safety on campus courses," *Scientific Consultation (Education and Research)*, vol. 12, p. 47, 2019.

[12] S. Zhang, D. Jia, and B. Zhai, "Investigation and research on the knowledge, belief and behavior of children in the summer swimming " elementary class" in kunming city," *International Journal of Social Sciences in Universities*, vol. 4, no. 2, 2021.

[13] M. Tan and Li Jin, "Research on the construction of general swimming courses for physical education majors in colleges and universities," *Journal of Guangzhou Sport University*, vol. 41, no. 03, pp. 120–123, 2021.

[14] Y. Fang, L. Dai, M. S. Jaung, and C. Xiaoxuan, "Child drowning deaths in Xiamen city and suburbs, People's Republic of China, 2001-5," *Injury Prevention*, vol. 13, pp. 339–343, 2007.

[15] L. Petrass and J. Blitvich, "Preventing adolescent drowning: understanding water safety knowledge, attitudes and swimming ability: the effect of a short water safety intervention," *Accident Analysis & Prevention*, vol. 70, pp. 188–195, 2014.

[16] J. P. Mccool, K. Moran, S. Ameratunga, and R. Elizabeth, "New Zealand beachgoers' swimming behaviors, swimming abilities and perception of drowning risk," *International Journal of Aquatic Research and Education*, vol. 1, pp. 7–15, 2008.

[17] X. Wen, B. Wang, and L. Lian, "The experience and enlightenment of water safety education for students in developed countries," *Hubei Sports Science and Technology*, vol. 5, pp. 502–504, 2011.

[18] X. Wen, *Theoretical and Empirical Research on Water Safety Education for Primary School Students*, Central China Normal University, Wuhan, China, 2012.

[19] F.. Liu, *Research on the Operating Characteristics and Strategies of Children's Swimming Training Institutions in Xi'an*, Xi'an Institute of Physical Education, Xi'an, China, 2019.

[20] S.. Dou, *Research on the Current Situation and Development of Swimming Courses in Primary and Secondary Schools in Mianyang City*, Southwestern University of Finance and Economics, Chengdu, China, 2019.

[21] Y. Wang, *Investigation and Analysis of the Status Quo of Water Safety Education for Primary School Students in Wuhan*, Central China Normal University, Wuhan, China, 2012.

[22] L.. Ma, *Research on the Status Quo of Amateur Swimming Training in Luzhou City*, Central China Normal University, Wuhan, China, 2020.

[23] Canadian Red Cross Society, "An analysis of drownings and other water-related injury fatalities in Canada for 1999[EB/OL]," Visual Surveil-lance Report: 2001 Edition, Canadian Red Cross Society, Ottawa, Ontario, Canada, 2001.

[24] R. Brenner, G. Taneja, and D. Haynie, "The as- sociation between swimming lessons and drowning in childhood: a case-control study," *Archives of Pediatrics and Adolescent Medicine*, vol. 163, no. 3, pp. 203–210, 2009.

[25] J. Weiss, "Technical report—prevention of drowning," *American Academy of Pediatric*, vol. 4, pp. 253–262, 2020.

[26] A. Peden, "A 9 Year Analysis of Drowning in Chlidren and Adolescents Aged 5-19 Years in Australia 2002-2011," *BMJ Journals*, vol. 18, p. 133, 2012.

[27] X. Wen, S. Mou, and B. Wang, "Research on the knowledge, letter and behavior model of water safety education for primary school students," *China Safety Science Journal*, vol. 24, no. 04, pp. 136–141, 2014.

[28] K. Moran, *What youth do during aquatic activity: factsheet physical educator*, Physical Education, Tamil Nadu, India, 2007.

[29] H. Zhang, B. Wang, and L. Shi, "Experiment on the primary education mode of water safety for college students based on hierarchical teaching," *Journal of Physical Education*, vol. 24, no. 04, pp. 88–93, 2017.

[30] T. Turgut, Y. Metin, and A. Turgut, "Educating children on water safety for drowning prevention," *Social Indicators Research*, vol. 129, pp. 787–801, 2016.

[31] H. Zhang, B. Wang, L. Shi, and X. Wen, "Research on the influencing factors of students' high-risk behaviors in waters based on grounded theory," *Chinese Safety Science Journal*, vol. 27, no. 03, pp. 7–12, 2017.

[32] W.. Yu, *Research on the Integration of Water Safety Education in Swimming Training Institutions in Xi'an*, Xi'an Institute of Physical Education, Xi'an, China, 2019.

[33] J. Howland, R. Hingson, T. Mangione, and S. Bak, "Why are the most drowning victim men? Sex differences in aquatic skill and behaviours," *American Journal of Public Health*, vol. 86, no. 1, pp. 93–96, 1996.

[34] C. C. Irwin, R. L. Irwin, T. D. Ryan, and J. Drayer, "Urban minority youth swimming (in) ability in the United States and associated demographic characteristics: toward a drowning prevention plan," *Injury Prevention Journal of the International Society for Child&Adolescent Injury Prevention*, vol. 15, no. 4, pp. 234–239, 2009.

[35] H.. Liu, "Cognitive reappraisal, interpersonal relationship distress and adolescent physical exercise: a cross-school-year longitudinal research data," *China Sports Science and Technology*, vol. 57, no. 08, pp. 79–87, 2021.

[36] LR. Brody, *Gender and Emotion: Social Psychological Perspectives*, p. 24, Cambridge University Press, England, UK, 2000.

[37] A. J. Lee and W. H. Lin, "The influence of gender and somatotype on single-leg upright standing postural stability in children," *Biomechanics*, vol. 23, no. 3, pp. 173–179, 2007.

[38] K. Deaux and B. Major, "Putting gender into context: an interactive model of gender-related behavior," *Psychological Review*, vol. 94, pp. 369–389, 1987.

[39] K.. Moran, "Taking the plunge: diving risk practices and perceptions of New Zealand youth," *Health Promotion Journal of Australia*, vol. 19, pp. 68–71, 2008.

[40] P.-L. Kjendlie and R. K. Stallman, "Water Safety Education Is More than Teaching Swimming Skills: Comprehensive Drowning Prevention Education," in *Proceedings of the World Conference on Drowning Prevention*, pp. 10–13, Danang, Vietnam, May 2011.

[41] F. Potdevin, S. Jomin-Moronval, P. Pelayo, and D. Jeanne, "What is the best swimming stroke to master for beginners in water safety tests?" *European Physical Education Review*, vol. 25, no. 1, pp. 174–186, 2017.

[42] World Health Organization, *Global Report on Downing: Preventing a Leading Killer*, pp. 18–40, Bloomberg Philanthropies, New York, NY, USA, 2014.

[43] R. A. Brenner, G. Saluja, and G. S. Smith, "Swimming lessons, swimming ability, and the risk of drowning," *International Journal of Injury Control and Safety Promotion*, vol. 10, no. 4, pp. 211–216, 2003.

[44] L. Shi, B. Wang, and H. Zhang, "The impact of water safety skills on high-risk behaviors of adolescents in waters: a mediating effect," *Journal of Shenyang Institute of Physical Education*, vol. 36, no. 01, pp. 66–72, 2017.

[45] R. K. Stallman, K. Moran, L. Quan, and L. Stephen, "From swimming skill to water competence: towards a more inclusive drowning prevention future," *International Journal of Aquatic Research and Education*, vol. 10, no. 2, pp. 1–35, 2017.

[46] R. K. Stallman and P.-L. Kjendlie, "A proposed framework for developing a plan for research in lifesaving and water safety," *International Journal of Aquatic Research and Education*, vol. 2, no. 1, pp. 78–84, 2008.

[47] R. K. Stallman, M. Junge, and T. Blixt, "The teaching of swimming based on a model derived from the causes of drowning," *International Journal of Aquatic Research and Education*, vol. 2, no. 4, pp. 372–382, 2008.

[48] A. Terzidis, "Anastasia Koutroumpa, Ilias Skalkidis, et al. Water safety: age-specific changes in knowledge and attitudes following a school-based intervention," *Injury Prevention*, vol. 13, pp. 120–124, 2007.

[49] S. Langendorfer, "Considering drowning, drowning prevention, and learning to swim," *International Journal of Aquatic Research and Education*, vol. 5, no. 3, pp. 236–243, 2011.