

International Journal of Aquatic Research and Education

Volume 12
Number 2 *Volume 12, Issue 2*

Article 5

4-10-2020


Effectiveness of an Intensive Drowning Prevention Program and Skills Retention by Children with and without Disabilities

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Recommended Citation

Forde, Anna L. OTD, OTR/L, CTRS; Zeman, Emily A. OTD, MS, OTR/L; and Clarke, Lynn (2020) "Effectiveness of an Intensive Drowning Prevention Program and Skills Retention by Children with and without Disabilities," *International Journal of Aquatic Research and Education*: Vol. 12 : No. 2 , Article 5. DOI: 10.25035/ijare.12.02.05
Available at: <https://scholarworks.bgsu.edu/ijare/vol12/iss2/5>

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Effectiveness of an Intensive Drowning Prevention Program and Skills Retention by Children with and without Disabilities

Cover Page Footnote

A special thanks to John Wong, PhD for statistical analysis support.

Abstract

This study examined the effectiveness of a drowning prevention program and the retention of swimming and water safety skills for 3-14 year-old children with and without disabilities. The intensive program, SWIM Central, used a top-down approach to teach 6 swimming and water safety skills during 10, 30-minute sessions. A post-participation parent survey results suggested that children ages 3-14 with and without disabilities who had previously participated in SWIM Central retained swimming and water safety skills to a similar degree. The current swim skill assessments showed that there was not an overall difference in swim skill performance in the presence of a disability; therefore, the SWIM Central program was effective in increasing overall swimming performance for children with and without disabilities.

Keywords: drowning prevention, children, disabilities, swimming skills

Introduction

Drowning is the leading cause of unintentional injury death for children ages 1-4 years, and the second leading cause of unintentional injury death for children ages 5-14 years (Centers for Disease Control and Prevention [CDC], 2016). A lack of aquatic and water safety skills, knowledge, and attitudes were often contributors to this reality (Stallman, et al., 2008). In the U.S. the majority of drownings occurred in home swimming pools and open water settings (CDC, 2016). Causes of drowning often included an unexpected event prior to entering the water (e.g., slipping and falling), an unexpected experience during submersion (e.g., hitting head), an inability to recognize danger, and, inadequate skills to survive. Drowning survival skills include the capability to turn onto one's back safely, a capacity to turn from back to front and perform strokes, and sufficient endurance to be able to turn over to rest and float (Stallman, et al., 2008). Although unexpected events cannot be avoided, other factors that may mitigate unexpected events can be learned through learn-to-swim and drowning prevention programs.

Many of the swimming skills consistent across learn-to-swim programs appear to address the causal factors of drowning. Swimming skills include water entry (e.g., jumping or diving), regaining surface and swimming after submersion, swimming comfortably underwater, acquiring at least two fundamental strokes (one in prone and one in supine), breath control combined with other skills, rolling from prone to supine and conversely, changing direction, and remaining afloat (e.g., stopping and resting with minimal movement) (Stallman, et al., 2008). Successfully performing these skills requires cognitive functions such as sequencing, following directions, judgement/planning, gross motor tasks, and a minimum degree of muscular strength and endurance. The relationship of the body to the characteristics of the water (e.g., temperature, texture, pressure, taste) in order to produce propulsion and push through the water resistance also contributes to performing

swim skills. Additionally, increasing the child's confidence in the water is a contributing factor to learning to swim (Stallman, et al., 2008).

Swimming is a common leisure activity for adults and children; children often learn how to swim or engage in water safely in developed (i.e., high income [HIC]) countries through local community programs, starting as young as 6 months of age, until a degree of competence is acquired to the instructor's or family's satisfaction. Children are normally taught the aforementioned skills through a progression of classes in the context of a "playful lesson." This "bottom-up approach" focuses on the achievement of developmentally-easier skills in the progression before moving on to the next skill. (Gelinias & Reid, 2000). In communities across the U.S., pools are ubiquitous, and water safety training/drowning prevention programs are plentiful.

For a child with a disability to learn and retain these important water skills may be impacted by symptoms or characteristics associated with their diagnosis including cognitive and physical limitations. In addition to limited awareness of water safety, children with certain disabilities such as autism spectrum disorder (ASD) tend to wander and are often attracted to water, making drowning a leading cause of death for persons with ASD. "In 2009, 2010, and 2011, accidental drowning accounted for 91% total U.S. deaths reported in children with an ASD ages 14 and younger subsequent to wandering, elopement" (National Autism Association, 2017).

Children with some disabilities may experience sensory aversions toward water, creating a different human body-water relationship experience and thus may never learn to swim. Other diagnoses such as cerebral palsy (CP), Down syndrome, and developmental coordination disorder (DCD) present with physical characteristics (e.g., abnormal muscle tone, spasticity, and bone abnormalities) that limit children's gross motor performance and the muscular strength and endurance needed to swim. Furthermore, the progressive, bottom-up, format of learning skills step-by-step used in typical learn-to-swim programs are not necessarily developmentally effective for children with physical disabilities (Gelinias & Reid, 2000). Moreover, limited participation in typical learn-to-swim programs may be due to environmental, attitudinal, or societal barriers for this population (Fragala-Pinkham, et al., 2010).

So-called "top-down approach" swim programs are developing across the country to serve children with disabilities. The top-down approach, as opposed to the bottom-up approach, focuses on the individual person, their functional swimming task, and the specific swimming environment, to achieve swimming success. This approach is consistent with the dynamic systems view of motor control, which states that "individuals may reach the same skill goal through the use of different movements depending on characteristics of the performer, the demands of the task, and the environment in which the task is

being performed” (Gelinas & Reid, 2000, p. 271). These types of program locations are limited and can be costly. For example, the Swim Angelfish aquatic program hires qualified instructors such as occupational and physical therapists to provide child-centred therapy and swim lessons to children with disabilities. Families pay upwards of \$100 per hour for these sessions, and not all families of children with disabilities can afford this cost (J. Robbins, personal communication, November 18th, 2017). This top-down approach also challenges the validity of learn-to-swim programs for typically developing children (Gelinas & Reid, 2000), and it is unclear whether this learn-to-swim approach is linked specifically to drowning prevention.

While drowning is the leading cause of death for children starting at age 12 months, a starting age of 3 years is most feasible to measure the effectiveness of drowning prevention programs for children with or without disabilities. At age 3, many children begin attending preschool. Their receptive language and ability to understand vocabulary has developed, and they are now able to follow simple multi-step directions for learning and skill retention. By this age, children have also developed many of the gross motor skills required to perform swim skills (Case-Smith & O’Brien, 2015). Furthermore, the Council for National Cooperation in Aquatics (CNCA) previously recommended that the minimum age for organized swimming instruction be set at age 3 “because certain considerations affecting the child’s learning and safety require a degree of development not attained by most children before they are three years old” (Diamond, 1975, p. 59). However, more recent CNCA guidelines suggest that learning to swim is not dependent upon a minimum age requirement, but rather the prerequisite skills of motor skills (i.e., head control, trunk control, reciprocal arm/leg movements) and the ability to maintain breath control (Council for National Aquatics, 1985). The minimum age for swim lessons and drown prevention programs continues to be researched; most recent guidelines suggest that children should be older than 1 year old with parents’ discretion considering the child’s health and developmental readiness (Langendorfer and American Red Cross Scientific Advisory Council, 2019). Although children with disabilities may have delays in the aforementioned skills, it is still important to start the process early and allow for repeated lessons to accommodate for slower learning processes (Case-Smith & O’Brien, 2015).

SWIM Central is a drowning prevention program that was established in Broward County, Florida in 1999 to reduce the number of drowning incidences among children. The program targets children in local pre-school, kindergarten, and first grade classes by providing ten, 30-minute curriculum-based swim safety lessons over a two-week period. Lessons are taught by certified water-safety instructors who have been trained through SWIM Central. Since the program’s inception, more than 606,020 children have participated in SWIM Central, and only one of these children has been involved in a fatal drowning incident. This program has not only spread to various locations across

the State of Florida but has also served as the basis of many drowning prevention aspects of swim programs including the YMCA Safety Around Water Program (J. Sanford, personal communication, April 29th, 2019).

In 2012, the SWIM Central program launched in Collier County, Florida. This program provided the same two-week session format, free of charge to children aged 3-5 years-old who attend social-economically disadvantaged day cares and preschools.

“Each session begins with an evaluation of each child’s water safety skills. After an initial evaluation, the children are split into groups and work to develop water safety skills at their own pace. There is a maximum ratio of one instructor for every six children, but generally the ratio is much lower, and all children receive individualized attention” (Safe & Healthy Children’s Coalition of Collier County, 2019).

Since its launch, over 6,371 children have participated in Collier County’s SWIM Central program, and only two of these children have been involved in a drowning incident, one fatal and one non-fatal. The program’s effectiveness in preventing drowning is currently only measured by running the names of drowning victims through the participant list serve. There are also no current means of measuring the retention of learned swim skills after participation in the program (P. DiGrigoli, personal communication, April 9th, 2019).

Although SWIM Central was not designed specifically for children with disabilities, the Collier County program has begun offering the program specifically to this population. Additionally, the program’s success, free service to families, and individualized top-down instruction shows promise for this population. Due to the alignment of the top-down approach and role of occupational therapists working with children with and without disabilities in health promotional settings, occupational therapists trained in aquatics have a key role in this setting. Therefore, the purpose of this study is (1) to determine if children with and without disabilities, ages 3-14, who have previously participated in SWIM Central, are retaining the learned swim and safety skills, per parent report, and if there is a difference in skills of children identified with disabilities versus those who are identified without disabilities, (2) to determine if SWIM Central is effective in increasing swim and safety skills for children with and without disabilities, ages 3-14, and if there is a difference in skills of children identified with disabilities versus those who are identified without a disability. In turn, this will determine if the SWIM Central program is effective in improving drowning prevention and swim safety skills for children ages 3-14 with and without disabilities; and thus, can be a suggested program design for future drowning prevention programs across the country.

Method

Research Aims

A mixed-methods research design was used to address two research objectives: 1) to assess the retention of swimming skills for children in previous SWIM Central program sessions using a mixed-methods, quantitative and qualitative exploratory design via a post-test of a retrospective cohort; and 2) to assess the impact of the drowning prevention SWIM Central program on children's swim skills using a quantitative, quasi-experimental, single group, pre-test – post-test design. These types of designs lack randomization and comparison groups; therefore, all program participants received the same swimming session lesson format and the same repeated measurements administered before and after the program.

Participant Recruitment

Participants in this study were recruited independently to address both research aims.

Participants for Aim 1

A retrospective cohort comprised 41 children, identified with disabilities ($N = 6$) and without disabilities ($N = 35$) who participated in past SWIM Central program sessions between July 1, 2018-November 30, 2018, in Collier County, Florida.

Participants for Aim 2

A convenience sample of children ages 3-14 years ($N = 76$), identified with disabilities ($N = 6$) and without disabilities ($N = 70$), enrolled in the SWIM Central program sessions from January 14, 2019-April 5, 2019, in Collier County, Florida.

Participant Criteria

To investigate Aim 1, a sample of 3-14 year-old children who had enrolled in SWIM Central between July 1, 2018 and November 30, 2018, and who completed the program at least two months prior to completing the research study survey and were pre-approved by SWIM Central program directors. All children enrolled in SWIM Central, with and without disabilities, were offered inclusion in this study. Parents who opted out of their child's participation in the research study or who speak languages other than English were excluded from this sample.

To investigate Aim 2, a sample of 3-14 year-old children enrolled in SWIM Central between January 14, 2019 and April 5, 2019 who were pre-approved by SWIM Central program directors. All children enrolled in the program, with and without disabilities, were offered inclusion in the voluntary study. Parents who opted out of their child's participation in the research study were excluded, without any impact on their child's experience and participation within the swim program itself. Fourteen participants (in addition to the $N = 76$)

who did not complete the entirety of the SWIM Central session also were excluded.

Study Variables and Measures

The independent variable for both research aims was the intensive 10-day SWIM Central program intervention. The dependent variables for this study were: 1) parent's perceptions of the child's retention of swim skills two or more months after previously participating in the program, and 2) the children's swimming and water safety skills at the conclusion of the current SWIM Central sessions as indicated by post-test assessment results.

An anonymous survey was developed to assess the retention of swimming and water safety skills for program participants. This survey was distributed to parents/guardians of previous participants via email. The survey included questions about demographics (e.g., age, ethnicity, diagnosis), the aquatic facility location at which the child participated in SWIM Central, the number of times the child had swam since completing the program, whether the parent knew how to swim, and the parent's perceptions of the child's retention of swimming and water safety skills (Table 1). Parents were provided with a study information and informed consent on the survey email. By agreeing to participate in the survey, parents indicated implied consent.

An existing assessment checklist established by SWIM Central was used to assess the impact of the SWIM Central program on participant's swim skills (Table 2). This overall pretest and posttest checklist included six skills: 1) never swim alone/call for help/reach, and throw, don't go; 2) skill level to enter the water by jumping in; 3) performance of front progressive arm stroke; 4) performance of back float with no support for three seconds, 5) performance to jump in, turn, and stoke/kick to wall, and 6) skill to exit water using ladder/steps/side.

The assessment was administered to each child on the first and last lesson of the 10-day session. In each event, the child was asked to perform each skill, and then scored with a P (i.e., pass- did it on their own), T (i.e., tried it on their own), W (i.e., with help- did it with help), or R (i.e., refused to attempt). In addition to this assessment, each child's de-identified registration form was reviewed to obtain demographic information confidentially. Parents were provided with a study information sheet upon program registration, and implied consent was granted by registering their child for SWIM Central.

Table 1

SWIM Central Post Participation Parent/Guardian Survey Swimming Skill Questions

	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
My child knows that they should never swim alone	1	2	3	4	5
My child knows that they should call for help if they are in trouble while swimming	1	2	3	4	5
My child can enter the pool independently	1	2	3	4	5
My child can exit the pool independently	1	2	3	4	5
My child can put their head under water and regain surface independently	1	2	3	4	5
My child uses their arms to stroke in the water	1	2	3	4	5
My child has relaxed breathing when they swim	1	2	3	4	5
My child can change direction in the pool	1	2	3	4	5
My child can roll to/from their back in the water	1	2	3	4	5
My child can float on their back for more than 3 seconds	1	2	3	4	5

Table 2
SWIM Central Overall Skills Assessment

INSTRUCTOR NAME: _____ COURSE LOCATION: _____ DATES START-END: _____ Each child should be asked to perform each of the skills shown below. Score him/her with a P for pass-did it on his/her own, T for tried on his/her own, W for “did with help” or R for refused to attempt		PARTICIPANT NAME	PRETEST	POSTTEST
SCORE	SKILLS ASSESSMENT CHECKLIST			
P/T/W/R	Skill 1) NEVER SWIM ALONE/CALL FOR HELP/REACH, THROW, DON'T GO!			
P/T/W/R	Skill 2) ENTER WATER BY JUMPING IN			
P/T/W/R	Skill 3) FORWARD PROGRESSIVE ARM STROKE			
P/T/W/R	Skill 4) BACK FLOAT-NO SUPPORT-3 SECONDS			
P/T/W/R	Skill 5) JUMP IN-TURN/KICK/STROKE TO WALL			
P/T/W/R	Skill 6) EXIT WATER USING LADDER/STEPS/SIDE			
P = pass, on his/her own, T = tried independently, W = did with help, R = refused to attempt				

Results

Aim 1

Of the 41 survey respondents, 6 respondents (15%) identified their child as having a disability, and 35 respondents (85%) identified their child as not having a disability. The average age of these children was 5.7 years. The age distribution of SWIM Central participants in this study is shown in Figure 3.

Figure 1

Age Distribution of SWIM Central Post-Participation Parent/Guardian Survey

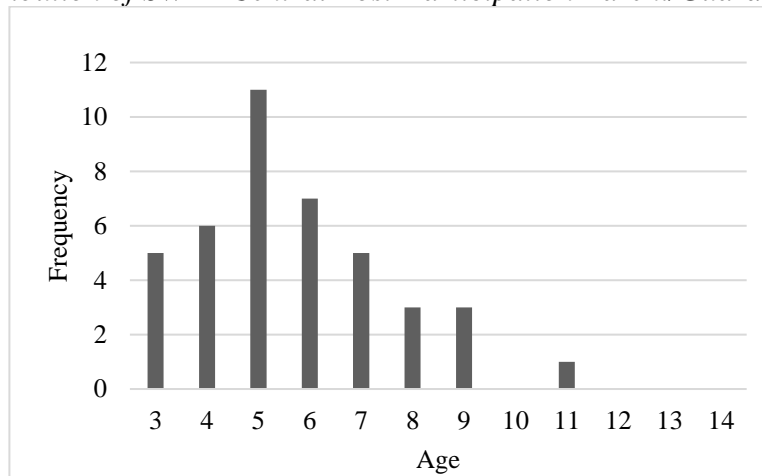


Table 3 presents the descriptive statistics of survey scores of the parent's perceptions for each skill (i.e., 1= Strongly Agree to 5 =Strongly Disagree) for the two populations (i.e., having a disability versus not having a disability). The ordinal data from the dependent measures were analysed using a nonparametric regression (Kendall's tau b). According to this analysis, having a disability was significantly correlated with the skill "My child knows that they should call for help if they are in trouble while swimming" (tau b= 0.370, p=0.012), but not with any other skills. All other swim skills had a mid-average correlation with each other. Overall, the parents' perceptions of their child's swimming ability did not vary greatly between both groups (child with a disability=2.35±1.06; child without a disability 2.04±1.09). Bonferroni adjustments were not utilized because the overall null hypothesis was not considered.

Table 3*Parent Perception of Swim Skill Retention*

Skill	Child with Disability			Child without Disability			<i>p</i>
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N^a</i>	<i>M</i>	<i>SD</i>	
My child knows they should never swim alone	6	2.17	0.98	34	1.65	0.95	0.110
My child knows they should call for help if they are in trouble while swimming	6	2.50	0.84	35	1.46	0.82	0.012*
My child can enter the pool independently	6	2.17	1.47	35	2.14	1.22	0.788
My child can exit the pool independently	6	1.50	0.55	34	1.75	1.15	0.619
My child can put their head underwater and regain surface independently	6	2.67	1.37	34	2.09	1.14	0.176
My child uses their arms to stroke in the water	6	1.67	0.52	34	2.65	1.19	0.733
My child has relaxed breathing when they swim	6	2.50	0.84	34	2.24	1.16	0.201
My child can change direction in the pool	6	2.17	0.98	34	2.09	1.08	0.327
My child can roll to/from their back in the water	6	3.00	1.55	33	2.39	1.07	0.334
My child can float on their back for more than 3 seconds	6	3.17	1.47	34	2.32	1.07	0.130
Overall	6	2.35	1.06	34	2.04	1.09	0.265

Note: Score Interpretation- 1= Strongly Agree, 2= Agree, 3= Undecided, 4= Disagree, 5=Strongly Disagree.

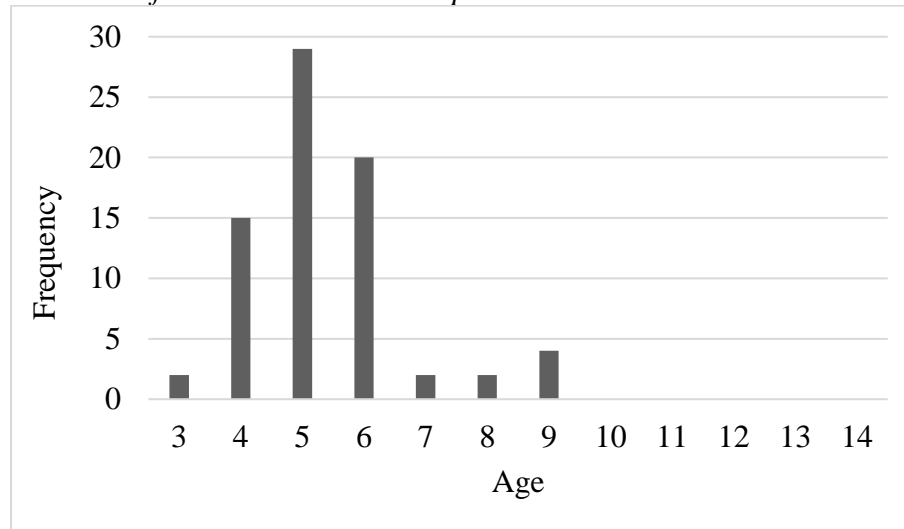
^a Change in N value due to unanswered skill questions from survey respondents.

**p*<0.05.

Aim 2

Of the 76 participants, 6 children (8%) were identified as having a disability, and 70 children (92%) were identified as not having a disability. The average age of these children was 5.4 years. The age distribution of SWIM Central participants is shown in Figure 2.

Figure 2
Age Distribution of SWIM Central Participants



The descriptive statistics shown in Table 4 and Table 5 indicate the mean pre-test and post-test scores of children with and without disabilities, respectively. Upon the start of the session, children with disabilities, on average, required help or tried to attempt, the first 5 swim skills. All children in this group were able to complete the skill of “exiting the water using ladder/steps/side” at pre-test. At pre-test, children without disabilities, on average, tried independently or required help for all 6 swim skills.

At post-test, children with disabilities, on average, were able to utilize a forward progressive arm stroke, back float for 3 seconds with no support, and exit the water. On average, this group tried to independently enter the water by jumping in, jump in and swim to the wall, and identify the safety skill of “Never Swim Alone/Call for Help/Reach, Throw, Don’t Go!” At post-test, children identified without disabilities, on average, passed the swim skills entering the water by jumping in, utilizing a forward progressive arm stroke, jumping in and swimming to the wall, and identifying the swim safety skill of “Never Swim Alone/Call for Help/Reach, Throw, Don’t Go!” On average, this group tried to independently back float with no support for 3 seconds.

By examining pre-test and post-test assessment scores, it is indicated that children with and without disabilities who participated in SWIM Central showed an overall improvement in all swim skills. The Wilcoxon signed rank test is a nonparametric statistical hypothesis test used to compare repeated measures (i.e., pre-test and post-test scores for both groups). This test indicated that the swim skill improvement in children without disabilities is statistically significant for all six skills ($p < 0.001$); the only swim skill that shows statistical significance for children with disabilities is “Back Float- No Support- 3 Seconds” ($p = 0.023$). The Wilcoxon signed rank test indicated that the overall

scores between pretest and posttest for both groups are significantly different ($p < 0.001$).

Table 6 shows the change in swim skill assessment scores for both children identified with a disability and children without a disability. According to normality testing, the distribution of the change in average scores for each skill are not normally distributed; therefore, non-parametric tests were used for both independent variables. The non-parametric Mann Whitney test indicated that there was an overall difference, in mean swim skill scores ($p = 0.013$) between children with disability (0.61 ± 0.44) and children without disability (1.25 ± 0.65). We noted that for children with a disability, no score changes occurred in skill 1 or skill 6. The skill that showed the greatest change within this group was back floating (1.33 ± 0.52). Children without disabilities showed change in all swim skills, with the greatest change in learning the swim safety skill “Never Swim Alone/Call for Help/Reach, Throw, Don’t Go!” (1.63 ± 0.80). In addition, according to the test statistics, having a disability has a significant effect on learning the swim skill “Never Swim Alone/Call for Help/Reach, Throw, Don’t Go!” ($p < 0.001$), but not with any other swim assessment skills.

Discussion

Aim 1

Although it is not possible to report equal representation of children with disabilities and children without, the percentage of children with disabilities represented through the survey is representative of the number of students in public schools enrolled in special education in the United States (13%) (National Center for Education Statistics, 2018).

Per parent/guardians’ perceptions, the survey results indicate that children who have previously participated in SWIM Central, on average, are able to demonstrate the learned swim and safety skills. This information; however, was not directly correlated to the previous SWIM Central assessment results of each child; therefore, it cannot be determined if these children have retained the same level of swim adequacy since completion of the program.

The effect of having a disability on the second skill (“My child knows they should call for help if they are in trouble while swimming”) as statistically significant corroborates with external knowledge highlighting the characteristics of children with disabilities including challenges with communication and higher level of cognitive skills (Centers for Disease Control and Prevention [CDC], 2019).

Table 4*Data from Swim Skill Assessment- Children with Disability*

Skill	Pretest Scores			Posttest Scores			<i>p</i>
	<i>N</i> ^a	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	
1) Never Swim Alone/Call for Help/Reach, Throw, Don't Go!	5	1.20	0.45	5	1.20	0.45	1.000
2) Enter the Water by Jumping In	6	1.83	1.33	6	2.50	0.84	0.180
3) Forward Progressive Arm Stroke	6	1.83	0.98	6	2.67	0.52	0.059
4) Back Float- No Support- 3 Seconds	6	1.33	0.52	6	2.67	0.52	0.023*
5) Jump in/Turn/Kick/Stroke to Wall	6	1.33	1.03	6	2.17	0.98	0.102
6) Exit Water Using Ladder/Steps/Side	6	3.00	0.00	6	3.00	0.00	1.000
Overall	6	1.77	1.12	6	2.40	0.81	<0.001***

Note: Score Interpretation- 3=pass, 2= tried independently, 1=did with help, 0=refused to attempt.

^a Change in N value, 1 skill marked as non-applicable for 1 participant.

* $p < 0.05$. *** $p < 0.001$.

Table 5*Data from Swim Skill Assessment- Children without Disability*

Skill	Pretest Scores			Posttest Scores			<i>p</i>
	<i>N</i>	<i>M</i>	<i>SD</i>	<i>N</i>	<i>M</i>	<i>SD</i>	
1) Never Swim Alone/Call for Help/Reach, Throw, Don't Go!	70	1.20	0.55	70	2.83	0.42	<0.001***
2) Enter the Water by Jumping In	70	1.64	1.08	70	2.94	0.34	<0.001***
3) Forward Progressive Arm Stroke	70	1.41	0.81	70	2.70	0.62	<0.001***
4) Back Float- No Support- 3 Seconds	70	1.06	0.61	70	2.44	0.71	<0.001***
5) Jump in/Turn/Kick/Stroke to Wall	70	1.20	0.73	70	2.53	0.74	<0.001***
6) Exit Water Using Ladder/Steps/Side	70	2.40	0.95	70	3.00	0.00	<0.001***
Overall	70	1.49	0.923	70	2.74	0.571	<0.001***

Note: Score Interpretation- 3=pass, 2= tried independently, 1=did with help, 0=refused to attempt.

*** $p < 0.001$.

Limitations

This aim examined a 6-month period of past participants, but the survey did not ask when each child completed the program. Therefore, this limited knowledge of how long each child had retained learned swim skills. Additionally, many children with disabilities enrolled in the program were taught on a 1:1 student/instructor ratio, unlike children without a disability who were usually taught in a 1:6 student/instructor ratio. This could also have impacted the learning of the 6 swim skills during SWIM Central. Furthermore, the low response rate of surveys was probable for lower socioeconomic status population, a partial immigrant population, lack of parents having email addresses or email changes since program completion, and the reliance on hosting program facilities for survey distribution. The survey was also only available in English, and a large number of the population requested Spanish translation.

Aim 2

Overall, the pre-test scores of children without a disability indicated a greater need for assistance to complete the swim skill, when compared to scores of children with a disability. Although the total participants with a disability (N=6) was much smaller than the total participants without disabilities (N=70), it was interesting to note that all children with disabilities passed the skill “exit water using ladder, steps, side” at pre-test, and several children without disabilities did not at pre-test.

It is important to note that although there was not a change in skill 6, exiting the water, for children with disabilities, all participants in this group passed this skill at pre- and post-test. Similar to Aim 1, the effect of having a disability on the first skill as statistically significant corroborates with other data highlighting the characteristics of children with disabilities including challenges with communication and higher-level cognitive skills (CDC, 2019).

Despite the small sample size of children with disabilities, nonparametric testing indicated that there was a relationship between the knowledge item of “never swim alone, call for help, and reach/throw, don’t go” and having a disability. There may be important changes in other skills, but the study’s small sample size of children with disabilities lacked the statistical power to detect small differences.

Limitations

Similar to the results in Aim 1, the 1:1 student/instructor ratio for children with a disability versus 1:6 student/instructor ratio for children without a disability could have impacted the swim skills assessments. Furthermore, different teaching styles of various instructors also could have impacted the learning of the swim skills. The safety skill of “Never Swim Alone/Call for Help/Reach, Throw, Don’t Go!” was only tested by having each child verbalize the safety

rules of the pool. Further research is needed to determine appropriate testing measures of this skill that meet the needs of each child. In addition, this safety skill as measured by SWIM Central examines three different skills (i.e., knowledge to never swim alone, knowledge to call for help, and knowledge to reach or throw a personal flotation device) as one unit, and could use revision. The validity and reliability of the current SWIM Central Skill Assessment is also unknown and could be a limitation of this study. Both validity and reliability of the instrument, especially the scoring rubric need to be studied.

Conclusions

Aim 1

These findings suggested that, per parent report, children ages 3-14 with and without disabilities who have previously participated in SWIM Central were retaining learned swim & safety skills, and there was not an overall reported difference in skill retention in the presence of a disability. Further research is needed to determine the retention of swim skills after finishing the program.

Aim 2

The overall significant increase in swim skills for all participants indicated that SWIM Central was effective in increasing swimming skill in regard to the 6 swim skills assessed during the program. Further research with a larger sample size for children with disabilities would be beneficial to detect smaller changes in swim skill ability.

Overall

This research will add to the growing body of literature in health promotion and prevention, could play a role in aquatic therapy of those with disabilities, and should inform drowning prevention programs nationwide for children of all abilities.

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