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Effects of a Staff Training Program on Community Instructors' Ability to Teach Swimming Skills to Children With Autism

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Abstract

Several recent studies have shown that children with autism spectrum disorder (ASD) are less physically active than their typically developing peers and are thus at risk of health problems associated with inactivity (e.g., obesity or diabetes). There is a need to examine the effectiveness of interventions such as swimming that are aimed at increasing physical activity, using approaches that are ecologically valid—that is, that are designed to address real-world problems in natural settings with typical intervention agents. This community-based study used a modified non-concurrent multiple baseline design to assess the impact of behavioral skills training to train recreation center staff in the use of discrete trials and visual activity schedules to teach swimming skills to children with ASD in public pools. Following completion of the training, five of six instructors showed evidence of instructional skill acquisition; the sixth instructor showed improvement during baseline, so the effect of the intervention could not be assessed. In addition, an experimental effect for increased compliance was evident for seven of the eight children, and all eight acquired new swimming skills. Social/ecological validity ratings by instructors and parents were uniformly high. The results and limitations are discussed, along with suggestions for future research.

Keywords

swimming, autism, staff training, behavioral skills training

Swimming is a popular choice for family recreation that is age appropriate across the life span and is also an essential safety skill (Smith & Patterson, 2012). It can be a form of vigorous physical exercise that has corresponding health benefits, and it can be either an individual or a team/group activity (Rogers, Hemmeter, & Wolery, 2010). In addition, research has shown that, for individuals with autism spectrum disorder (ASD), swimming may have ancillary benefits such as improved balance and flexibility, reduced stereotypic behavior, and enhanced social behavior and social interaction skills (Chu & Pan, 2012; Pan, 2010; Yilmaz, Yanardag, Birkan, & Bumin, 2004).

Several studies have examined the efficacy of various instructional approaches for teaching swimming skills to children with ASD. *Efficacy* studies examine the impact of an intervention under highly controlled conditions, including the use of experienced interventionists who implement a treatment with a high degree of fidelity, in a context that is designed to eliminate or reduce confounding variables (Robey, 2004). In swimming instruction efficacy studies, researchers or graduate students with extensive background working with individuals with ASD typically provide instruction in some type of specialized or therapeutic pool, using carefully controlled experimental designs. In some of these studies, researchers examined the outcomes of a holistic approach to swimming instruction (i.e., the Halliwick method) or a variation thereof (Pan, 2010; Yilmaz et al., 2004). In other studies, researchers assessed the impact of one or more behavioral teaching procedures (Chu & Pan, 2012; Rogers et al., 2010, Yilmaz, Birkan, Konukman, & Yanardag, 2010a; Yilmaz et al., 2010b). Although participants with ASD in these studies all acquired various swimming skills, none of the studies evaluated intervention *effectiveness*—that is, the extent to which an intervention "works" in real-life settings, under less-than-ideal conditions (Robey, 2004). For example, instruction was not provided in community-based aquatic facilities by certified swimming instructors with little or no background in ASD.

Unfortunately, numerous barriers may deter or prevent individuals with ASD from accessing community-based

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swimming programs. One such barrier is lack of access to staff who are trained to provide instruction that accommodates the instructional and learning needs of individuals with ASD. For example, many individuals with ASD have difficulty complying with directives (e.g., "Put your face in the water"), particularly when the directives are issued by individuals with whom they have no previous history of reinforcement (such as unfamiliar swimming instructors). In such cases, pairing an unfamiliar person with highly preferred activities that are provided non-contingently can be effective for establishing initial rapport (Kemp & Carr, 1995; Magito McLaughlin, & Carr, 2005). Compliance is also enhanced when instructors are in close physical proximity to learners and have secured learners' visual and/or auditory attention prior to issuing an instruction (Stephenson & Hanley, 2010). Language and communication challenges also make it difficult for many individuals with ASD to comply with verbal directives, and difficulties with imitation may limit the extent to which instructor modeling can serve as a useful alternative. However, many individuals with ASD benefit from the use of visual activity schedules (VASs), which have been shown to increase both on-task behavior and instructional compliance (Koyama & Wang, 2011; Krantz, MacDuff, & McClannahan, 1993). Typically, VASs consist of a series of simple pictures that depict upcoming activities in an instructional sequence, in the order that they will occur (e.g., jump in the pool, blow bubbles, kick feet). Finally, children with ASD often require systematic instruction when learning new skills and thus benefit from discrete trial teaching (DTT), which consists of a series of learning trials composed of an instructional cue (i.e., discriminative stimulus), optional prompt, response, and consequence (Smith, 2001). For example, in a swimming program, a discrete trial might begin with a verbal instruction such as "Do what I am doing," "Kick your feet," or "Blow bubbles." This might be followed immediately by a modeling prompt or a physical prompt (either partial or full), to assist the child to produce a response. The consequence for a correct response or approximation would include verbal praise, non-verbal social feedback (i.e., smiling, high fives), and/or brief access to a preferred item or activity (e.g., playing with a favorite water toy). Alternatively, if a child does not respond with at least an approximation of the target behavior, the instructor would re-issue the verbal instruction and provide a more directive prompt than on the first attempt, followed by a reinforcing consequence. When used in combination with other antecedent interventions (e.g., VASs), DTT has been shown to enhance motivation and effectively teach new skills (Smith, 2001).

Behavioral skills training (BST) is an instructional approach that has been shown to be effective for teaching a variety of skills that are required in school and community settings. Among other applications, BST has been used to teach DTT procedures to staff who work with children with ASD and other developmental disabilities in clinical settings such as schools (Fetherston & Sturmey, 2014; Sarakoff & Sturmey, 2004). BST is composed of four main components: (a) verbal and/or written instructions that describe the desired behaviors and the circumstances in which they are expected to occur, (b) modeling of the desired behaviors, (c) role-plays or rehearsals of the behaviors, and (d) instructor feedback following role-plays or rehearsals, consisting of praise or other reinforcers for correct behaviors or approximations thereof, combined with instructions that identify how performance can be improved when errors are made (Miltenberger, 2012). To date, BST has not been used to teach DTT to instructors in community settings such as public pools.

Participation in swimming and other recreational activities can have both behavioral and health benefits. Although community-based instructors are highly trained to teach swimming in general, they may not have the skills that are required to secure instructional compliance by children with ASD. This lack of staff training prevents many parents from enrolling their children with ASD in community-based recreation programs (Obrusnikova & Miccinello, 2012). Thus, there is real need for research aimed at teaching community swim instructors to implement evidence-based procedures such as DTT and VASs that have been shown to be effective in efficacy studies. The purpose of this study was to explore the effectiveness of a simple, BST-based training package designed to enhance the instructional skills of instructors who teach children with ASD in community-based pools. The study addressed four questions: (a) Will BST-based instruction increase community swim instructors' use of DTT and other key skills during swimming lessons? (b) Is there an association between BST-based instructor training and increased child compliance? (c) Following instructor training, do children with ASD show evidence of swimming skill acquisition? and (d) How do swimming instructors and parents rate the BST-based training with regard to social and ecological validity?

Method

Participants

Study participants included six community-based swimming instructors and eight children with ASD.

Instructors. Six swimming instructors (five females, one male) were recruited through two community pools located in a large metropolitan area in Western Canada. Instructors ranged in age from 19 to 30 ($M = 23.1$) with 2.5 to 13 years of previous swim instructor experience ($M = 5.6$ years). Instructors had attained all the following certificates or credentials at the time of the study: Lifesaving Instructor,

National Lifeguard Service, Water Safety Instructor, I Can Swim, Aquatic Emergency Certification or Standard First Aid, and CPR–Level C. In addition, all six instructors reported that they had taught swimming to children with ASD in the past, in either private lessons or group formats; however, only one instructor had prior training in ASD, through a college-level disability survey course. One instructor had completed a university degree at the time of the study, one had completed a 1-year college program, and the remaining four had 1 to 3 years of postsecondary education.

Children with ASD. Eight children diagnosed with ASD (7 boys and 1 girl, ages 5–8) participated in the study. Inclusion criteria were parent report of (a) an ASD diagnosis by a multidisciplinary team, (b) no fear of water, and (c) no severe problem behavior (e.g., aggression, self-injurious behavior) in community recreation settings. In addition, during a pre-enrollment home visit with the child and his or her family, the first author engaged the child in a few unfamiliar play activities that required physical prompting (e.g., puzzles) to assess the child's willingness to accept physical guidance provided by an unfamiliar adult. No child reacted negatively (e.g., cried, whined) or resisted hand-over-hand physical prompting when it was offered; these types of behaviors would have resulted in exclusion from the study. During this visit, the first author also administered either the *Preschool Language Scale, Fourth Edition* (PLS-4; Zimmerman, Steiner, & Pond, 2002) or the *Clinical Evaluation of Language Fundamentals, Fourth Edition* (CELF-4; Semel, Wiig, & Secord, 2003) to each child, to establish his or her ability to understand simple verbal directions.

All eight child participants were able to speak; their receptive language age equivalents ranged from 2 years 6 months on the PLS-4 to 7 years 3 months on the CELF-4. All but one child had had previous swimming instruction, but most were unable to put their faces in the water, blow bubbles, or float. Only one participant was working on more advanced swimming skills and learning to swim using strokes. None of the participants had received previous instruction from the instructor to whom they were assigned in the study. Five children were assigned their own instructors, and three children were assigned as a group to a sixth instructor because of constraints related to participant availability and scheduling at the two pools.

Setting and Materials

Swimming lessons occurred at two large indoor pools located in community recreation centers in Western Canada. The lessons occurred in one lane of the pool while several other lessons were also in progress nearby (i.e., the pools were noisy, and all lanes were occupied). Materials for the swimming lessons (e.g., kick boards) were supplied by the pools where lessons occurred and varied to accommodate the interests of individual children and the content of instruction. In addition, VASs were used in all intervention lessons; they consisted of Picture Communication Symbols (Mayer–Johnson LLC, 1981–2011) and color photographs that were laminated and mounted on a plywood display that was affixed to the side of the pool.

Dependent Variables

Four dependent variables were measured in the study: swimming instructors' use of the skills taught during the training phase, child compliance, child swimming skill acquisition, and social/ecological validity.

Instructors' use of key skills. Swimming instructors were taught to use a set of seven key skills that had been shown in previous research to improve motivation, compliance, and skill acquisition in children with ASD. The key skills included (a) engaging in rapport-building activities, (b) using a VAS, (c) providing a verbal instruction only when the child was attending ("wait until ready"), (d) providing an instruction only when the child was no more than 3 feet away (i.e., the arm's length rule), (e) delivering clear verbal instructions, (f) prompting when necessary, and (g) reinforcing both correct responses and approximations with praise. Table 1 provides operational definitions of the key skills.

Baseline and intervention data were recorded from videotapes of each lesson to determine the percentage of key skills demonstrated correctly by each instructor. The inclusion or omission of a rapport-building activity was coded once at the beginning and once at the end of each lesson. Use of a VAS was coded for each skill that was taught during a lesson (e.g., blowing bubbles, kicking with a flutter board). Every verbal instruction was coded *correct/incorrect* with regard to the arm's length rule, "wait until ready," clear instructions, and use of praise. The use of a prompt was coded as either *correct* or *incorrect* each time a child failed to attempt a skill after an instructor's first and second verbal instruction (see Table 1). The percentage of correct demonstrations of each skill was calculated for each lesson by dividing the total number of times an instructor used a skill correctly by the total number of opportunities that arose to use it.

Child compliance. *Compliance on the first attempt* was coded if a participant attempted to perform an action within ~3 s after the instructor issued a verbal instruction (e.g., "Put your face in the water"). The participant did not need to perform the action correctly; however, his or her attempt had to bear some topographical resemblance to the action that was requested (e.g., If the instruction was "Do a dolphin kick" and the child approximated the kick but did not exhibit perfect form, the attempt was coded as *occurring*).

Table 1. Key Instructor Skills (Dependent Variables).

Skill	Definition
Rapport-building activity	At the beginning and at the end of each swimming lesson, the instructor engages in a fun, non-instructional activity with the child for 3 to 5 min (e.g., goes down the slide, plays on the raft).
Use of a visual activity schedule (VAS)	This skill has three components: (a) Prior to each lesson, the instructor prepares a pictorial schedule to show the sequence of planned activities for the entire lesson; (b) immediately prior to each activity, the instructor shows the child a picture of the desired skill; and (c) after each activity is finished, the instructor removes the related picture, points to the next picture, and tells the child what comes next.
"Wait until ready"	The instructor issues a verbal instruction only when the child's ears are above the water and the child is not talking or playing with a toy. The child does *not* need to be looking at the instructor.
Arm's length rule	The instructor issues a verbal instruction only when he or she is within 3 feet (i.e., one "arm's length") of the child.
Clear instruction	The instructor issues a short verbal instruction in declarative form (e.g., "Blow bubbles").
Prompts	If the child does not respond to a verbal instruction within approximately 3 s, the instructor provides a partial or full physical prompt whenever possible; if a physical prompt is not possible (e.g., "Blow bubbles"), the instructor models the desired behavior instead. If the child does not respond to the prompt with at least an approximation of the desired behavior, the instructor issues a second verbal instruction accompanied by a more directive prompt (e.g., full physical instead of partial physical, or an exaggerated model instead of a simple model).
Praise	The instructor provides verbal praise after each instruction that a child attempts to follow, *regardless* of whether the child's response was preceded by a prompt.

Compliance on the second attempt occurred if the participant attempted to perform an action within ~3 s after the instructor re-issued a verbal instruction that was not followed the first time. The percentage of compliance was calculated for each lesson by dividing the number of instructions followed by the total number of instructions issued, for both first and second attempts. If a child did not attempt the skill after two verbal instructions, additional instructions were not coded.

Child swimming skill acquisition. The swimming skills of the child participants were assessed by the first author using a sequential skill list with mastery criteria that was provided by the instructors in the two community pools. Swimming skills were coded *incorrect, emerging*, or *established* during the last five trials in a phase, which occurred in the final session of baseline or intervention for 83% of skills. The remaining skills (17%) were coded across more than one session in the group where three children were assigned to one instructor, because it was not possible to code all five trials in a single session. Incorrect skills were those that, on each of the final five trials in a phase, were performed inaccurately (or not at all) in response to an instructor's directive and thus required some type of prompt. In other words, if the instructor directed the child to perform a skill (e.g., "Kick your feet") and the child either did nothing or performed the action incorrectly (e.g., moved his arms, touched his feet), this was coded as *incorrect*. Established skills were those that the child performed correctly and independently (i.e., without a prompt) after one instructor request, on at least four of the final five trials in a phase. Emerging skills were skills that fell between the definitions of incorrect and established – that is, the skill was demonstrated without a prompt on one to three of the last five trials.

Social and ecological validity. On completion of the study, swimming instructors and parents completed a survey designed to evaluate the social and ecological validity of the training and in-pool coaching aspects of the study. The instructor survey consisted of 15 statements, and the parent survey consisted of 10 statements, all of which were rated on a scale of 1 (*strongly disagree*) to 5 (*strongly agree*).

Research Design

This exploratory study used a modified, non-concurrent multiple baseline design (MBD) to examine the effectiveness of a training intervention on instructor skills acquisition and child compliance. In a typical non-concurrent MBD, participants are assigned at random to one of three or more pre-determined baseline lengths (Watson & Workman, 1981). However, in this study, participants were assigned to one of two baseline lengths, to accommodate instructor and child availability. Thus, across the five individual participants, phase changes took place at two distinct points in time (after 4 to 5 baseline sessions and 9 to 10 baseline sessions), rather than the three phase changes that are required to demonstrate a functional relation in single-participant research (Horner et al., 2005; Kratochwill et al., 2010). Training was implemented across instructors and the child participants to whom they were assigned at different points in time over a 5-month period.

Procedures

Prior to enrollment, a home visit was arranged to meet each child and his or her family, to determine whether the child met the study inclusion criteria (see "Participants"). No children were excluded from the study after this visit.

Baseline. Baseline occurred over 4 to 10 sessions that spanned 1 to 5 weeks depending on instructor availability, which was dictated by the recreation centers where they worked. All baseline sessions were 30 min in length. During baseline, instructors were told to conduct swimming lessons as they typically would, to teach skills from the developmental skills curriculum that was used at both pools. They were told that they could use any materials or devices that they believed to be appropriate, but they were not provided with specific tools in this regard. No instruction or feedback was provided to the instructors before, during, or after the baseline sessions, and no intervention was provided to the children during this phase.

Instructor training. Instructor training began 3 to 7 days following completion of baseline. During this phase, the child participants were not involved in swimming either at the recreation center pool or at home and did not receive any swimming instruction. Instructors were trained using a BST-based approach that combined didactic instruction and in-pool coaching. A 3-hr workshop was presented by the first author 3 times during the study, with two instructors attending each time. The workshop used a combination of training strategies, including verbal and written instructions, role-playing, and feedback to the instructors for both correct and incorrect responding.

In the workshop, the first author provided a brief overview of the language, social interaction, and play challenges that are common in children with ASD. She then provided a Microsoft PowerPoint presentation with multiple examples of the seven key skills that instructors were expected to implement during swimming lessons (see Table 1). In particular, instructors were introduced to the use of "learning loops" (i.e., discrete trials) that included (a) a clear, verbal instruction (e.g., "Blow bubbles"); (b) an optional prompt; (c) a child response; and (d) instructor praise for a correct response or approximation, regardless of whether or not a prompt was provided. Instructors were taught that, if a child failed to produce at least a skill approximation within ~3 s of a verbal instruction, they should provide a prompt. The type of prompt was left up to the instructors' discretion, depending on the skill requested. For example, they were told that, whenever possible (e.g., "Kick your feet"), they should provide a partial or full physical prompt; however, if this was not appropriate (e.g., "Blow bubbles"), they could provide a modeling prompt instead. If the child did not respond to the first verbal instruction (with or without a prompt), instructors were taught to repeat it, together with a more directive prompt than they used the first time. Instructors were free to use their own discretion about how to provide corrective feedback for skills that were performed incorrectly, as they were all qualified swimming instructors who had extensive experience in this regard. Following the PowerPoint presentation, instructors reviewed several video clips of the researcher teaching swimming to children with ASD who were not involved in the study, and were asked to identify when the key skills were performed correctly and how to correct errors when they were performed incorrectly. At the end of the training workshop, the instructors received brief information about the child/children with ASD with whom they would work during the training phase and practiced building VASs for them.

One week after each workshop, the in-pool coaching component of training was initiated on a 1:1 basis with each instructor while he or she provided 30-min swimming lessons to one to two boys with ASD (ages 6–8) who participated in this component of the study only. Four children were assigned to each of five instructors (one child worked with two different instructors over the course of the study), and two children were assigned to the sixth instructor, who worked with them as a group. No baseline or outcome data were collected for the children who participated in coaching; their only purpose was to provide opportunities for the instructors to practice the skills that were taught in the workshop. During this part of the training, each instructor received exactly 2.5 hr of individual coaching from the first author. In some cases, coaching was provided in 30-min segments over 5 lessons, and in other cases, coaching was provided in 15-min segments over 10 lessons, depending on the scheduling requirements of the recreation centers. The coach was either in the pool or close to the instructor on the pool deck for all lessons. During each lesson, the instructor determined the target skills to teach, but the coach provided input on the use of the key skills—with specific emphasis on correct implementation of "learning loops"—through a combination of modeling, verbal prompting, corrective feedback, and praise for correct performance.

Intervention. On average, this phase commenced 3.6 weeks following the completion of baseline (range = 3–5 weeks) and 5 days following the completion of instructor training (range = 1–11 days). All intervention sessions were 30 min in length, during which the eight child participants were again paired with the same instructor as during baseline. In total, the children received 2.5 hr of swimming instruction over five lessons that spanned 1 to 5 weeks. Instructors were asked to teach their lessons using the key skills they learned and practiced during training. The researcher did not provide any feedback or coaching to the instructors during this phase.

Data Collection, Coding, and Inter-Observer Agreement

Data collection. Six volunteer undergraduate students filmed all swimming lessons throughout the baseline and intervention phases, using handheld Sony Handycam DVD camcorders. The first author provided the students with a training manual that outlined the videotaping procedures, watched each student film the first few lessons, and provided feedback as needed (e.g., told the student to get closer to the pool to enhance the sound clarity). In addition, student filmers were provided with regular feedback about the quality of the filming so that adjustments could be made.

Coding. The first author, who was the primary data coder, trained a graduate research assistant (RA) who was blind to the purpose of the study to code the dependent variables from the videotapes. The RA was provided with a scoring manual containing operational definitions, examples and non-examples of the target behaviors, and a scoring protocol. Training was provided on videotapes that were filmed outside of the present study until the RA achieved 90% accuracy (compared with the researcher's codings) over three consecutive videotapes. Subsequently, the RA independently coded 33% of baseline videotapes and 33% of intervention videotapes, selected at random, for the relevant dependent variables. For the instructor who taught a group of three children, data were coded separately for each of the instructor–child dyads. The RA and the first author independently coded one new participant lesson and compared their ratings. In both cases, reliability was to ensure that they were still coding the dependent variables consistently. The videos that were coded during these meetings were not used in the final calculations for inter-observer agreement (IOA).

Inter-observer agreement. The percentage of total agreement for each dependent variable was calculated by dividing the number of agreements by the total number of agreements plus disagreements, multiplied by 100. The mean IOA for the instructors' key skills was 83% (range = 77%–100%). The mean IOA for child compliance was 87% (range = 79%–95%). The mean IOA for child swimming skills during the last five trials of a phase was 92% (range = 87%–100%).

Results

For each instructor–child dyad, the researcher first conducted a preliminary examination of baseline and intervention data for each of the seven key skills taught to the instructors. In general, instructors' baseline rates were low for five of the seven key skills: rapport-building activities, clear instructions, use of prompts, use of praise, and use of a VAS. However, all six instructors showed high levels of both the arm's length rule and "wait until ready" skills at baseline, with little room for improvement. Based on this preliminary analysis, two composite scores were created for the instructors' use of key skills: a "new skills" score and a "pre-existing skills" score. The new skills score represents instructors' use of the five skills (listed previously) that did not occur at a high rate during baseline, and the pre-existing skills score represents instructors' use of the two skills—the arm's length rule and "wait until ready"—that were demonstrated at high levels during baseline. The two types of skills were graphed separately for visual analysis.

The logic of single-subject research was used to determine whether an experimental effect was demonstrated by examining five features of the data for each dyad: (a) level, (b) trend, (c) variability, (d) immediacy of effect, and (e) overlap (Horner et al., 2005; Kratochwill et al., 2010). When there was visual evidence of an increasing trend during baseline for an instructor or child, the split middle method of trend estimation (Wolery & Harris, 1982) was used to make a judgment about whether the level and trend during intervention represented an improvement over what would be predicted from baseline. This technique was used to examine first and/or second child compliance trends for David, Jeff, and Oscar, and the instructor use of new skills trend for Katie (all instructor and child names are pseudonyms).

Instructor Skill Acquisition and Child Compliance

Table 2 summarizes the instructors' scores for correct use of the seven key skills during baseline and intervention (i.e., post training). The two pre-existing skills are displayed first, followed by the five new skills in the order of the percentage of change.

The two pre-existing skills (i.e., the arms length rule and "wait until ready") remained near ceiling levels both before and after training. However, following training, all six instructors demonstrated gains in the use of the other five key skills, to varying degrees. Because none of the instructors used a VAS during baseline, the percentage change for this skill was the most substantial. With regard to the remaining four skills, instructors had quite diverse skill profiles, both during baseline and after training. For example, one instructor showed dramatic increases in the use of clear instructions, prompts, and rapport-building activities after training, but still had one of the lowest change scores for use of praise. Another instructor had the highest percentages for clear instructions, praise, and rapport building during baseline, and showed marked improvement in her use of prompts.

Despite this variability, training effects were evident for the use of the five new skills by all instructors except Katie, whose baseline data intersected with the trend during intervention. Figure 1 displays the results for both instructor skill acquisition and child compliance, for the five single

Table 2. Percentage of Instructor Skills Performed Correctly in Baseline and Intervention.

Instructor skill	Baseline	Intervention	Change
Pre-existing skills			
Arm's length rule			
M	95.1	98.1	+3.0
Range	87–100	96–100	+0-9
"Wait until ready"			
M	99.1	99.6	+0.5
Range	97–100	99–100	+0–2
New skills			
Visual schedules			
M	0	96.5	+96.5
Range	0	92–100	+92–100
Prompts			
M	9.9	80.5	+70.6
Range	5–20	57–94	+51–84
Praise			
M	31.3	70.0	+38.7
Range	11–44	38–88	+3–75
Rapport-building activities			
M	41.3	78.8	+37.5
Range	30–50	60–100	+10–50
Clear instructions			
M	63.4	92.1	+28.7
Range	39–84	86–98	+12–56

instructor–child dyads. Training effects were evident for the use of the five new skills by all instructors except Katie, whose baseline data showed an increasing trend.

Intervention effects were evident for child compliance on both the first and second attempts for Chris, Sara, and Arthur. An intervention effect was demonstrated for child compliance on the first attempt but not the second for Carter, and no effects were evident for David. Thus, effects were demonstrated in every case that was not compromised by an increasing trend in baseline.

Figure 2 displays the results for both instructor skill acquisition and child compliance, for the sixth instructor and the three children who she taught in a group.

A training effect was demonstrated for Kristina's use of new skills with all three children. Effects were also evident for child compliance on both the first and second attempts for both Luke and Oscar, and on the first attempt for Jeff. Thus, as with the single instructor–child dyads, effects were demonstrated in every case that was not compromised by an increasing trend in baseline.

Child Swimming Skills

Swimming skills were coded as *incorrect, emerging*, and *established* during the last five trials of both baseline and intervention. Across the eight children, 18% to 100% of skills assessed in baseline improved by at least one level during intervention. One child had a skill decrease by one level, but that child also showed increases in two skills. Figure 3 summarizes these results.

Increases in established skills (i.e., those that a child performed independently on 80% of the final five intervention trials) were evident for seven of the eight children, and the number of newly established skills ranged from zero to six across children. Increases from incorrect to emerging skills were also seen in all the children except Arthur, and the range was 0 to 7 skills.

Social and Ecological Validity

Table 3 summarizes abbreviated items, mean scores, and ranges on the instructor and parent social/ecological validity surveys.

On the instructor survey, the mean ratings of positive statements about the process and effectiveness of the training ranged from 4.2 to 5.0 (i.e., *agree* to *strongly agree*). One survey item stated that instructors felt overwhelmed by the training; the mean rating of 1.2 indicated that instructors strongly disagreed with this statement. Several instructors commented that the training should be mandatory for aquatics instructors working with children with special needs, and four instructors provided specific comments about the VASs and how useful they were for the children. The mean parent ratings ranged from 4.7 to 5.0. Many parents commented that they hoped that more training would be available at community pools and noted that the training should be offered in connection with other recreation programs, such as ice skating, skiing, gymnastics, and biking.

Discussion

This was the first study to evaluate the effectiveness of a BST intervention provided to community recreation center staff in public community pools, rather than in more specialized pool settings where noise, movement, and visual distractors are more constrained (e.g., Rogers et al., 2010). In addition, unlike in previous studies, the training package was designed to be simple and easy to both learn and implement in the natural setting of a community pool. For example, instructors were taught to use "learning loops" (i.e., discrete trials) that included a clear instruction, optional prompt, child response, and instructor praise. However, they were not taught to use a specific prompt hierarchy that would have required them to keep track of the order of prompts used for each skill. Rather, if a child failed to respond to a verbal instruction, he or she was taught to insert either a modeling or physical prompt, depending on the skill being taught, and to increase the directiveness of the prompt with each subsequent verbal instruction related to that skill. They were also taught to use rapport-building

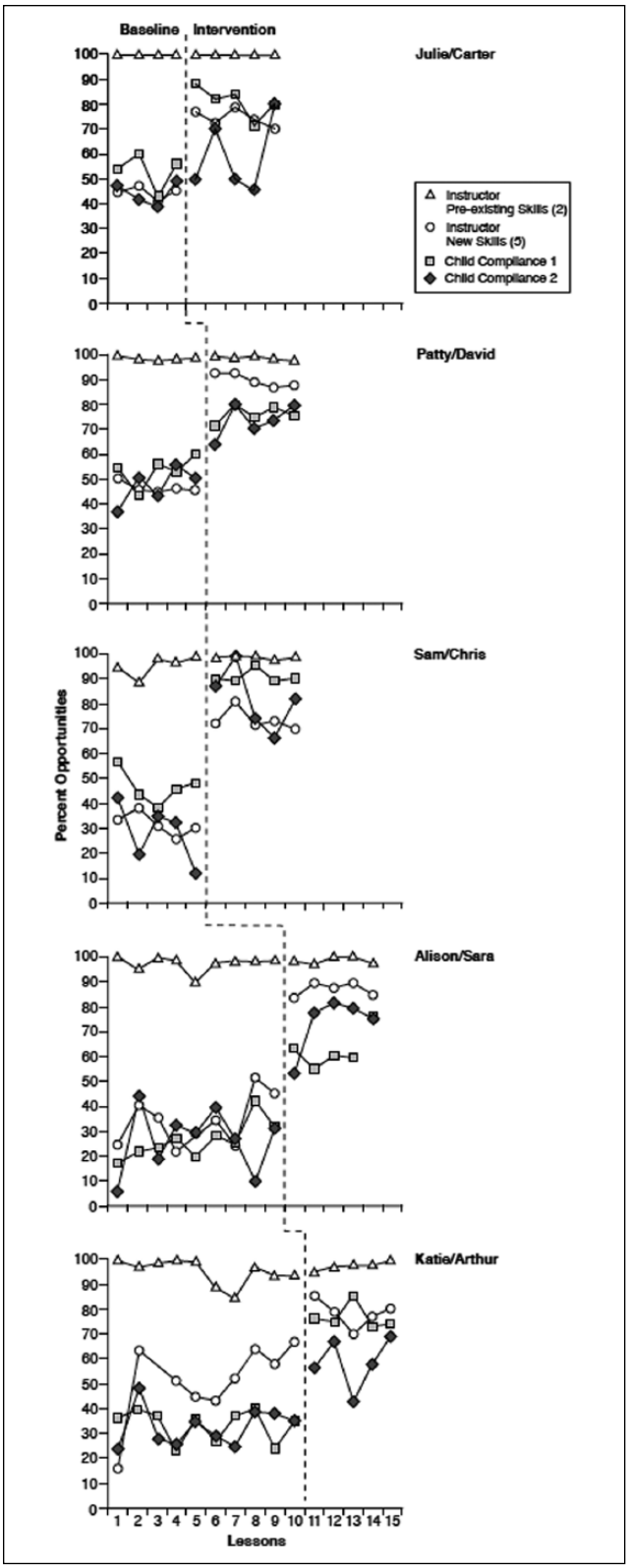

Figure 1. Instructor skill acquisition and child compliance results for five instructors and the child taught by each (instructor name/child name).

activities and VASs that were easy to implement in a community setting. Following training, five of six instructors met the criteria for demonstration of an effect for five new skills; the sixth instructor showed improvement during baseline, so the effect of the intervention could not be assessed. Instructors' use of VASs and prompts showed the most improvement from baseline, when none used VASs and most simply repeated verbal instructions over and over again if a child did not respond. An experimental effect was demonstrated for child compliance on the first attempt for seven of the eight children, and an effect for compliance on the second attempt was evident for five children. In addition, the swimming skills of all eight children showed improvements from lower to higher levels of accuracy and independence. Finally, social validity measures indicated that both instructors and parents responded favorably to the training and its impact on the children in the study.

The variability that occurred as a side effect of the public, community setting in which this research was situated enhanced its external validity. For example, although the research involved a small sample of instructors and children, there was considerable variability within both groups. Children varied by racial/ethnic background (i.e., Chinese, Filipino, Caucasian, etc.), gender, language ability, and swimming ability. The instructors were also a diverse group, varying somewhat by age, educational background, and previous experience with children with ASD. Although their skill profiles still varied somewhat in the intervention phase, all the instructors demonstrated improvements across all the key skills, suggesting that the training package can be effective across a range of instructors.

The variability that was present in the research design also provides some evidence that this intervention may be effective across a variety of lesson structures. This study provided one demonstration (i.e., Kristina) that the training can have a positive impact on instructors who teach small groups of children in addition to those who teach private lessons. In addition, positive results were observed across children and instructors who participated in lessons that occurred daily for 5 days, as well as lessons that occurred weekly over 5 weeks. Thus, the study provides some evidence that the intervention package can accommodate the variable registration requirements and lesson structures that may be present in community recreation centers.

Limitations

Although the results of this study are encouraging, the modified non-concurrent MBD did not permit demonstration of a functional relationship between implementation of the training and improvements in either instructor skills or child compliance. The general standard for demonstrating a functional relation is a change in target behavior immediately

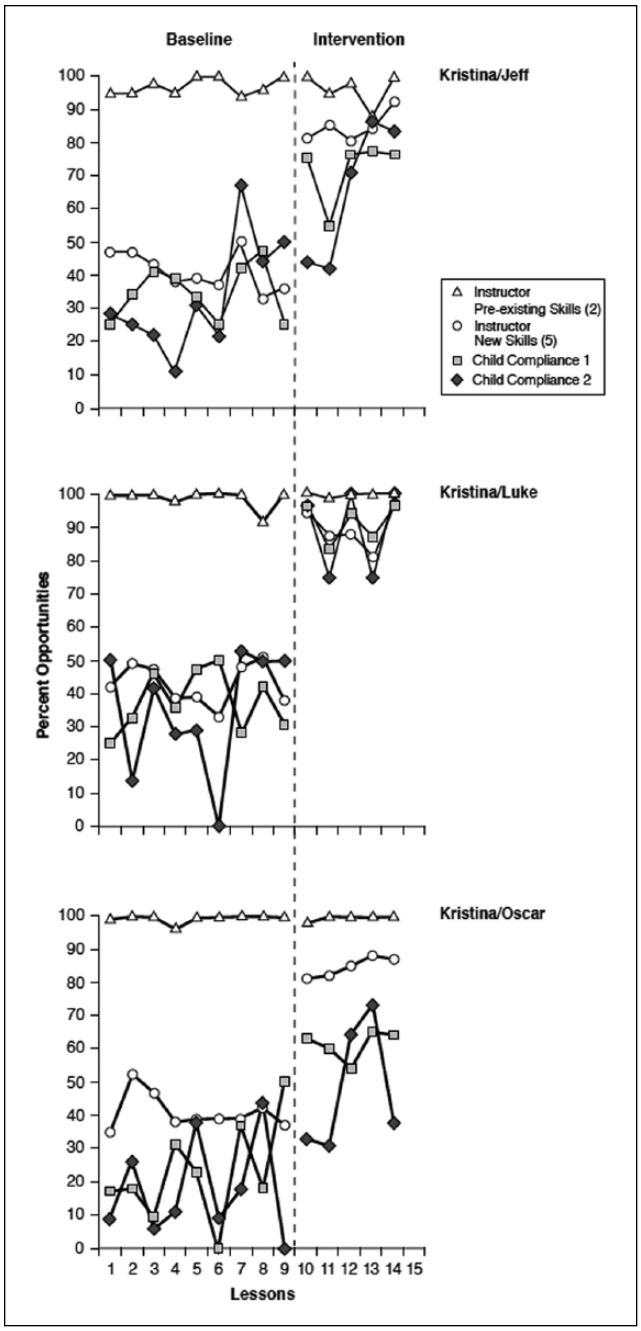

Figure 2. Instructor skill acquisition and child compliance results for one instructor and the three children in her group (instructor name/child name).

following the introduction of an intervention across at least three participants at three different points in time (Horner et al., 2005; Kratochwill et al., 2010). In this study, baseline lengths of 4 to 5 sessions and 9 to 10 sessions permitted two, but not three, demonstrations of such a change, which was most evident for the Sam/Chris (Figure 1), Alison/Sara (Figure 1), and Kristina/Luke (Figure 2) dyads. In addition, due to the nature of the data that were collected, it is not possible to know which of the key instructor skills was most important for affecting behavior change across the participating children.

Although all the children's swimming skills showed improvement between baseline and intervention, these skills were not measured on a scale that permitted an evaluation of changes in level, trend, and variability in baseline and treatment phases. In addition, the nature of the relationship between increased child compliance and improved swimming skills is unclear. It appeared that as instructors' skills increased, both child compliance and swimming skills improved. However, it is also possible compliance was primarily affected by the children's improving skills competence rather than by improvements in instructor abilities. In addition, it is possible that the introduction of new swimming skills to some children during the intervention phase had a positive effect on compliance, although this is unlikely given that all the new skills were more difficult than those assessed in baseline. Additional research is needed to determine the precise nature of the relationships between instructor skills, child compliance, and swimming skills acquisition.

No data were collected to assess the fidelity of implementation during the training phase, further limiting the conclusions that can be drawn. In addition, the swimming instructors were aware at all times that their behavior was being observed closely (i.e., all lessons in the study were videotaped) and that the data would be used in a research study. Thus, it is possible that they behaved differently because they knew they were being filmed. Finally, it is important to acknowledge that the changes in both child and instructor behaviors that were observed during this study were short-term in nature. It is not possible to know whether the instructors' use of key skills was sustained, whether improvements in child compliance were lasting, or whether child skill acquisition continued on its intervention trajectory after the study was completed.

Future Research

Additional research with a stronger experimental design is needed to establish a functional relationship between changes in instructors' skills and both child compliance and child skill acquisition as a result of the training package used in this study. Concurrently, child skills should be measured more precisely, in ways that allow examination of changes in level, trend, and variability before and after instructor training.

Although there was some variability across instructors and children in this study, research is needed with a wider range of both instructors and children (e.g., those who are intermediate or advanced swimmers). In addition, although the children had a wide range of communication abilities

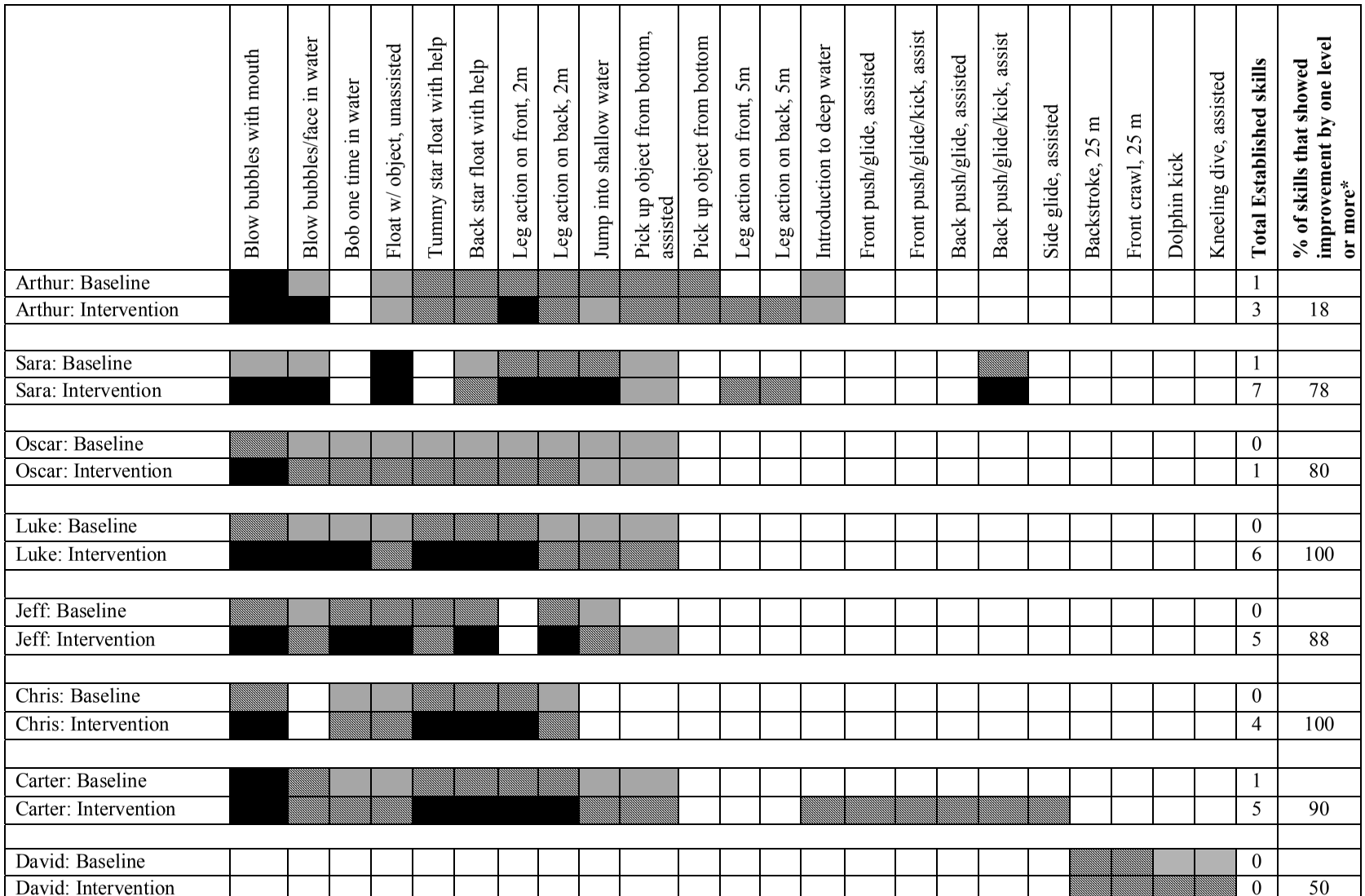

Figure 3. Swimming skills rated as incorrect, emerging, and established for eight children during baseline and intervention.

Table 3. Mean Scores for the Social/Ecological Validity Surveys.

Statement	Instructors	Parents
Workshop included useful information about ASD and how to teach swimming to children with ASD.	5	N/A
Workshop had a good mix of different ways of learning (e.g., lecture, video, role-plays).	4.2	N/A
Workshop information made it easy for me to apply the strategies to swimming lessons.	4.8	N/A
In-pool coaching helped me to learn the skills I was taught during the workshop.	4.4	N/A
Skills practiced during in-pool coaching are important for instructors who teach children with ASD.	4.9	N/A
In-pool coaching was supportive and positive for me.	5	N/A
In-pool coaching was sufficient for me to be confident using the skills presented during the workshop.	4.6	N/A
I was able to continue to use the skills I learned without the support of the researcher/coach.	4.8	N/A
I felt overwhelmed by the number of strategies, even by the *end* of the intervention phase.	1.2	N/A
Skills I was taught are critical for instructors who teach swimming to children with ASD.	5	N/A
The time spent at the workshop and receiving in-pool coaching was worthwhile.	5	N/A
The children in our swimming program will benefit from what I learned during this training experience.	5	N/A
I had enough time to learn the skills before I was asked to do them on my own.	4.7	N/A
I am more prepared to teach children with ASD than instructors who have not received the training.	5	N/A
My child enjoyed swimming lessons and was happy/excited to come to the pool for them.	N/A	4.8
The instructor made the lessons fun and interesting for my child.	N/A	4.8
The instructor was able to get my child's attention and keep him or her involved during the lesson.	N/A	5
The instructor used visual schedules that were helpful to my child.	N/A	4.8
The instructor used prompting that was helpful for my child.	N/A	4.8
The instructor provided lots of encouragement and praise to my child.	N/A	5
My child learned new swimming skills.	N/A	5
Watching my child participate has encouraged me to take my child swimming/enroll him or her in other recreation activities.	N/A	4.9

Note. ASD = Autism Spectrum Disorder.

and behavioral characteristics, future research should explore the effectiveness of this intervention with a more diverse range of children, including those who engage in severe problem behaviors (e.g., tantrums, aggression toward others). Research is also needed to explore the impact of the training on instructors who teach both segregated (i.e., children with ASD only) and integrated (i.e., children with and without ASD) group lessons, and to answer several questions regarding the training package itself. For example, it would be interesting to conduct a component analysis, to determine which of the key instructor skills had the strongest impact on child compliance and skill development.

Future research could also explore the effectiveness of a "train the trainer" model as a method for distributing information across a number of different recreation centers. In such a model, a trainer could provide training to one staff member at each of several community centers, who would then in turn provide training to a group of swimming instructors within each facility. Finally, research is needed to explore the impact of a similar training package with community instructors who teach other types of activities, such as ice skating and gymnastics. Such research will add to existing literature examining the effectiveness of training approaches designed to enhance community participation in individuals with ASD and other developmental disabilities.

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Authors' Note

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