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Using Auditory Feedback to Improve Dance Movements of Children with Disabilities

by

Takema J. James

A thesis submitted in partial fulfillment of the requirements for the degree of Master of Arts in Applied Behavior Analysis
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Dedication

This manuscript is dedicated to the wonderful South Florida dance company for their love and support of my research throughout the entire process. Thank you to the parents for believing in this study and for your encouragement, questions, and feedback. Thank you to the director for graciously welcoming me into the fold and agreeing to participate in the research. A special thank you to the dance instructor for her tireless dedication to working with me, learning a new process, and asking questions to ensure the study was a success. You did amazing work with the dancers and I am forever grateful to you. Thank you to the secondary instructor for her assistance during the study and making yourself available when we needed it the most. Lastly, thank you to my little dancers without whom this project would be non-existent. Thank you for hanging out and learning new steps and being open to learn in new ways! Continue to shine bright, move to the music, and express yourself with all of your being.
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Table of Contents

List of Figures ................................................................................................................................. ii

Abstract .......................................................................................................................................... iii

Chapter 1: Introduction ....................................................................................................................1

Chapter 2: Method ...........................................................................................................................6
  Participants and Setting........................................................................................................6
  Materials ......................................................................................................................................7
  Target Behaviors ..................................................................................................................8
  Data Collection ....................................................................................................................8
  Interobserver agreement...........................................................................................9
  Social validity ..........................................................................................................9
  Treatment fidelity .....................................................................................................10
  Design and Procedure ........................................................................................................10
  Instructor training ...................................................................................................10
  Baseline ..................................................................................................................11
  Auditory feedback ..................................................................................................11
  Baseline (without the instructor) ...........................................................................13
  Auditory feedback ..................................................................................................13

Chapter 3: Results ..........................................................................................................................14
  Percentage Correct on Task Analysis ................................................................................14
  Social Validity Results.......................................................................................................15

Chapter 4: Discussion and Limitations ..........................................................................................18

References ......................................................................................................................................22

Appendices .....................................................................................................................................28
  Appendix A: Task Analyses for Target Behaviors ............................................................29
  Appendix B: Research Assistant Inclusion and Training Checklist ..................................32
  Appendix C: Instructor Training Checklist.........................................................................33
  Appendix D: Treatment Fidelity Checklist............................................................................34
  Appendix E: Auditory Feedback Student Post-Study Survey ...........................................35
  Appendix F: Auditory Feedback Instructor Post-Study Survey ..........................................36
  Appendix G: Auditory Feedback Parent Post-Study Survey ..............................................37
  Appendix H: IRB Approval Letter .................................................................
List of Figures

Figure 1: Multiple baseline across participants design with an embedded ABAB design of percentage of correct steps..........................................................17
Abstract

Research incorporating behavior analysis to improve sports performance has shown that various feedback types (e.g., video feedback, public posting) can increase skills. Recently, auditory feedback has been shown to be effective. The purpose of this study was to evaluate the utility of auditory feedback to improve dance movements of children with disabilities using an ABAB design embedded in a multiple baseline across participants design. The target behaviors were fundamental dance skills, individualized to each student, and scored using a task analysis to calculate the percentage of correct steps. The results showed that auditory feedback was valuable in increasing the specific dance skill for each student. Although the skills decreased during the second baseline phase, the skills increased to their respective levels following treatment withdrawal.
Chapter 1:
Introduction

Physical activity is defined as any movement produced by the contraction of muscles that increases energy and motor skills (Centers for Disease Control and Prevention [CDC], 2014). The recommended amount of physical activity is 30 min to 2 hr per day for children and adults with and without disabilities (American Heart Association, 2014; CDC, 2014). Unfortunately, millions of individuals living with a disability do not have adequate opportunities to engage in the recommended amount of daily physical activity which may lead to poor health and decreased motor functioning (Luiselli et al., 2013; Rimmer, Riley, Wang, Rauworth, & Jurkowski, 2004). Research shows that constructive activities and sports, such as dancing, can improve overall fitness and increase social skills (Murphy & Carbone, 2008; Yilmaz, Yanardag, Birkan, & Bumin, 2004).

Dance is a transformative expression of movement that can be experienced by individuals of all ages and abilities (Arizona Dance Coalition, 2013). Nationwide there are many programs, such as the “Let’s Move” campaign, launched by First Lady Michelle Obama, that are aimed to increase physical activity for young children and adolescents (Let’s Move, n.d.). It is important that individuals with disabilities are provided recreational, sports, or exercise-related opportunities to increase social integration with non-disabled individuals. This can enhance independence, fitness, and quality of life (Disabled Sports USA, n.d.; O’Conner & Cuvo, 1989). However, the number of programs designed for individuals with special needs is not as extensive.
as the number available to individuals without disabilities (Law et al., 2006). Because traditional
dance teachers have minimal experience working with individuals with disabilities, several
organizations such as the American DanceWheels Foundation are designed to enrich the dance
education of individuals regardless of ability, mobility, or impairment (American DanceWheels,
2013; Roswal, Sherrill, & Roswal, 1988; Whatley, 2007).

As an art form, dance encourages individuals of all abilities to express themselves
through various rhythmic patterns, music, and spirituality (Harvard Magazine, 2011).
Furthermore, dance is increasing in popularity both recreationally and competitively, and
individuals with disabilities may compete at all levels, including elite sport competitions such as
the International Paralympic Committee (IPC) and Special Olympics (Moser, 2014; Murphy &
Carbone, 2008). Dancers have to exhibit the same level of endurance, skill complexity,
performance, and precision as other athletes (Russell, 2013). There is a disparity, however, in
the availability of dance program development and professional training for individuals with and
without disabilities. Some studios offer integrated dance classes but few offer specialized
programs designed for dancers with disabilities as lengthier instruction time is often required to
learn dance skills, which can be costly for a studio. Dancers with disabilities need access to
studios and trainings that use positive teaching strategies, modified and advanced programming
to increase their technical competency, and present recreational opportunities and potential

Literature in behavior analysis supports the use of positive reinforcement strategies to
improve sports performance for individuals without disabilities (e.g., Smith & Ward, 2006).
However, there is a paucity of sports-related research (including dance) evaluating procedures to
increase skills of individuals with disabilities (Luiselli et al., 2013).
In the last 30 years, behavior analysis researchers have used a combination of feedback modes to increase athletic skills (Martin, Thompson, & Regehr, 2004). Early studies evaluated the effects of feedback on athletic performance (e.g., among football players and dancers) and incorporated several behavioral procedures (e.g., instructions, shaping) to increase complex skills. The results showed an increase in skill execution with some generalization to in-game performances (Allison & Ayllon, 1980; Januário, Rosado, & Mesquita, 2013; Kladopoulos & McComas, 2001; Rush & Ayllon, 1984). Other studies have demonstrated the effectiveness of video feedback (with and without video modeling) to increase skill performance in swimming (Hazen, Johnstone, Martin, & Srikameswaran, 1990), martial arts (BenitezSantiago & Miltenberger, 2011), inline skating (Anderson & Kirkpatrick, 2002), and gymnastics (Boyer, Miltenberger, Batsche, & Fogel, 2009).

To increase reinforcer immediacy, other studies have provided feedback using auditory stimuli (e.g., Scott, Scott, & Goldwater, 1997). Early discussions of the value of auditory feedback to improve behavior began with *How to Teach Animals* by B. F. Skinner. The time between the execution of the target behavior and the delivery of the reinforcer must be short for reinforcement to be most effective. Once the desired behavior occurs, the reinforcer must be delivered immediately or the reinforcement effect will be lost. Since the pioneering observations of Skinner, several studies have evaluated the utility of auditory reinforcement to increase athletic skill performance (e.g., Hume & Crossman, 1992). The literature shows that a number of feedback types can be used to increase skills but not all forms of feedback provide the immediacy or precision required to reinforce the response most effectively (Kluger & DeNisi, 1996; Skinner, 1951).
The use of auditory feedback (AF) with a device such as a clicker is a behavioral technology developed to increase precision and fluency in a particular skill. TAGteach (Teaching with Acoustical Guidance) is a procedure incorporating AF to reinforce athletic performance (e.g., Quinn, Miltenberger, & Fogel, 2015). A key area of TAGteach (and AF more generally) is to identify a specific learning target or tag point (e.g., “point toes”) and follow this response immediately with an auditory stimulus (clicker), thus pinpointing and reinforcing the precise moment of correct execution. The AF from the clicker provides immediate feedback to the learner and increases the probability of future, correct responding (Fogel, Weil, & Burris, 2010; Stokes, Luiselli, Reed, & Fleming, 2010; TAGteach International, 2012). With the use of AF there is minimal or no vocal feedback from the instructor, thus decreasing the likelihood of the influence of extraneous variables (e.g., tone of voice and inflection) on responding. The use of AF (including TAGteach) has been evaluated in only a handful of studies and shown to be effective in the areas of golf (Fogel et al., 2010), football (Harrison & Pyles, 2013; Stokes et al., 2010), pole vaulting (Scott et al., 1997), target shooting, (Mononen, 2007), and dance (Quinn et al., 2015).

Quinn et al. (2015) evaluated AF (TAGteach) to increase correct performance of three competitive dance movements (turn, kick, and leap) by four young dancers. The results showed that AF increased the performances of all dance moves for all participants (with the addition of token reinforcement for one participant). In other research using AF, Stokes et al. (2010) and Harrison and Pyles (2013) increased correct performance of pass blocking and tackling skills with high school football players, Fogel et al. (2010) increased correct performance of three different golf strokes with a novice golfer, and Scott et al. (1997) increased correct form for a pole vaulter which allowed him to reach increasingly greater heights in his vaults. Although
some studies have evaluated behavioral procedures for increasing athletic performance of
individuals with disabilities including swimming (Dowrick & Dove, 1980), soccer (Luyben,
Funk, Morgan, Clark, & Delulio, 1986), bowling (Jiabei, Bridget, Shihui, & John, 2004), golf
(Tekin et al., 2001), leisure dance (Lagomarcino, Reid, Ivancic, & Faw, 1984), and basketball
(Hindawi, 2013; Lo, Burk, & Anderson, 2014), no research has evaluated AF for individuals
with disabilities or with disabilities and dance.

Due to a small number of studies evaluating the effectiveness of AF (including
TAGteach) for increasing performance for athletes and the absence of research on AF for sports
performance by individuals with disabilities, the purpose of this study was to evaluate AF for
enhancing athletic performance of individuals with disabilities. In particular, this study
examined the use of AF to improve the dance skills of children with varying disabilities. This
study also extended the AF and sports performance literature by targeting children with
disabilities, examining the treatment fidelity of the instructor, and withdrawal and reintroduction
of treatment.
Chapter 2:

Method

Participants and Setting

Participants included one dance instructor and three students of dance. Recruitment for the study was conducted in the studio through discussions with parents and the principal investigator (PI). The PI arranged meetings during dance class with parents who were interested in the study to answer research-related questions and collected consent and assent forms.

To qualify for the study, students had to have a physical or intellectual disability and dance experience in the specific studio selected for the study. Additional participant criteria included a signed parental consent form and assent form, availability for weekly 10-min sessions, and reliable transportation for up to 6 months. Exclusion criteria included students with severe problem behavior that interfered with instructor instruction and typically developing children.

Participants selected for the study included three young students of varying abilities from the selected studio with 2-3 years of experience each. Alexis was a 10-year-old female wheelchair dancer, diagnosed with cerebral palsy with no additional intellectual disability. Cindy was a 12 year old female dancer diagnosed with autism spectrum disorder (ASD) with no physical disability. Jasmine was a 9 year old female wheelchair dancer, diagnosed with spina bifida with no additional intellectual disability. The students were chosen collaboratively by the
PI and the instructor based on their underperformance relative to the expectations of the instructor which was demonstrated by their low baseline scores.

The instructor was a female in her late twenties with 3 years of performance experience with dancers with disabilities and a minor in applied behavior analysis. She was one of the lead teachers at the studio where the study was conducted, had one year of dance teaching (including teaching dancers with disabilities) experience and teaching the students in this study. Instructor inclusion criteria included 1 year of teaching experience, commitment to a 4-hr pre-intervention training of the auditory feedback (AF) intervention, availability for weekly 10-min sessions, and attendance of weekly post-session meetings (5 to 10 min) for up to 6 months. The instructor received $150 onto a Visa gift card at the conclusion of the study.

The research study was conducted at a South Florida dance studio focused on promoting dance education classes to students of mixed abilities and experience. The company conducted weekly, Saturday classes for children with developmental (e.g., autism) and physical disabilities (e.g., spina bifida) ages 5-14. Both baseline and treatment were conducted in an air conditioned studio with one room. The studio contained white walls, a large wooden floor and a counter that was 4 ft from one wall. The studio also contained a mirror that extended two walls and a metal barre (non-adjustable and wall mounted handrail used for various exercises) that extended across one mirrored wall. The wall opposite the barre had two windows with cushioned metal chairs.

**Materials**

Materials included a small, hand-held clicker and a Nokia Lumia smart phone to record assessments across all phases in the study. A Toshiba Satellite laptop was used to display information and videos during instructor and research assistant training.
**Target Behaviors**

Target behaviors were chosen by the instructor following student selection. The target behaviors were selected based on fundamental movements the students practiced in class but had not mastered (below 50%) or movements not yet introduced but deemed socially valid to the instructor. The target behaviors were modified to each student based on her physical ability and dance performance level. Once the skills were selected, the instructor and the PI task analyzed the target behavior into small, discrete steps to ensure they were observable and measurable.

Target behaviors included a port de bras, a pas de bourrée, and a traveling port de bras. The pas de bourrée and the port de bras are fundamental dance movements that novice dancers learn in their early dance training (Gillan, 2007). Alexis performed the port de bras, a flowing movement of the arms in various positions, which consisted of a 22 step task analysis. A pas de bourrée, a movement of body weight from side to side with foot movements, was chosen for Cindy and consisted of 19 steps. Due to the lack of standardized wheelchair dance terminology, the PI and the instructor developed the ‘traveling port de bras’ as the movement for Jasmine, defined as the movement of the wheelchair that included a pushing forward motion, a port de bras, and turns and consisted of 24 steps. Task analyses (see appendix A) were prepared to include the list of 19-24 steps that explicitly described the steps to be performed in the dance movement. The data were collected via video recordings and scored by research assistants (RAs). Up to four attempts of each target behavior were recorded per session.

**Data Collection**

To review and score videos, two research assistants (RAs) were recruited via email and selected following a subsequent interview and training from the PI. The email consisted of the title, purpose of the study, and a synopsis of the RA requirements. The RAs were full-time
students, committed to in-person meetings twice per month, completed a 2-hr training on video scoring using behavioral skills training, and completed a training checklist form (see appendix B) (Quinn et al., 2015). During training, an overview of the study and instructions on video scoring was provided. The RAs observed dance videos and used a task analysis to score the percentage of correct steps. The videos included a dancer unrelated to the study performing unrelated target behaviors. To be considered fluent at video scoring, the RAs performed above a 90% criterion level (minimum three opportunities) agreement with the PI. The RAs were given opportunities to ask questions at the conclusion of training and throughout the study.

**Interobserver agreement.** Assessment of interobserver agreement (IOA) was conducted in 59% of baseline and intervention sessions by having the RAs observe the videos and record the correct and incorrect behaviors performed based on the task analysis. To calculate the IOA percentage for the task analysis, the number of agreements was divided by the number of agreements plus disagreements. When a step in the task analysis was scored as an occurrence or nonoccurrence by both observers, it was marked as an agreement. If a step in the task analysis was scored as an occurrence or nonoccurrence by the PI and an RA scored the opposite, it was marked as a disagreement. The IOA average across all phases and participants was above 95% (95-98%) with the overall study IOA score at 97%. The individual IOA ranged from 89-100% for Alexis, 90-100% for Cindy, and 89-100% for Jasmine.

**Social validity.** To assess the students’, instructor, and parents’ opinions of the intervention a survey using a 5-point Likert scale (see appendices E, F, G) was completed at the conclusion of the study. The surveys were adapted from Quinn et al. (2015) and assessed the likeability and perceived effectiveness of the intervention. For the instructor and the parents, the 13 survey questions included the perceived difficulty of the intervention for the student, the
likelihood of future use, and the recommendation potential for the intervention. The survey also presented an opportunity for the students, instructors, and parents to provide feedback to the researcher including areas to be enhanced in the study. The survey for the students included 11 questions and a smiley face system as responses to the questions. The PI read the survey to the students using child-friendly language and subsequently scored each survey.

**Treatment fidelity.** To assess the accuracy of instructor implementation, treatment fidelity was assessed using a fidelity checklist (see appendix D) designed by the PI. The steps used during the procedure included the use of the clicker as feedback following correct steps performed. Treatment fidelity was assessed by the PI using the number of correct steps in the task analysis divided by the number of task analysis steps. Treatment fidelity was assessed for the instructor during the AF phase of the study. The overall score for the instructor was 94% with a range of 72-100%.

**Design and Procedure**

Intervention was evaluated for one target behavior for each student using a nonconcurrent multiple baseline across participants with an embedded ABAB design. Data collection occurred for 6 months (mid December 2014- June 2015) on Saturdays during and after the scheduled dance class. Baseline and intervention sessions were conducted in the studio and lasted from 5 to 15 min. Across the baseline and intervention phases, all students attended their regularly scheduled dance class taught by the instructor in this study and received instructions and modeling on dance movements unrelated to their specific target behaviors.

**Instructor training.** Prior to baseline data collection, the instructor was trained to implement the AF intervention, and two booster sessions were conducted when treatment fidelity data were not 90% or better. Pre-intervention training included an overview of AF, introduction
of the clicker, and specific training to use AF for this study. Training to use AF was conducted using behavior skills training (instructions, modeling, rehearsal, and feedback).

Training continued until the instructor achieved minimum 90% mastery of treatment implementation (minimum three opportunities). Training concluded with opportunities for the instructor to ask questions and completion of a training checklist form (see appendix C) (Quinn et al, 2015).

**Baseline.** The baseline assessments for all participants occurred while the regular dance class was being conducted. During the baseline phase, the dance instructor asked each individual student, at separate times, to relocate to the opposite, empty side of the studio. The instructor asked the student to perform a particular dance movement (e.g., pas de bourrée) and if the student asked for clarification, the instructor stated “do whatever you think it is” with no assistance or specific feedback provided. Once the student engaged in the behavior four times, the instructor stated “thank you” in a neutral tone and voice. The clicker was not used during this phase of the study.

**Auditory feedback.** The AF intervention incorporated components of the TAGteach method. Key elements used in TAGteach include a clicker, the step to be completed (aka, tag point), and providing AF (TAGteach International, 2012). The steps are stated to the learner in a sequential manner as she progresses through the task analysis (TAGteach International, 2012). The AF procedures in this study were adapted from the Quinn et al. (2015) study.

The initial training session included a brief overview of the study and an introduction of the clicker. The overview began with the instructor stating “Today you will be learning about dance using AF.” The instructor then presented the clicker and stated “This is a clicker. The clicker makes a clicking sound (instructor presses clicker). Today I will give you instructions to
do a dance step. If you do the step correctly, you will hear the clicking sound (instructor presses clicker). If you do not hear the clicking sound, then you need to try the step again. If you are having trouble with the step after a few tries, then we need to practice the steps again.” The instructor provided the student an opportunity to manipulate the clicker and restated the rules: if the step is performed correctly, you will hear the clicker (instructor pressed clicker); if you do not hear the clicker, then you need to do the step again. The instructor stated to the student “Do you feel okay with the clicker or any questions about what we are going to do?” The instructor answered all of the student’s questions and if she was ready to proceed stated “Okay, let’s start. Today we are learning about the (target behavior). The instructions are…The step is…”

All subsequent sessions (following the initial session), began with the PI and instructor identifying the steps that needed to be worked on for the specific student. The instructor stated, “Today we are going to practice the (specific target behavior). Are you ready to practice the steps?” The instructor always started with the first step in the task analysis for each student. The instructor then proceeded to model the target behavior to the student. The student then executed the behavior and received a click if correct. If after the third attempt the student did not execute the skill correctly, the instructor discussed the instructions and the step with the student, split the step into a smaller unit (e.g., if the step is to bring up left foot and point, the step would be reduced to bringing up the left foot) to increase the probability of performance success, and practiced until the student was successful. The instructor then discussed the new step, modeled it, and asked the student to perform the new step. If the step was performed incorrectly, the previous steps were repeated (discuss step, model, perform behavior, and receive AF). If the step was performed correctly, the instructor pressed the clicker. After the student performed three correct demonstrations of the step, the instructor asked the student if she was prepared to
transition to the next step. If the student said she was prepared, she performed the new step until
the session time was complete. The dance session ended with the student completing a step
successfully and the instructor stating “thank you so much for working so hard.”

Following each AF training session, assessments of each target behavior were recorded
by the PI for each student. The instructor asked the student to perform up to four attempts of the
target behavior without the clicker. Trainings and assessments for Cindy and Jasmine occurred
during their dance class on the opposite side of where class was taking place, while Alexis’
training and assessments occurred in the studio after dance class ended.

**Baseline (without the instructor).** Following the treatment phase, baseline probes were
conducted where the student performed the dance movement without the clicker, training, or the
instructor present. Like the initial baseline phase, the assessments were conducted during dance
class and the student was pulled to the opposite side of the studio by the PI. The PI asked each
student to perform her specific target behavior, recorded up to four attempts of each behavior,
and stated “thank you” at the end of the assessments. The data were scored by the RAs using the
task analyses.

**Auditory feedback.** This phase was conducted in an identical manner to the first
auditory feedback phase.
Chapter 3:

Results

Percentage Correct on Task Analysis

The results for Alexis are shown in Figure 1. The results show that during baseline the percentage of correct steps was a mean of 7%. In the first AF phase, the target behavior increased to 76% during the final five assessments. During the second baseline phase, the data dropped to 45%. Treatment was then reintroduced and the percentage correct increased to 69% during the last five assessments.

The results for Cindy are shown in Figure 1. The results show that during baseline the percentage of correct steps was a mean of 6%. In the first AF phase, the target behavior increased to 45% during the final five assessments. During the second baseline phase, the data dropped to 29%. Treatment was then reintroduced and the percentage correct increased to 60% during the last five assessments.

The results for Jasmine are shown in Figure 1. The results show that during baseline the percentage of correct steps was a mean of 12%. In the first AF phase, the target behavior increased to 40% during the final five assessments. During the second baseline phase, the data dropped to 29%. Treatment was then reintroduced and the percentage correct increased to 63% during the last five assessments.
Social Validity Results

All participants rated the study favorably with a variety of responses. Alexis stated she felt good about doing the dance steps with the clicker, did not think it was boring, and would like the instructor to continue using the clicker. Cindy often asked the PI how her homework (the study) was going and if the PI was “getting a good grade.” The PI thanked her for her interest/concern and Cindy stated “I just want to help you get a good grade.” She stated there is nothing she would change about the study and enjoyed being a part of it. Jasmine noted that her turning skills have improved and would often laugh at her errors during training/assessment. Her feedback included not wanting to perform the movement “so many times.”

The instructor scored the overall study favorably. When the study began, the instructor stated her excitement for the intervention and its benefits for her students. The instructor noted that she has seen great improvements with all of the students and recognizes the value in the intervention and may utilize the methods or adaptations of it during her work as a dance instructor. She stated that the most challenging aspect in the study was to refrain from providing positive vocal feedback (such as saying “great job!”) during the AF intervention as her teaching style heavily includes positive verbal statements and gestures. Additional feedback she noted included ease in training to use AF and possibility of using the new steps in a routine.

The parents of the dancers in the study overall rated the intervention positively. Alexis’ father was present during the class and sessions and noted improved eye contact and longer durations of attention as changes in his daughter. Overall, he stated he was pleased with the intervention, liked the concentration on specific movements, and asked many questions including ways to incorporate AF during her home school and therapy sessions. Desire to use the
intervention outside of treatment settings indicates the value of AF and its generalization potential.

Cindy’s mother was present during the class and sessions and often spoke with the PI regarding her daughter’s progress or any information about her daughter that may have impacted her performance during training and assessments. Her mother stated her excitement for her daughter to be in the study at the beginning and throughout the study. She also stated that she would be “sad to see the study end.” Jasmine’s mother also stated her excitement for her daughter to be a part of the study and stated it was “so great to be a part of something that has never been done before and see Jasmine grow in the process of learning the dance moves.”
Figure 1. Percentage of correct steps for all participants across assessments (BL and AF).
Chapter 4:
Discussion and Limitations

The results of this study showed that auditory feedback improved the dance movements of children with disabilities. This study follows the findings of Quinn et al. (2015) and is the first study to assess the utility of auditory feedback to improve dance for individuals with disabilities. One interesting finding is that when auditory feedback was withdrawn in the middle of the intervention, the dancers’ performance decreased. However, when AF was re-introduced, the performance increased to match and exceed the levels achieved before intervention was withdrawn.

During the study, the researcher had conversations with the parents in which they spoke highly about their daughter’s participation in the study. Throughout the study the researcher observed the instructor implementing the treatment with fidelity. Furthermore, through conversations with the instructor, the researcher found that the instructor viewed the intervention as very useful. An asset to the study included the willingness and ease with which the director and the parents accepted the premise of the study and were excited about the possible results of the intervention. The instructor proved to be an invaluable asset to the study due to her knowledge of applied behavior analysis. She understood any changes or modifications to the presentation of the study or variations in the schedule and the treatment decisions.

One limitation in this study was the decrease in performance when the students were asked to perform the skills during the intervention withdrawal. These data suggest that the skills
failed to maintain and generalize from the individual training to the dance class and another individual requesting the performance of the skill without the instructor. This result could be due to the skills not being mastered when the intervention withdrawal took place in the middle of the intervention phase, or due to the stimulus control of the instructor’s presence during training but not during the return to baseline sessions when the teacher was absent. It would have been valuable to conduct another assessment at the end of the intervention phase to see if the skills maintained and generalized after a longer period of exposure to the intervention.

Another limitation in this study was the limited time that the researchers had access to the participants for assessment and intervention sessions. Due to the number of students and the variability in the presence of dance assistants, it was challenging to reserve time for the instructor to conduct the treatment during the class time without the presence of the secondary instructor conducting class with other students. Another limitation included the presence of the parents during training and assessment. This was evidenced by the parents engaging in conversation with the students or the students leaving the dance floor to engage with their parent. The presence of the parents or other people in the studio may have served as a distraction for performance which was observed during several sessions with some participants, particularly Cindy. In competitive dance studios, dancers are usually prohibited from interactions with their parents. Dance classes are usually regimented in regards to the structure of the class timeline, parental involvement, and responsibilities of the dancers. It is important to note that the class was designed to be an integrated classroom and a free-form class where children could come to dance class and express their creativity without feeling displaced.

In the studio, the dance floor doubled as a training space for the research while class was simultaneously being taught. This was shown to be a distracter for some participants as they
often looked at the class being conducted with their peers and asked “when it was time to go back to class.” In addition, the voices of the additional instructor, assistants, and dancers were distracting on a number of occasions. Another important note is that participant Alexis, who increased her performance substantially in relation to the other dancers, received AF after class finished. The environment was free of many distracters that were present for the other dancers. Her dad and sister were usually present during the sessions, however, their presence was not observed to be an enormous interruption to her attending to the instructor or treatment. Researchers may want to consider conducting treatment in a facility where there is ample space or tools to minimize distracters for the dancers (e.g., dividers) to increase attendance to the instructions, thus potentially increasing performance. Additional studies may also identify opportunities to conduct sessions with the same participant during the natural setting (dance class) and in a contrived setting and analyze changes in performance similar to the baseline probes collected in this study, with and without training and the presence of the instructor.

Although the target behaviors did not reach the maximum of 100% correct for any participant, this finding was expected. It is rare for studies on enhancing sports performance to produce responding that approaches 100% correct with children as participants (Boyer et al., 2009; Quinn et al., 2015). Similarly, the results of studies on increasing sports skills for individuals with disabilities show similar results (Hindawi, 2013; Jiabei, 2004).

The participants of the study rated the study positively and indicated a variety of opinions of the AF intervention. Alexis, during several sessions, stated that she “remembered the steps” and was going to “get them right.” On one occasion, the PI heard Jasmine and Alexis discussing the study by talking about the “moves” they were learning. When the instructor called Jasmine to start her session to receive AF, Alexis asked the PI if she could watch the session. Alexis did
state occasionally that she felt “tired” or that she couldn’t do certain movements. The comments may be due to muscular difficulties, resulting from her cerebral palsy diagnosis. Alexis’ father stated that he encourages her to stretch her muscles to reduce the likelihood of muscle fatigue. In future studies, it may be helpful to lessen the number of assessments required for dancers with cerebral palsy or any muscular related issues to increase performance quality of the assessments and reduce fatigue for the dancer. It may be valuable to conduct two training/assessment trials per dance class to program for exhaustion/muscle fatigue.

Auditory feedback is useful in increasing the dance performance of students with disabilities. It is a behavioral method that can be used in the studio for dance instructors looking to increase specialized instruction. The dancers in the study all substantially increased performance from baseline levels. This study adds to the sports performance with disabilities literature by showing that a method for providing immediate feedback was successful and that it was implemented with excellent fidelity by the teacher with little training.

Future research should evaluate the use of AF with adult dancers with varying disabilities. The study should also be conducted with younger dancers in the sole presence of the instructor and conduct generalization probes during a recital or community event to note differences in performance. Future studies should also consider incorporating aspects of other types of feedback including positive vocal praise and compare to other students not receiving praise in conjunction with the AF.
References


Appendices
Appendix A- Task Analyses for Target Behaviors

Alexis:

<table>
<thead>
<tr>
<th>Skill: Port de Bras</th>
<th>Step</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Arms down in preparation</td>
<td>Preparation</td>
</tr>
<tr>
<td>2. Head straight and facing forward</td>
<td>Head straight</td>
</tr>
<tr>
<td>3. Bring arms to first position arms with elbows bent</td>
<td>First position</td>
</tr>
<tr>
<td>4. Eyes looking up/straight ahead</td>
<td>Eyes up</td>
</tr>
<tr>
<td>5. Open right arm to second position</td>
<td>Arm to second</td>
</tr>
<tr>
<td>6. Eyes look to the right side with arms in second position</td>
<td>Look at right hand</td>
</tr>
<tr>
<td>7. Right hand moves down and then in front of the chest</td>
<td>Scoop right arm</td>
</tr>
<tr>
<td>8. Eyes follow the right hand by looking down and then looking straight ahead</td>
<td>Look down at hand</td>
</tr>
<tr>
<td>9. Bring hand from first position to above the head</td>
<td>Right arm in fifth</td>
</tr>
<tr>
<td>10. Look up at hand above the head</td>
<td>Look up at hand</td>
</tr>
<tr>
<td>11. Bring hand down to second position with elbows bent</td>
<td>Arm to second</td>
</tr>
<tr>
<td>12. Eyes and head follow hand to second position</td>
<td>Look at hand</td>
</tr>
<tr>
<td>13. Bring left arm to second position</td>
<td>Arm to second</td>
</tr>
<tr>
<td>14. Eyes looking at left hand</td>
<td>Look at left hand</td>
</tr>
<tr>
<td>15. Left hand moves down and then in front of the chest</td>
<td>Scoop left arm</td>
</tr>
<tr>
<td>16. Eyes follow the hand by looking down and then looking straight ahead</td>
<td>Look down at hand</td>
</tr>
<tr>
<td>17. Bring left hand from first position to above the head</td>
<td>Left arm in fifth</td>
</tr>
<tr>
<td>18. Look up at hand above the head</td>
<td>Look up at hand</td>
</tr>
<tr>
<td>19. Bring hand down to second position with elbows bent</td>
<td>Arm to second</td>
</tr>
<tr>
<td>20. Eyes and head follow hand to second position</td>
<td>Look at left hand</td>
</tr>
<tr>
<td>21. Head moves from left side to the front</td>
<td>Move head</td>
</tr>
<tr>
<td>22. Bring both arms down to preparation</td>
<td>Preparation</td>
</tr>
<tr>
<td>Cindy:</td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td><strong>Skill: Pas de bourréé</strong></td>
<td><strong>Step</strong></td>
</tr>
<tr>
<td>1. Arms down in preparation</td>
<td>Preparation</td>
</tr>
<tr>
<td>2. Feet in first position</td>
<td>First position</td>
</tr>
<tr>
<td>3. Eyes facing up</td>
<td>Eyes up</td>
</tr>
<tr>
<td>4. Bring arms up to first position</td>
<td>Arms in first</td>
</tr>
<tr>
<td>5. Open arms to second position</td>
<td>Arms to second</td>
</tr>
<tr>
<td>6. Step forward on right foot</td>
<td>Step on right foot</td>
</tr>
<tr>
<td>7. Bring right arm toward stomach in a downward angle with left arm out</td>
<td>Change arms</td>
</tr>
<tr>
<td>8. Bring up left foot and point</td>
<td>Point left foot</td>
</tr>
<tr>
<td>9. Step back on left foot</td>
<td>Step back</td>
</tr>
<tr>
<td>10. Right foot in second position on relevé</td>
<td>Relevé</td>
</tr>
<tr>
<td>11. Open arms in second position</td>
<td>Arms to second</td>
</tr>
<tr>
<td>12. Step forward on left foot</td>
<td>Step on left foot</td>
</tr>
<tr>
<td>13. Bring left arm towards stomach in a downward angle with right arm out</td>
<td>Change arms</td>
</tr>
<tr>
<td>14. Bring up right foot and point</td>
<td>Point right foot</td>
</tr>
<tr>
<td>15. Step back on right foot</td>
<td>Step back</td>
</tr>
<tr>
<td>16. Step into second position with left foot on relevé</td>
<td>Relevé</td>
</tr>
<tr>
<td>17. Open arms to second position</td>
<td>Arms to second</td>
</tr>
<tr>
<td>18. Slide right foot to first position</td>
<td>Slide right foot</td>
</tr>
<tr>
<td>19. Bring arms down to preparation</td>
<td>Preparation</td>
</tr>
<tr>
<td>Jasmine:</td>
<td>Skill: Traveling Port de Bras</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>1.</td>
<td>Arms down in preparation</td>
</tr>
<tr>
<td>2.</td>
<td>Eyes up and facing forward</td>
</tr>
<tr>
<td>3.</td>
<td>Shoulders down and back straight</td>
</tr>
<tr>
<td>4.</td>
<td>Turn to the left corner</td>
</tr>
<tr>
<td>5.</td>
<td>Both arms hold the top of the wheels</td>
</tr>
<tr>
<td>6.</td>
<td>Push two wheel rotations in a diagonal</td>
</tr>
<tr>
<td>7.</td>
<td>Bring right arm to shoulder level</td>
</tr>
<tr>
<td>8.</td>
<td>Use the left arm to pull and turn to the back</td>
</tr>
<tr>
<td>9.</td>
<td>Turn to the back with the right arm in fifth position</td>
</tr>
<tr>
<td>10.</td>
<td>Turn to side horizontally (180°)</td>
</tr>
<tr>
<td>11.</td>
<td>Turn to the side with the right arm in fifth position</td>
</tr>
<tr>
<td>12.</td>
<td>Turn to the front corner in a diagonal</td>
</tr>
<tr>
<td>13.</td>
<td>Turn to the front corner with right arm in first position</td>
</tr>
<tr>
<td>14.</td>
<td>Bring arms down and both hands grab the wheels</td>
</tr>
<tr>
<td>15.</td>
<td>Push back two wheel rotations in diagonal</td>
</tr>
<tr>
<td>16.</td>
<td>Bring right arm to shoulder level</td>
</tr>
<tr>
<td>17.</td>
<td>Use the left arm to pull and turn to the back</td>
</tr>
<tr>
<td>18.</td>
<td>Turn to the back with the right arm in fifth position</td>
</tr>
<tr>
<td>19.</td>
<td>Turn to side horizontally (180°)</td>
</tr>
<tr>
<td>20.</td>
<td>Turn to the side with the right arm in fifth position</td>
</tr>
<tr>
<td>21.</td>
<td>Turn to the front corner in a diagonal</td>
</tr>
<tr>
<td>22.</td>
<td>Turn to the front corner with right arm in first position</td>
</tr>
<tr>
<td>23.</td>
<td>Turn to the front with eyes forward and back straight</td>
</tr>
<tr>
<td>24.</td>
<td>Bring arms to preparation</td>
</tr>
</tbody>
</table>
Appendix B: Research Assistant Inclusion and Training Checklist

This checklist was used to ensure proper training as a Research Assistant (RA). To be an RA, videos had to be scored with 90% or above agreeability with the Principal Investigator (PI).

1. PowerPoint Presentation Training:
   YES_____ NO_____
   • Purpose of the study and overview of auditory feedback (AF) methodology.
   • Discussed RA responsibilities.

2. Task Analyses Training:
   YES_____ NO_____
   • Copies of Task Analyses were provided and reviewed with the candidates.
   • The PI displayed videos with a dancer performing unrelated target behaviors.
   • Candidates practiced scoring videos with PI (minimum 3 practice opportunities).
   • Comparison of each candidate's score to the PI’s score on the TA.
   • Feedback provided to increase scoring fidelity and answer questions about the TA.
   • Following practice trials, RA’s scored 3 independent test rounds of videos.

3. Candidate demonstrated at least a 90% on the 3 independent testing opportunities:
   YES_____ NO_____

4. Candidate was provided opportunities to ask questions regarding the study, roles, or TA:
   YES_____ NO_____

I accept responsibility as a research assistant in the study: “Using Auditory Feedback to Improve Dance Movements of Children with Disabilities.” I was trained on the Task Analyses and provided multiple opportunities to practice. I understand that training is ongoing and agree to attend future trainings to ensure proficiency in data collection. My role was explained to me by the Principal Investigator and opportunities to ask questions were provided; if any future questions, I may contact Takema via phone or email.

______________________________________________
Research Assistant Signature & Date

______________________________________________
Principal Investigator Signature & Date

Contact Info:
Takema James, BCaBA
takemajames@mail.usf.edu
340-626-6709
Appendix C: Instructor Training Checklist

This checklist was used to ensure proper training on conducting the auditory feedback (AF) procedure and develop the task analyses with the principal investigator (PI). To conduct treatment, a 90% score had to be obtained during training.

Implementing Auditory Feedback:

1. PowerPoint Presentation Training:
   YES_____ NO_____  
   • Overview of the study, the AF methodology, and instructor responsibilities.  
   • Modeling of AF procedure by the PI.  
   • Role play of AF procedure with the PI and instructor (minimum 3 practice opportunities).  
   • Performance feedback provided to the instructor following role play with the PI.

2. Instructor given opportunities to ask questions about AF implementation:  
   YES_____ NO_____  

3. Instructor demonstrated above 90% on AF implementation following training.  
   YES_____ NO_____  

Development of the Task Analyses:

4. Development of the TA with the PI:  
   YES_____ NO_____  

5. Demonstrations of instructor implementation (above 90%) using the TA:  
   YES_____ NO_____  
   • Modeling of the steps with the PI and instructor.  
   • Role play of using the TA and implementing treatment with the PI and instructor.

I accept responsibility as the Instructor in the study: “Using Auditory Feedback to Improve Dance Movements of Children with Disabilities.” I was trained to implement the procedure and given multiple opportunities to practice. I understand that training is ongoing and agree to attend future trainings to ensure proficiency in implementation. My role was explained to me by the Principal Investigator and opportunities to ask questions were provided; if any future questions, I may contact Takema via phone or email.

_______________________________________________  
Dance Instructor Signature & Date

_______________________________________________  
Principal Investigator Signature & Date

Contact Info:  
Takema James, BCaBA  
takemajames@mail.usf.edu  
340-626-6709
### Appendix D: Treatment Fidelity Checklist

<table>
<thead>
<tr>
<th>Task Analysis Steps</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Gained student’s attention -“e.g., Are you ready to practice the steps?”</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>2. Stated the instructions</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>3. Modeled the step for the student</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>4. Stated “the step is…”</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>5. Marked the behavior (clicker) (correct response)</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>6. Modeled correct behavior (incorrect response)</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>7. Student performed the skill</td>
<td>Y</td>
<td>N</td>
</tr>
<tr>
<td>• Marked the behavior (correct response)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Modeled behavior (incorrect response)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(moved to next step)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Percentage of Steps Correct:** __________

(correct/total number of steps)

**Treatment session date:** __________

**Student name:** ________________
Appendix E: Auditory Feedback Student Post-Study Survey

1. Did you think using the clicker was more fun than regular dance class?

2. Would you like to use the clicker again?

3. What did you like most about doing dance with the clicker?

4. Was there anything you did not like about using the clicker?

<table>
<thead>
<tr>
<th>I feel good about my dance skills.</th>
<th>😊</th>
<th>😐</th>
<th>😞</th>
</tr>
</thead>
<tbody>
<tr>
<td>I feel good about doing the dance steps I learned with the clicker.</td>
<td>😊</td>
<td>😐</td>
<td>😞</td>
</tr>
<tr>
<td>I feel good about doing the new steps in front of other people.</td>
<td>😊</td>
<td>😐</td>
<td>😞</td>
</tr>
<tr>
<td>I would like my instructor to keep using the clicker.</td>
<td>😊</td>
<td>😐</td>
<td>😞</td>
</tr>
<tr>
<td>I think the clicker is boring.</td>
<td>😊</td>
<td>😐</td>
<td>😞</td>
</tr>
<tr>
<td>I want to use the clicker to learn more dance moves.</td>
<td>😊</td>
<td>😐</td>
<td>😞</td>
</tr>
<tr>
<td>The clicker helped me learn new dance moves.</td>
<td>😊</td>
<td>😐</td>
<td>😞</td>
</tr>
</tbody>
</table>
Appendix F: Auditory Feedback Instructor Post-Study Survey

1. How did the auditory feedback (AF) procedure compare to your typical dance class instruction as far as difficulty and fun?

2. Would you recommend this training to another dance instructor/colleague for students?

3. What did you like most about the AF training?

4. What, if anything, did you dislike about the AF training or would change?

<table>
<thead>
<tr>
<th>Statement</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My student’s dance skills are better following the AF intervention.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teaching skills with AF will help my students learn more complex dance movements.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am comfortable creating a routine for my students using the new dance steps.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I liked using AF with my students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It was easy for me to be trained to use AF.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It was difficult for me to train my students using AF.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It was easy for me to follow the AF procedures.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am interested in using AF with future dance students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am interested in using AF during my regular dance class.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix G: Auditory Feedback Parent Post-Study Survey

1. How did the auditory feedback (AF) intervention compare to the typical dance class instruction your child receives, as far as difficulty and fun?

2. Would you recommend AF training to another dance parent for their child?

3. What did you like most about the AF training?

4. What if anything, did you dislike about the AF training or what would you change?

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Slightly Disagree</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Slightly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>My child's targeted dance skill is better following the AF intervention.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Learning new skills using AF will help my child move on to more complex dance movements.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I have noticed an improvement in my child's behavior (other than dance) following AF training.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I liked the use of AF with my child.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>It appeared easy for my child to be trained using AF.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>My child practiced the new skills learned at home.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I would like to see the instructor use AF in the class.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I am interested in using AF with my child in the future.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
November 26, 2014

Takema James
ABA-Applied Behavior Analysis
Tampa, FL  33612

RE:  Expedited Approval for Initial Review
IRB#: Pro00017993
Title: Using Immediate Auditory Feedback to Improve Dance Movements of Children with Disabilities

Study Approval Period: 11/26/2014 to 11/26/2015

Dear Ms. James:

On 11/26/2014, the Institutional Review Board (IRB) reviewed and APPROVED the above application and all documents outlined below.

Approved Item(s):
Protocol Document(s):
   Using Immediate Auditory Feedback to Improve Dance Movements of Children with Disabilities

This study involving data pertaining to children falls under 45 CFR 46.404 – Research not involving greater than minimal risk

Consent/Assent Document(s)*:
   Combined Parent Form .pdf
   Instructor Consent Form.pdf
   Participant Assent Form.pdf
   Assent Script (Child) **not stamped

*Please use only the official IRB stamped informed consent/assent document(s) found under the "Attachments" tab. Please note, these consent/assent document(s) are only valid during the approval period indicated at the top of the form(s).
It was the determination of the IRB that your study qualified for expedited review which includes activities that (1) present no more than minimal risk to human subjects, and (2) involve only procedures listed in one or more of the categories outlined below. The IRB may review research through the expedited review procedure authorized by 45CFR46.110 and 21 CFR 56.110. The research proposed in this study is categorized under the following expedited review category:

(6) Collection of data from voice, video, digital, or image recordings made for research purposes.

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

As the principal investigator of this study, it is your responsibility to conduct this study in accordance with IRB policies and procedures and as approved by the IRB. Any changes to the approved research must be submitted to the IRB for review and approval by an amendment.

We appreciate your dedication to the ethical conduct of human subject research at the University of South Florida and your continued commitment to human research protections. If you have any questions regarding this matter, please call 813-974-5638.

Sincerely,

[Signature]

Kristen Salomon, Ph.D., Vice Chairperson
USF Institutional Review Board