RESEARCH ARTICLE

An Intervention Featuring Public Posting and Graphical Feedback to Enhance the Performance of Competitive Dancers

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Abstract This study evaluated an intervention package that used public posting and feedback to enhance dance movements for adolescent dancers on a competition team. Four dancers each performing two or three dance movements (a turn, kick, and/or leap) had their scores posted on a bulletin board at their studio. Dance movements were scored as a percentage correct by using a 14- to 16-step task analysis checklist. Intervention was evaluated in a multiple baseline across behavior design. The students received graphical feedback on their performance from the previous weeks and saw the scoring sheet that reviewed the incorrect and correct aspects of their performance. This study found that this treatment package including public posting and feedback enhanced each of the dance movements for all participants.

Keywords Dance · Feedback · Public posting · Teenagers

Dance is a popular sport, especially for females, as well as a staple competitive sport in the USA. For female adolescents who participate in dance, 39 % of their moderate to vigorous physical activity (MVPA) was attributed to this activity (O'Neill, Pate, & Liese, 2011). In addition to physical health benefits, dance as a creative activity has been linked with improved mental health outcomes for its adolescent participants as well (Duberg, Hagberg, & Sunvisson, 2013). With

approximately 32,000 private studios and 3.5 million children receiving dance instruction, studios strive to provide the most effective and competitive education possible (National Dance Education in the Arts, 2016). Success in dance competitions allows a dance studio to tangibly show potential clients and participants the success of the dancers when judged by a panel and as compared to other facilities through permanent products such as trophies and certificates.

Competitive dance training however has a history of focusing on aversive training methods (e.g., Lakes, 2005; Van Rossum, 2004) such as using yelling, social humiliation, and negative feedback. Behavior analysts can assist in the training of competitive dancers or athletes in other sports by developing user-friendly interventions, which are more positive, and focus on specific feedback to improve athletic performance. Behavior-specific feedback has been shown to be imperative for student learning outcomes (e.g., Clynes & Raftery, 2008; Saraf, Bayya, Weedon, Minkoff, & Fisher, 2014).

Researchers in sports psychology recognize the importance of feedback during coaching to improve athletic performance. Feedback is delivered in a variety of ways such as verbal feedback, auditory feedback, and public posting (e.g., Luiselli, Woods, & Reed, 2011; Martin, Thompson, & Regehr, 2004). In dance, behavior-specific feedback on correct elements of performance has been shown to increase performance when delivered by a dance instructor (Quinn, Miltenberger & Fogel, 2015) or by a peer (Quinn, Miltenberger, James, & Abreu, 2015). By focusing on specific contingencies that lead to improved performance, coaches do not have to rely on a “train and hope” procedure (Ward & Carnes, 2002). Furthermore, Garcia-Dantas and Qusted (2015) found that accurate and specific feedback on a student’s dance movement delivered by instructors increases the self-efficacy of the dancers to whom it was delivered. Additionally, Krenn, Wurth, and Hergovich (2013) found that

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positive feedback after successful trials makes individuals more likely to seek a higher difficulty level in tasks.

Although feedback is necessary for effective coaching, for certain competitive sports such as dance, instructors often seek ways to motivate their students to climb to heightened levels of performance, in addition to providing the athletes feedback. “Unmotivated students” have been reported by dance teachers as one of the most stressful aspects of teaching (Robson, Book, & Wilmerding, 2002). The subject of motivating athletes during practice is a significant area of research in sports psychology (Martin et al., 2004). For competitive sports environments, interventions such as public posting have been proven to enhance motivation and therefore improve performance in sports (e.g., Brobst & Ward, 2002; Ward & Carnes, 2002). Public posting serves as a mechanism to provide feedback to an athlete about his or her performance and also creates a motivating operation to engage in the behavior.

Public posting involves posting the levels of each player’s individual performance so that all team members can see. When the athlete’s scores from the previous performance are posted, the posting may create an establishing operation that increases the value of the reinforcer (success of the movement) for the individual. Therefore, the behavior to access that reinforcer (correct implementation of the dance movement) is more likely to occur. In addition, public posting can also evoke feedback from the coach to the student, which can be positively reinforcing for the student’s performance (Ward, 2011).

Public posting has been demonstrated to be effective at reducing problem behaviors such as speeding (Ragnarsson & Bjorgvinsson, 1991; Van Houten, Nau, & Zopito, 1980), disruptive behaviors of elementary school children (Holland & McLaughlin, 1982), and absenteeism at work (Camden & Ludwig, 2013). In addition, public posting has been used to increase desirable behaviors such as teacher praise to students (Gross & Ekstrand, 1983), oral hygiene (Blount & Stokes, 1984), completion of chores such as bed making (Bacon-Prue, Blount, Hosey, & Drabman, 1980), increasing attendance and performance for employees (Hutchison, Jarman, & Bailey, 1980; Nordstrom, Lorenzi, & Hall, 2014), increasing adult exercise (Martin & Sharpe, 2009), and improving academic performance and peer interaction for students (Van Houten, Hill, & Parsons, 1975).

Depending on the type of information posted, public posting can simply serve as a procedure to enhance motivation. Therefore, posting has been studied as a packaged intervention. Brobst and Ward (2002) demonstrated its effectiveness when public posting was used in conjunction with goal setting and oral feedback. Soccer player’s performances were recorded at practice for three different targeted movements (those with the ball, during restarts, and after the player passed the ball). The players were scored as correct or incorrect in their executions and during intervention phases their percentages were posted in a location visible to the entire team. The

coaches set a goal of 90 % correct since the players at practices already rehearsed these behaviors. When the scores were posted, the players received praise only if they met the 90 % goal from the previous session of data collection. If they did not meet the goal, they were encouraged for the next session but were not provided any additional feedback for correcting their performance. All of the players improved in their performance, and some of these improvements for participants transferred over to performances during games. The authors hypothesized that the improvements were likely due to the objective feedback provided to the athletes. When athletes are given objective feedback with their posted performance, it is more likely that they can complete the necessary behaviors to improve their performance.

In a dance studio, objective feedback is beneficial because in competitions, dancers are judged and given a score based on their technique and success in implementing movements. Garcia-Dantas and Quesed (2015) identified that when students receive objective and accurate feedback instead of just a general score (such as a ranking), then they can focus future efforts on what they need to change about their performance to succeed. Objective feedback holds the dancer accountable and can empower a dancer to improve her performance. Public posting provides objective feedback on the student’s performance and makes it visible to other students.

One of the drawbacks of public posting could be the potentially aversive nature of an individual’s scores being seen by others. However, in the competitive dance environment, such as dance competitions and auditions, feedback is given directly and others see casting and rank order. Research also shows that public posting in groups, rather than on an individualized basis, can be less aversive for the individual (Austin, Olson, & Wellisley, 2001).

Despite research showing that dancers respond well to feedback and goals that are specific and measurable (e.g., Mainwaring & Krasnow, 2010), typical dance training methods do not involve objective feedback delivered consistently and on an individual basis (Walker, Nordin-Bates, & Redding, 2012), and dancers have even reported that this negatively affects their confidence. Research has demonstrated that often dance training includes elements of aversive or punishing training methods such as insulting corrections and public humiliation (Mainwaring & Krasnow, 2010) and an authoritarian teaching structure (Papaefstathiou, Rhind, & Brackenridge, 2012). Therefore, an intervention, which focuses on directing a dance instructor to positive aspects of a student’s improvement, and providing them specific individualized feedback, is warranted.

Public posting could potentially increase the frequency of praise statements provided by the instructor to a student by directing the instructor to notice when a student improves via objective data. Dance instructors report that they give much more criticism than praise in class (Klockare, Gustafsson, &

Nordin-Bates, 2011). Displaying graphs of a dance student's improvement could also facilitate positive comments from individuals in the studio other than the dance instructor. Social support for dancers has been shown to provide motivational benefits for future performance (Quested & Duda, 2009).

Public posting feedback has been provided in a variety of ways. These variations include providing a score to the individual or simply writing a “yes” or “no” if the individual met a predetermined goal with no specifics regarding how close or far away he or she was to the goal (Ward & Carnes, 2002). Feedback can also be provided through visual displays such as a graph and has been used in some public posting studies (e.g., Anderson, Crowell, Doman, & Howard, 1988; Gross & Ekstrand, 1983). Studies have shown that when adding graphical feedback to an intervention, the target behavior increased in the desired direction (Leach & Conto, 1999). Graphing participant performance has been shown to be effective when used as a treatment package in many areas from increasing weekly running distance in healthy adults (Wack, Crosland, & Miltenberger, 2014) to increasing teachers' use of incidental teaching in a preschool classroom (Casey & McWilliam, 2008).

Currently, no research has examined the influence of public posting or graphical feedback on the performance of dancers. The purpose of this study was to evaluate the effects of a treatment package comprised of weekly public posting via graphical feedback and behavior-specific feedback to enhance the accuracy of dance movements for dancers on a competition team. In this study, graphical feedback was provided to the students on their scores from their previous sessions. In addition, the researcher provided behavior-specific feedback by giving students a copy of their scoring sheets from the previous week so they could see which steps of the task analysis were scored as correct and which were scored as incorrect. Finally, a “star” was added to the public posting procedure as a reinforcement contingency for obtaining weekly goals.

Method

Participants and Setting

Participants were four girls, ages 13–16 years, who were members of a competition team at a local studio. They were all participants in an advanced “Broadway Jazz” dance class, which occurred weekly. The participants had at least 6 months of experience in dance classes at the studio but had not yet accomplished specified target behaviors above a mean 70 % criterion during baseline assessments. The percentage was calculated by dividing the number of steps on the task analysis the student correctly performed by the total number of steps and multiplying this number by 100. The students' mean scores across all baseline sessions were calculated to ensure

that they were scoring less than 70 % on average on the selected dance movements across all baseline sessions. The dance instructor recruited participants by identifying students who were interested in improving their dance movements for competition purposes.

The intervention took place at a local dance center in a rural setting. Data collection occurred in a training center adjacent to a main rehearsal room where the dance class took place. The training center was an air-conditioned 10 m × 6 m room with a black dance mat on the floor and a ballet barre stretching across one of the walls. The room also contained an observation room to its left with a window for individuals to observe. However, no other individuals were in the room during data collection for this study other than the student and the researcher or research assistant who operated the filming device.

Materials

The materials used in this study were the graphs for each participant posted on a large display board (which showed their progress from the previous sessions), task analysis scoring sheets, and an iPhone with a video camera function for video assessment purposes.

Response Measurement and Interobserver Agreement

The dependent variables were the percentage of steps performed correctly of each dance move on a 14–16-item checklist (depending on the dance move). These dependent variables were adapted from Quinn, Miltenberger, and Fogel (2015). These dependent variables were chosen because they are moves identified by the instructor to be difficult yet impressive for competition numbers and also moves that these students practiced in class. A step of the task analysis was only marked as achieved if the student performed it to the criteria listed. For example, for step number 2 “prepare arms,” a student was not marked correctly if she put her arms out to the position but the specific criteria (listed in the task analysis) were not met. The student was only scored correct for this step if the student met the criteria listed (i.e., arms were at shoulder level and the fingertips extended from the palm (pointed)). All task analyses used in this study can be referenced in [Appendix 1](#).

Data were collected by videotape so that independent observers could score the target behaviors by freeze framing, rewinding, fast forwarding, or repeatedly watching behaviors in real time if necessary. Percentages were calculated by dividing the number of steps performed correctly by the number of steps in the task analysis. Data collectors were familiar with the movements by being scorers in a previous research study, which used these same movements (Quinn, Miltenberger, &

Fogel, 2015). However, the task analyses were revised to be more descriptive with the criteria that constituted a correct movement prior to beginning data collection for this study. An agreement occurred when both observers scored a dance step as occurring correctly or not occurring correctly. Because participants were receiving their scoring sheets back, whenever a disagreement occurred, the two observers discussed the disagreement and came to a decision of whether each step would be marked as correct or incorrect for the student's score sheet. However, the original disagreement was still noted for IOA purposes.

Interobserver agreement was calculated for 100 % of all sessions during every phase of this study. IOA was calculated for 100 % of sessions because the students were receiving feedback via their scoring sheets of their target behavior each week. To deem the data as consistent between observers, it was imperative to conduct reliability checks weekly. The two independent observers were the first and third authors. The first author trained the third author on the task analyses of the dance movements via one-on-one behavioral skills training sessions prior to data collection. In addition, the third author had scored data for these same dance movements in prior studies. The mean IOA for each target behavior was as follows: 87 % for turn (range 69–100 %), 92 % for kick (range 79–100 %), and 91 % for leap (range 80–100 %).

Design and Procedure

A multiple baseline design across behaviors was used in this study and replicated across four participants. The three behaviors for each participant were a double grabbing leg around turn, back catch scorpion kick, and a switch kick side stride leap, with only two behaviors for Sandy (leap and kick). A maintenance condition was conducted for one participant (April) but was not conducted for the other participants due to time constraints.

The dance instructor was trained to implement the public posting intervention using a behavioral skills training model (instructions, role play, modeling, and feedback) by the primary researcher through one 20-min training session. In addition, the researcher was present to observe the instructor implement the intervention for the first four sessions and provided in person feedback following implementation. Although no formal treatment integrity data were collected, the researcher observed the teacher conduct the intervention with a high degree of fidelity during these four sessions.

Video recording in baseline and intervention occurred during class from 8:45 to 9:15 pm on Tuesdays. Each student was pulled out of class to review her scoring sheets from the previous week and film three attempts of each movement for data collection. The instructor conducted the public posting intervention on Mondays at 4:30 pm. For all phases of the study, the students were pulled out of class at the same time to

control for fatigue affects (i.e., Cathy pulled out at 8:30 pm, April pulled out at 8:40 pm, and so on).

No changes were made to the dance instructor's standard teaching routine, and the dance instructors at the studio were told not to rehearse these behaviors in class any more than they typically would. Because the students were pulled out of class in an adjacent room for data collection, one of the research assistants could see their dance class and confirmed each week that these movements were not targeted during class time. As the timing got closer to recital and competitions, the students were actually engaging in a much more fatiguing class, running tiring dance numbers back to back. Unfortunately, this information was only reported anecdotally. A typical class for the competition team involved (a) the dance teacher providing instructions to perform a skill and modeling the skill for the students (if necessary) in front of the mirror and (b) the students rehearsing the skill lined up as a group across the floor for quick corrective feedback from the instructor. Frequently, routines were rehearsed weekly for competition and recital during the class, and this increased throughout the season.

Baseline In each baseline session, the participant was asked to perform each of the three skills three times. Each data point depicted one attempt to perform a skill. Collecting three data points for each skill in each session remained consistent from baseline to intervention. The researcher or the teacher provided no feedback about implementation of the movements and, if the students asked questions about the movements, the researcher told the student to "try your best."

Public Posting Intervention Each week following the filming of assessments, the principal investigator plotted an average of the three scores per session to depict one data point on the graph to be publicly displayed. A text box with a percentage was displayed above the data point on the graph. A sample of this graph is provided in [Appendix 2](#). The public graphs did not show any phase lines. Only the graphs of the participants' behaviors in the intervention phase were publicly posted. No graphs or feedback were given on behaviors that were still in baseline. If the participant was absent the week before, a slip of paper saying "absent" was posted in place of the graphs from the previous week.

Gold stars were used as a potential reinforcer for improved levels of performance. Each week, the participants had an opportunity to earn a "star" if they performed at their best session average yet and/or maintained a score of 90 % or higher. Based on recommendations from Brobst and Ward (2002), we chose an individualized goal, such as their highest score yet, to ensure that the dancers still had an opportunity to earn a star even if they were physically incapable of performing at a 90 % or higher due to inadequate technique,

lack of flexibility, or other limiting factors. The criteria to earn a star were listed publically on the board.

Filming occurred on Tuesdays and the PI provided the graph with the participant's name to the dance instructor to be posted publically on Monday and told the dance instructor which students received stars. On Monday at 4:30 pm, the dance instructor conducted the public posting intervention by following the steps listed in the treatment integrity task analysis. On the first four sessions of intervention, the PI was present and provided the instructor notes and feedback. Following this, the PI assessed treatment integrity via verbal report and display of the graphs when she arrived at the studio on Tuesdays to collect assessment data. During the public posting intervention, the instructor gathered all of the students together in the lobby and directed the students to the wall where she posted the graphs. All of the students' graphs were on the same large board. However, each student had a spot on the board with her name and a space for three graphs. The dance instructor discussed the results of each student and praised students who demonstrated higher scores or high stability from the week before by saying something along the lines of: "Congratulations Cathy!" "You did wonderful on your kick last week," or "You got your best score ever! Keep it up!" A gold star was placed next to the participant's graph. The instructor also posted graphs of students who did not improve from the week before with some sort of encouraging statement such as "You can do it this week," "I have faith in you," and "Perhaps you just had an off day." No negative statements were made to students who did not score higher or as high as their sessions before. When a student engaged in negative self-talk about her scores, the teacher politely redirected her (see directions on task analysis). These sessions occurred in front of multiple dancers and parents who were in the lobby waiting for the next class. Furthermore, the graphs were intentionally placed in a central location accessible to parents and other dancers to evoke questions, praise, and feedback about the student's performance (please see "Discussion"). The participants who were having their graphs posted while other students were still in baseline conditions were asked to not share their specific feedback for their dance movements (via the scoring sheets) with other participants in the study even though the posting of the graphs occurred as a group, the individual feedback for each dancer's performance was provided only to that specific dancer.

Social Validity Measures

A social validity measure, similar to that used by Boyer et al. (2009) and Quinn, Miltenberger, and Fogel (2015), was used to assess the dance teacher and student reactions to the interventions. The participants were asked questions to assess the likeability and feasibility of the intervention and students were instructed to rate their answer on a five-point Likert scale

(Appendix 4). The instructor was asked similar questions to rate the intervention from her perspective (Appendix 5).

Results

Consistent with Boyer et al. (2009) and Quinn, Miltenberger, and Fogel (2015), the mean of the last half of baseline (last 50 % of data points) was calculated to capture any improvements that may have occurred due to dance class attendance and the mean of the last half of intervention was calculated to capture the increase that occurred over time during the intervention. Figure 1 shows the results of Cathy's performance during baseline and following the public posting intervention. Cathy's mean for turn was 44 % in baseline and 73 % when her scores were publically posted (top panel), a 66 % increase. Cathy's mean for kick was 24 % in baseline and 81 % during intervention (middle panel), a 234 % increase. Cathy's mean for leap was 58 % in baseline and 73 % during intervention

Fig. 1 The percentage of the task analysis performed correctly in baseline and intervention for turn, kick, and leap for Cathy

(bottom panel), a 26 % increase. Unfortunately, only one session of intervention data was collected for Cathy's leap due to a sports-related injury that caused her to withdraw from the study prior to the completion of data collection.

Figure 2 shows the results of April's performance during baseline, the public posting intervention, and also two sessions of maintenance. April's mean for kick was 40 % in baseline and 77 % when her scores were publically posted (top panel), a 94 % increase. April's mean for turn was 33 % in baseline and 69 % during intervention (middle panel), a 109 % increase. April's mean for leap was 44 % in baseline and 60 % during intervention (bottom panel), a 36 % increase. These scores maintained during the maintenance phase with the exception of leap for which increases were not as notable compared to turn and kick.

Figure 3 shows the results of Mimi's performance during baseline and following the public posting intervention. Mimi's mean for kick was an 11 % in baseline and 57 % when her scores were publically posted (top panel), a 418 % increase. Mimi's mean for leap was 41 % in baseline and 55 % during

Fig. 2 The percentage of the task analysis performed correctly in baseline, intervention, and maintenance for April

Fig. 3 The percentage of the task analysis performed correctly in baseline and intervention for kick, leap, and turn for Mimi

intervention (middle panel), a 34 % increase. Mimi's mean for turn was 41 % in baseline and 61 % during intervention (bottom panel), a 49 % increase.

Figure 4 shows the results of Sandy's performance during baseline and following the public posting intervention. Sandy's mean for leap was 29 % in baseline and 55 % when her scores were publically posted (top panel), a 90 % increase. Cathy's mean for kick was 36 % in baseline and 61 % during intervention (bottom panel), a 72 % increase. Limited data was available on these two behaviors due to frequent absences on behalf of Sandy.

Figure 5 shows a graph of the social validity data from the three dance instructors in the community who scored videos in random order from baseline and intervention conditions blindly and provided a score of 1–10 on the movement. Although the comparisons only show slight increases, with the exception of Cathy's turn (for which the score was the same), all

Fig. 4 The percentage of the task analysis performed correctly in baseline and intervention for leap and kick for Sandy

instructors in the community rated the intervention videos as higher than the baseline videos during blind rating assessments.

The participants' responses to the open-ended questions on the social validity survey were highly positive. All four participants stated that they thought having their scores publicly posted caused them to "try harder." Three of the four participants stated they liked having their scores posted in the studio. Some comments on this question included "Yes I did because it shows how good I am at that step" and "Yes, it allowed everyone to see you can improve in this if you work hard." All four stated that they tried harder to get a star when they did not receive a star the week before.

All four participants stated that they thought getting feedback from the score sheets helped them improve. Three of the four participants stated that they practiced the movements targeted by this intervention *outside* of their regularly scheduled dance class and assessment sessions. All four participants agreed or strongly agreed that they improved on their dance movements and would be comfortable performing them in a competition number, that they liked having their scores posted and felt proud when they received a star, and that their dance teacher was proud of them when they got a star. All four participants stated that there was nothing they disliked or would change about the training.

Fig. 5 The mean social validity video ratings of each participant's turn, kick, and leap by three dance teachers

On the social validity survey, the instructor said she thought the intervention worked well for some of the students but not all of them. She stated that she thought this procedure would be more effective for individuals around 10 and 11 years of age as they would "care much more about their scores." Some suggestions for future research she provided would be that the delay between the filming, feedback, and posting should be shorter. The week time period gap for feedback was not ideal and was selected for this study because of the dance instructor's schedule and the only consistent time students were all together in a group to go over the postings. She agreed that the

students who had their scores posted felt special, that others in the studio praised the students due to the presence of the graphs, and that she would like to use the procedure again. She also strongly agreed that she noticed improvement in her dancers that she would not have otherwise seen. This statement as well as the praise reported from others in the studio supports that this intervention could increase positive feedback from the instructor as well as other individuals in the studios (parents, other dancers), for the participants in this study who might have otherwise been receiving negative feedback due to the competitive nature of their training.

She also mentioned this type of posting via graphical feedback would be too hard for a dance instructor to implement without having training on scoring. She stated that her favorite part of the intervention was watching the “dance moms” in the studios react to the public graphs. Although the dance instructor’s reactions to the survey were not entirely positive, when watching the videos and scoring for social validity, she mentioned, “I wish I saw these videos prior to filling out the survey.” She stated that she did not realize how much all of the participants had improved until she watched the videos herself.

Discussion

The results are consistent with public posting and sports performance research (e.g., Anderson et al., 1988; Brobst & Ward, 2002) and showed that all of the participants’ performances increased once public posting with graphical feedback was initiated. Although these results are consistent with previous findings, a number of extensions of public posting are worth noting. This replication occurred in a novel environment (dance studio) on a dance competition team, collected social validity data, and used more complex or effortful target skills than previous public posting interventions. In addition, this study added a visual reinforcement contingency to the graphs for goals that were met.

In addition, a number of discussion points are worth noting in this study. The first is that, throughout this study, we noticed that many parents, teachers, and other students looked at the poster in the lobby and made comments and asked questions about it. When the dance instructor went over the scores with the participants on Mondays, many dancers and other students in the lobby circled around to watch and even clapped for participants who received a star. Many individuals also made comments that the poster was “pretty” and “eye catching.” To make sure the poster was a good fit to the dance studio environment, it was created with bright colors on a glitter poster board with large gold stars. The dance instructors and students commented that they liked this. Next to each graph was a Velcro spot on which the star could be adhered and removed each week. For public posting, we recommended placing the

poster in a “high traffic” area and making it visually appealing to match the environment in which it is posted (e.g., for a sports team, it could display the colors of the team).

One aspect that makes this study unique in public posting research is our use of the star. The star was chosen as an extra stimulus prompt to draw attention from individuals in the studio to a participant’s graph. We believe that the “star” evoked praise from individuals in the studio based on anecdotal observations and responses from the participants on their social validity survey. We also observed comments from the students such as, “Yes I got a star this week!” or “I’m trying for three stars this week,” which indicated the potentially reinforcing value of the star for the participants’ desirable performance. We chose an individualized goal for the students (i.e., best score yet) so that students of different levels were not compared to each other but only to their own individual best.

Throughout the study, we found that Mimi, who had not been dancing as long as the others, and had certain technique deficiencies which created a limitation for her scores, often made self-deprecating comments such as, “Well this is as good as it is going to get” or “I am never going to get a star.” For this reason, we suggest that public posting only be used with dancers of a similar technique level or that the goal for the participant each week is data-based for each individual rather than choosing one percentage criteria for the group. For example, Mimi’s goal could have been to maintain a 70 % or higher to receive a star (based on her lower baseline performance levels), rather than to receive a 90 % or higher. This is consistent with other recommendations in the public posting literature (Brobst & Ward, 2002). Bond and Stinson (2007) found that when students try to succeed at a dance movement that is too difficult for them, they become disengaged over time (i.e., extinction occurs).

Throughout the study, we also noticed increases in praise between the instructor and the dance students. Most of this was generated by the intervention (see treatment integrity checklist), and the teacher frequently encouraged the participants with positive comments during assessments such as, “Let’s get a star this week!” The students seemed to like the individualized attention they received from their dance instructor for their performance improvements, which likely would not have been given as frequently without the use of this intervention. This is evidenced through the participant’s responses in the social validity survey (see Likert scale questions).

We were pleased to find that the students were not embarrassed to have their scores posted and actually seemed to like it. Students made comments on the social validity surveys that they wanted others in the studio to see how well they did and one participant commented that having her scores posted even increased her confidence, as she was able to visually see her improvement each week and was proud to have this displayed. Although Brobst and Ward (2002) reported that some participants in their study stated that having their

scores publically posted “caused them distress,” we did not see this reported by any participants, even those with lower scores. This finding could be due to the context in which the research was conducted (in a competitive dance studio environment); we are not sure this would be the same across other sports teams. For example, dancers frequently receive corrective feedback in class and from auditions and competitions. This could have mitigated any feelings of embarrassment that might occur for lower scores being publically displayed. It is unknown if this would be consistent for dancers of different ages, levels, or across other sports domains.

Some limitations worth noting in this study include the lack of treatment fidelity data and the time required to score and graph data, which created a week gap between the dancers performing the movements and receiving feedback. We have provided some recommendations for future use of the intervention to potentially circumvent these issues. There were some treatment fidelity challenges throughout the study, as reported by the instructor. During the last month of data collection, dancers were preparing for a recital and the dance instructor mentioned that the dancers and instructors were exhausted. To add to this, the instructor reported on more than one occasion forgetting to put the graphs up on Monday or that she had to go over the graphs with the students quickly. Some of the students expressed how tired they were during weeks following competitions or tried to go through their sessions quickly to get back into class. Leaving class to participate in sessions nearing the end of the study seemed to be aversive for some students, as they would rush through sessions to get back class to avoid missing choreography, which could potentially result in punishment during class time. Oftentimes, students were absent, which was challenging for data collection. One participant (Cathy) injured her knee and was not able to dance for the rest of the season, which is why only one session of intervention data was collected for her leap. These are common challenges of conducting research in an applied setting with dancers on a competition team. For researchers working with this population, it would be wise to conduct research during an off-season from competition (if possible) or without pulling students out of class for assessment or intervention. Another limitation associated with how the data were collected is potential fatigue effects. Because three data points for three behaviors were collected at each session, sometimes performance dipped around the third data point. We attempted to control for fatigue effects by consistently collecting three data points at every session across phases. Furthermore, fatigue may have varied depending on the intensity of the session from which the dancer was pulled on a particular day. For example, we noted anecdotally that the class was “more intense” physically as the season went on, which may have contributed to more fatigue in later assessments. Future research could benefit from objective data on the elements of the class from which the students are being pulled.

Because two types of feedback were provided to the participants, graphical feedback via public posting and written feedback of the scoring sheets of how the scores on the graph were calculated, we cannot determine if posting the scores alone, or providing the scoring feedback alone, would have produced similar effects. This package also included elements of positive reinforcement. Future studies could evaluate public posting and graphical feedback individually and in combination. We believe that there was a combination of effects in this study but that the results were primarily due to the public posting creating an EO for increased performance through the evocative effects of the public scores and the delivery of a star. This study evaluated goal setting using a reinforcement contingency for meeting goals, public posting, and graphical feedback as a packaged intervention with the goal of maximum effects for students with minimum effort of the dance instructor. This treatment package provided a dance instructor multiple, easy-to-use behavioral procedures that produced a positive change in their dancers in a short time. It should be noted however that the inclusion of multiple procedures makes it difficult to say the observed increases were singularly due to graphical feedback and public posting.

Another limitation in this study is that there were physical technique limitations for Mimi and Sandy, in which their scores stopped improving above a certain level. For these participants, the positively reinforcing effects of the public posting intervention could not overcome the skills deficits or physical limitations that prevented performance of some steps in the task analysis. For such participants, we suggest adapting those participants’ individual goals or perhaps targeting easier behaviors for which they are more likely to achieve a higher score before moving on to such complex movements. For example, a competition team could use public posting by having a level system that requires the participant to achieve a criterion score on one movement, to move up into the next level and target a new more complex movement.

Another limitation in this study is the amount of time it took to score and graph the data each week. For four participants with two to three behaviors each, it took about 6 h per week to score and graph the data. This would likely be much too time for dance instructors to implement. Furthermore, they would need to be trained to use graphing software. Some suggestions for future use of this intervention in an applied environment would be to not have scoring which is so precise but only mark yes/no for salient aspects of the movement that the teacher could quickly observe in real time. Some examples for a turn include if the participant completed a single turn, a double turn, had her leg pulled tight into her body, and her chest and head up. Furthermore, studios could always use a front desk employee to score videos if there is any idle time at the desk during classes. It should again be mentioned that when a discrepancy of scoring occurred between data scorers, the scorers re-watched the video and discussed and came to an

agreement as to whether the step of the task analysis was correct or not. This could be considered a limitation, as there could be a potential of the student receiving inaccurate feedback on a step component, which was not initially agreed upon by scorers.

The effectiveness of the treatment package should be further established by comparing this training to typical dance instruction. Once this goal is accomplished, future research could also assess a training tool (such as a manual or software program) to teach instructors how to conduct this intervention themselves and determine the feasibility of intervention implementation.

It is unknown if there were novelty effects of this intervention which would wear off over time. Thus, we suggest collecting data for an extended period of time and suggest combining this intervention with external reinforcers if extinction effects occur with the use of instructor praise. In addition, we suggest conducting this study with a different population of dancers. It is unknown how a younger age group of dancers would react to having their scores publically posted in a studio and how it would affect their performance.

We evaluated public posting and reinforcement in a packaged intervention procedure within the context of graphical feedback and stars for achieving goals. These results will contribute to the literature on the use of behavioral training procedures with dancers (e.g., Liberatore & Luyben, 2009; Quinn, Miltenberger, James and Abreu, 2015; Quinn, Miltenberger, & Fogel, 2015) by demonstrating a useful behavioral training approach for a dance instructor to use with her students. This finding is important because public posting is a behavioral strategy that can benefit dancers in the class setting without the dance instructor needing to alter her current teaching methods. Public posting can also increase positive reinforcement from a coach to her students by directing her to record that her students are improving, where she might have otherwise not noticed. In a world of competitive sports training where coercive procedures are dominant, easy-to-use, positive behavioral procedures such as these are important not only for student success in competition, but for the enjoyment of students, and to promote continued participation in a sport, which has physical and mental health benefits.

Compliance with Ethical Standards No funding was received for this research.

Conflict of Interest There are no conflicts of interest with any authors.

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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