USING GRAPHIC AND VERBAL FEEDBACK WITH SELF-TALK AND SELF-MONITORING TO IMPROVE HIGH-SCHOOL SWIM PERFORMANCE

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The purpose of this study was to assess the effects of graphic and verbal feedback coupled with self-talk and self-monitoring procedures on freestyle swimming flip turns in an ABAC design across three swimmers. Graphic and verbal feedback produced no measurable improvement, while self-monitoring and self-talk coupled with graphic and verbal feedback reduced times by as much as .7 seconds. The results of this study suggest that self-talk and self-monitoring procedures can improve the performance of skilled swimmers. Implications and theoretical explanations are briefly explored.

INTRODUCTION

Competitive swimmers win or lose by fractions of a second. The difference between the gold medal and fifth place in the 2004 Olympic 200m woman's freestyle event was .85 seconds; the difference in the 100m freestyle for women was .7 seconds. Given the marginal differences separating skilled athletes, any fractional increase in performance is highly pragmatic.

Behavior analysis examines antecedent and consequential stimulus events to explain and predict behavior (Pierce & Cheney, 2001; Skinner, 1938). This paradigm has been shown effective in a variety of settings and with a variety of behaviors. The most salient applied applications of behavior analysis emerge from clinical and organization environments (Ahearn, 2004; Alavosius & Sulzer-Azaroff, 1986; Anderson, Crowell, Hantula & Siroky, 1988; Austin, Kessler, Riccobono & Bailey, 1996; Carr, Dozier, Patel, Adams & Martin, 2002; Gaetani, Hoxeng & Austin, 1985; Goff & Iwata, 2000; Grow & Northup, 2004; Kodak, Nikopoulous & Keenan, 2004; Komaki, Barwick & Scott, 1978; LaFleur & Hyten, 1995; LaMere, Dickinson, Henry, Henry & Poling, 1996; Piazza, Roane, Keeney, Boney, & Abt, 2002; Zhou). Though underrepresented in the literature, the application of behavior analysis to improve athletic performance has been taking place for over 30 years (Martin & Tkachuk, 2000). Researchers working in the athletic domain have increased general athletic endurance, skill performance, and accuracy across multiple sports (Hatzigeorgiadis, Theodorakis, & Zourbanos 2004; Johnson, Hrycaiko, Johnson, & Halas, 2004; Papaioannou, Ballon, Theodorakis, & Yves, 2004; Theodorakis, Weinberg, Natsis, Douma, & Kazakas, 2000; Ziegler, 1994). Applied to swimmers, behavioral interventions have decreased stroke rate, decreased off-task behavior, and increased correct swimming form (Hazen, Johnstone, Martin, & Srikameswaran, 1990; Hume, Crossman, 1992; Polaha, Keith, & Studley, 2004).

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For example, Theodorakis et al. (2000) used a self-talk intervention to increase soccer accuracy, badminton serving, abdominal endurance measures, and knee extension tasks. In all cases, participants were placed in either control, motivational self-talk, or instructional self-talk groups. Results indicated that both the motivational self-talk and instructional self-talk groups produced superior athletic performance than the control group. Researchers found instructional self-talk produced the best results for accuracy and skill performances while motivational self-talk produced the best results for power tasks.

Papaioannou et al. (2004) also used a self-talk and goal setting package with semi-professional soccer players in Greece. Athletes were instructed to kick the ball through a four foot hoop placed at each corner of the goal. Researchers found that when athletes used a self-talk and goal setting procedure their accuracy improved significantly over a control group which contained no self-talk or goal setting.

Hazen et al. (1990) worked with swimmers to increase correct form of freestyle flip turns and swimming form using a videotaped feedback package. In this study, flip turns were broken into 15 behavioral components for freestyle stroke and 6 behavioral components for backstroke. The dependant variable was the percentage of correct components in a given trial. Baseline measures consisted of traditional

coaching methods. A videotaped feedback package which included modeling and role-playing was implemented for both increasing flip turn performance and freestyle technique. Results indicate that while group video intervention was unsuccessful, individual video feedback with modeling was highly effective. However, individual feedback and modeling procedures were time consuming. As this study was conducted with young, unskilled swimmers, it also highlights the trend of using behavioral technology in sports as a teaching tool, rather than a performance enhancement tool.

No studies were found using high-school swimmers. Further, very few studies have combined the demonstrated effectiveness of graphic feedback and verbal praise with the self-talk and self-monitoring procedures. Although select components of behavior analysis have been shown effective with swimmers, the research has focused primarily on unskilled athletes and none have offered a comprehensive package intervention. This brief study attempted to produce pragmatic increases in the speed at which highly skilled swimmers performed flip turns by using a package intervention: graphical feedback with verbal praise, self-talk, and self-monitoring of performance.

METHOD

PARTICIPANTS AND SETTING

Three female swimmers (age 15-18) from a class B high-school located in the Midwestern US served as participants. All participants were part of a 38 member swimming and diving team. The team practiced at a local college pool 3-6 days per week, and raced 1-3 times per week. Because practice conditions were highly variable, only race performance was evaluated in the present study. All pools were 25 meters in length, with at least 6 individual swimming lanes. During races, only one swimmer occupied each lane at a given time. During relays, each relay member would need to touch a timing mat placed against the pool wall before the next swimmer on the relay team could enter the water. All procedures were approved by the university IRB. All pools hung backstroke flag lines above the water five meters from both pool walls. These flag lines function as discriminative stimuli for backstroke swimmers to begin a flip turn.

PROCEDURE

The Performance Diagnostic Checklist (Austin, 2000) combined with interviews of the head coach revealed that swimmers knew how to correctly perform flip turns, but the natural consequences (increased lactic acid, less oxygen, and more pain) of performing faster turns were highly aversive. The lack of salient positive consequences and feedback prompted the use of graphic and verbal feedback coupled with self-talk and self-monitoring.

The dependent variable was the duration of time between a swimmer's head crossing the backstroke flag line as she approaches the pool wall, completing a flip turn, and her head crossing the flag line swimming in the opposite direction. Measurement was conducted from an elevated (bird's eye) position, and races were videotaped to allow the calculation of inter-observer agreement (IOA). Because different swimming strokes require different flip-turns, only freestyle swimming was evaluated in the present study. A standard stopwatch was used for measurement. Observations were only conducted from one end of the pool, thus only half the swimmers' race turns were evaluated. For example, the 500m requires the athlete swim 20 pool lengths and complete 19 flip turns; however, only the 10 flip turns taken against the pool wall opposite the starting blocks were recorded for the present study. Similarly, the 50m requires the athlete swim 2 pool lengths and complete one flip turn against the far wall.

A naïve observer watched and timed videotaped race performance. IOA was calculated by dividing the number of agreements (+/- .1 second) by the number of agreements plus disagreements. IOA was assessed on 29% of the data and produced 75% agreement.

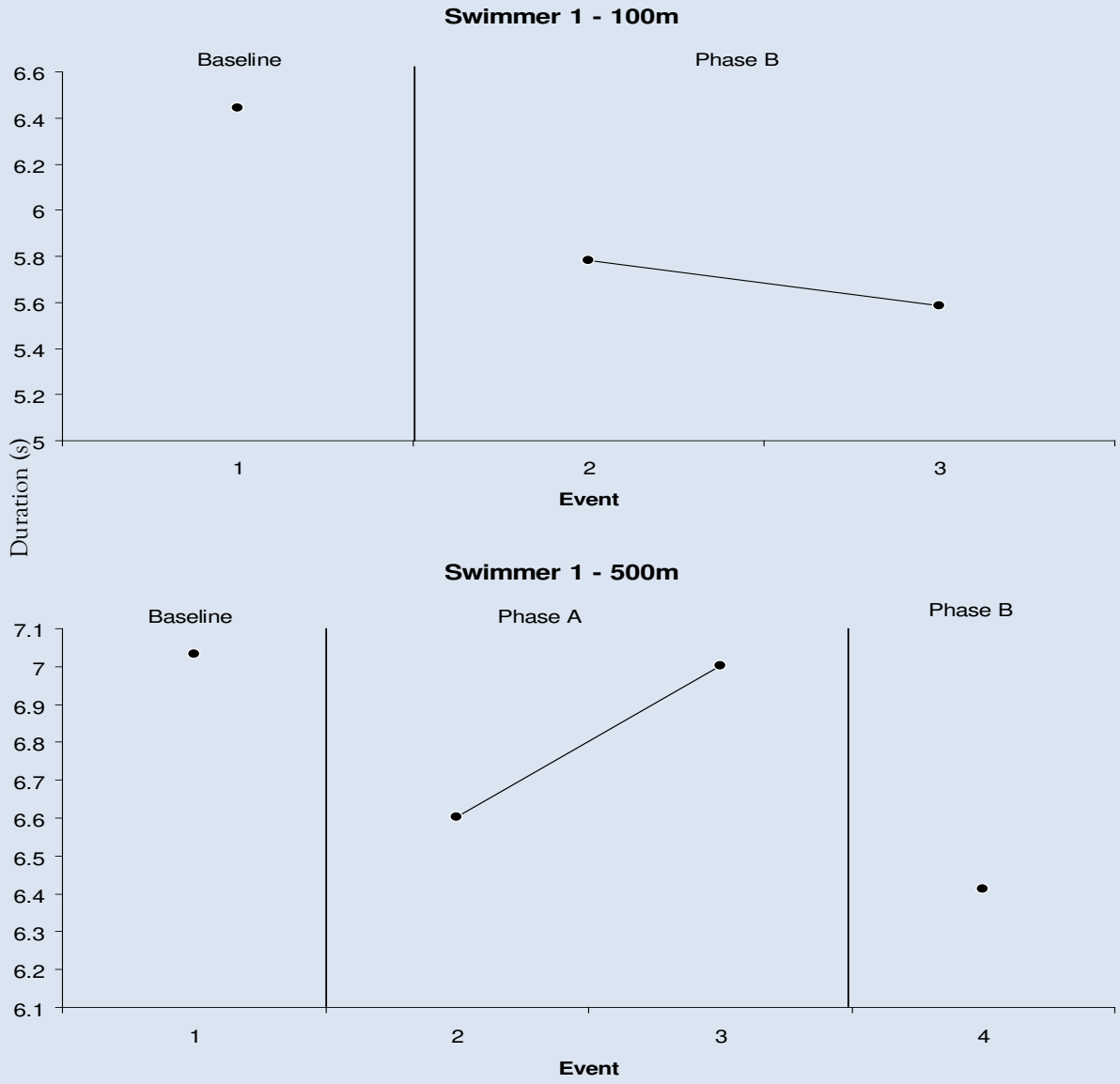
EXPERIMENTAL DESIGN

All experimental conditions were implemented across the entire team in an ABAC design. Three freestyle swimmers specializing in different race distances were targeted in this study. Experimental phase lengths were pre-determined by the experimenters. Although individual swimmers typically swam the same events across meets, the coach commonly substituted swimmers. Thus a swimmer may not have been exposed to one or more of the phases for a particular race distance because she was swimming a different event (backstroke, butterfly, etc.). For example, Swimmer 1 did not have a second

baseline for the 500m because she did not swim the event between Phase A and Phase B.

Baseline conditions consisted of the athletes' standard training and racing conditions. Phase A consisted of graphic feedback in the form of a bar graph and verbal feedback from the coach during practice. A bar graph was posted on the wall, indicating average flip turn in seconds for each swimming meet. Thus when swimmers competed on Tuesday, the graph was updated before swimmers arrived for practice on Wednesday. The coach told the swimmers that the graph represented the average of flip turn duration of a representative sample of the swimmers. The coach provided verbal feedback based on the trends on the graph and encouraged swimmers to continue to do their best. Phase A lasted for 2 meets. The graph was then removed and the swimmers returned to baseline condition for 2 meets.

Figure 1: Average flip turn time for Swimmer 1 across the 100m and 500m.



Phase B consisted of re-posting the graph, providing verbal feedback, and finally, instruction from the coach on self-talk and self-monitoring procedures. Pushing off the walls with more force and remaining streamlined after this push were selected as target behaviors. The two key words "explode" for

pushing off the walls, and "reach" for remaining streamlined were selected to be paired with these behaviors. During practice, the coach introduced these words and encouraged swimmers to use them during every flip turn. The coach continued to prompt swimmers to use the self-talk procedures during practice and praised them if they reported using the words. Self-monitoring forms were also introduced during the same practice and each athlete was asked to fill out one for after each event in the upcoming meets (see Appendix A). This form provided a self-report measure if the swimmers were using the key words during races, and potentially created a punishment/negative reinforcement contingency based on self-evaluation of effort. During practice and at the meets, the coach stressed the importance of honesty in completing the forms.

RESULTS

Participants' data are shown as an average of flip turn time by race length for baseline and treatment conditions in figures 1-3. Each data point represents the mean flip turn time for an entire event. For example, one data point on a 100m graph represents the average of 2 flip turns, while each data point on a 500m graph represents the average of 10 flip turns.

Figure 2: Average flip turn time for Swimmer 2 across the 200m and 500m. Notice the increasing trend

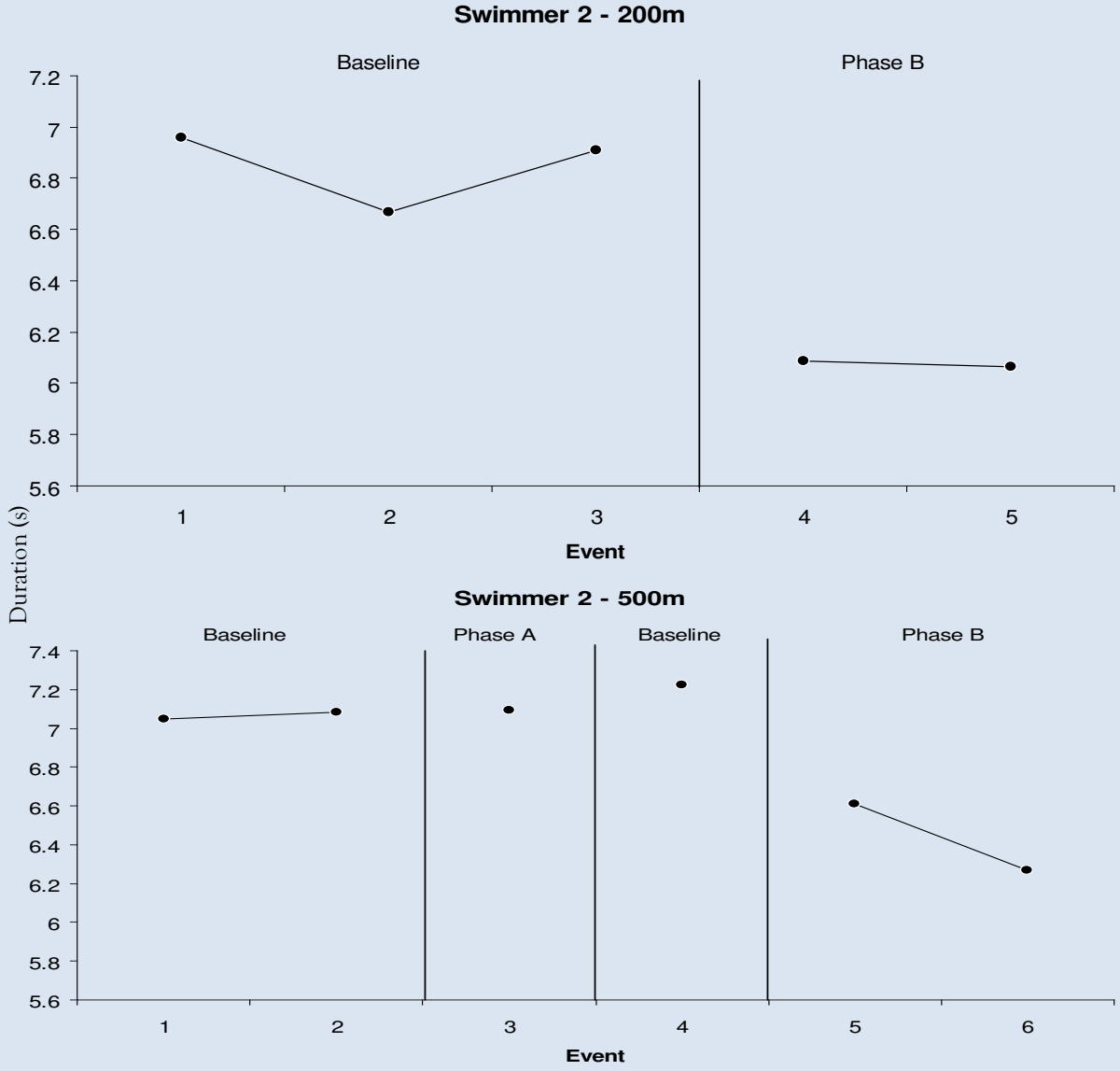
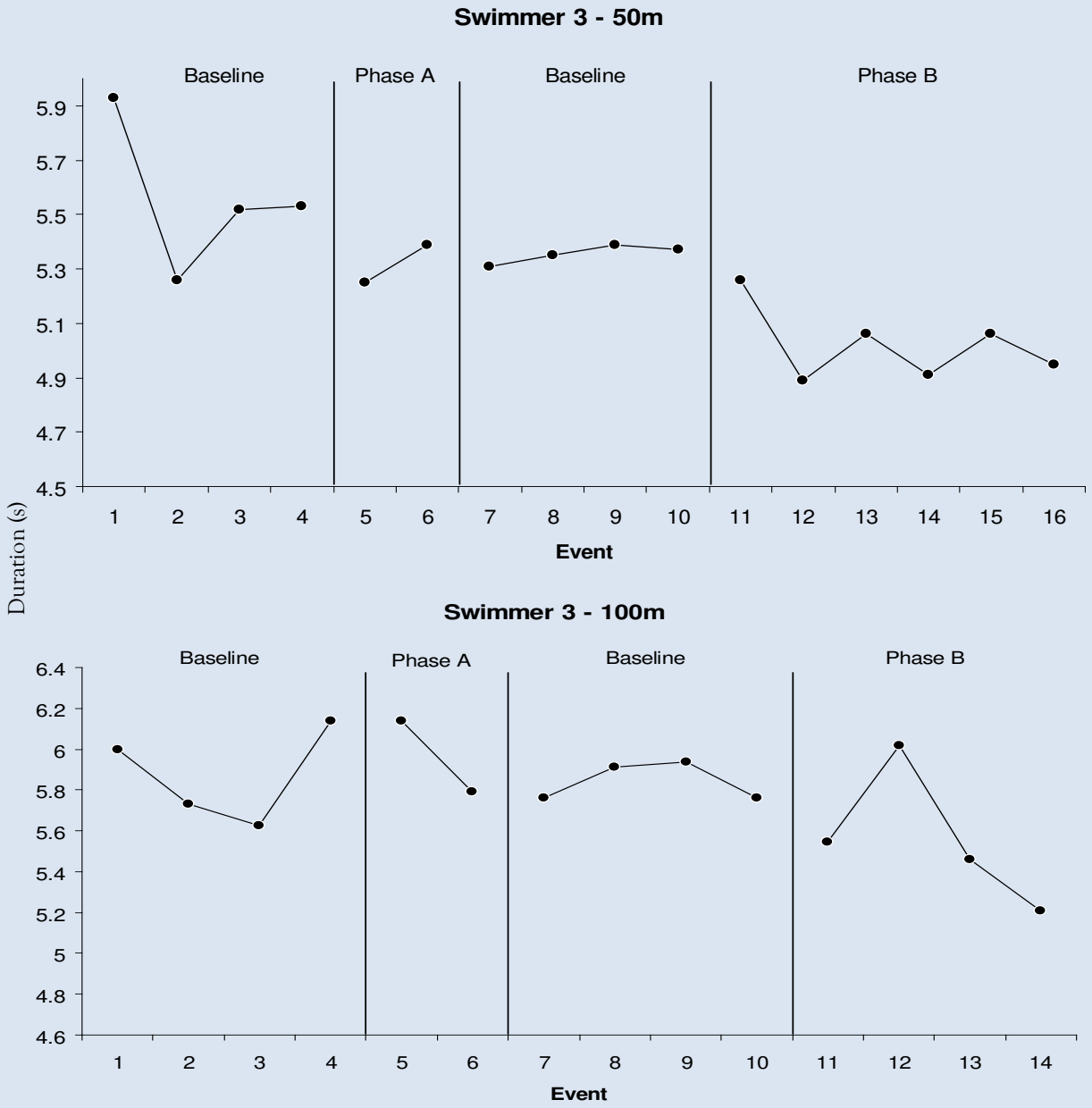


Figure 3: Average flip turn time for Swimmer 3 across the 50m and 100m.



The average flip turn for Swimmer 1 during baseline was 6.44s for 100m, and 7.03 for 500m. During Phase 1, her 500m average was 6.8s. During Phase 2 her 100m average was 5.68s and her 500m average was 6.4s. The decrease in time from baseline to Phase 2 represents a 12% decrease for the 100m and a 9% decrease for the 500m. The average flip turn for Swimmer 2 during baseline was 6.85s for the 200m and 7.11s for the 500m. Her Phase 1 500m average was 7.09s. During Phase 2 her 200m average was 6.07s and her 500m average was 6.43s. The decrease in time from baseline to Phase 2 represents a 12% decrease for the 200m and a 10% decrease for the 500m. The average flip turn for Swimmer 3 during baseline was 5.48s for the 50m and 5.83s for the 100m. Her Phase 1 50m average was 5.32s and her 100m average was 5.96s. During Phase 2 her 50m average was 5.02s and her 100m average was 5.55s. The decrease in time from baseline to Phase 2 represents a 6% decrease in time for the 50m and a 5% decrease for the 100m.

Although it was hypothesized that the athletes' flip turns would become faster due to maturation and increased fitness over time, this did not appear to be the case. Note the increasing trends across phase A for Swimmer 2 (500m) and Swimmer 3 (100m).

DISCUSSION

The present study aimed to improve the performance of skilled swimmers. Graphic and verbal feedback coupled with self-talk and self-monitoring appears to improve freestyle flip turns by a small but practically significant duration. The results suggest that skilled swimmers can enhance their performance by using these techniques.

Although performance improved substantially, this study contains a myriad of limitations. Swimmers typically swam more than one event per meet, thus a swimmer may have been fatigued during the later events if she swam many races prior. Also, there was no control over what the athlete ate, how much they slept, how physically aroused for competition they were, or a host of other performance-related variables. Thus, the physical and mental state an athlete was in as she approached the starting blocks could have varied from one swim meet to another. For instance, the swimmers may be particularly excited to swim against their county rival but very lax when swimming against a small, slower team. Although it would be difficult to control for all the potential variables, perhaps a pre-race diagnostic sheet would have been beneficial to pinpoint an athlete's state across different swim meets. The measurement method was also problematic. If a swimmer was swimming faster on a given day, she would be approaching the wall faster. Thus, her time between crossing the backstroke flag line and beginning the flip turn would be faster than if she were swimming slower. In this sense, more advanced measurement systems should be developed.

A practical limitation is the inability for the coach to continue the self-monitoring procedures. The time requirement to implement this treatment would likely be too great for the coach to continue. Measurement typically consisted of 60 minutes of observation followed by data entry and the creation of a new bar on the graph. Providing verbal praise for using self-talk during practice and races was quick and did not interrupt the normal procedures. However, analyzing the self-monitoring data would likely be impossible for the coach because of the lengthy time requirement of such analysis. Implementing the self-talk procedures and the self-monitoring forms at the same time represents a limitation. It remains unclear whether the performance increase stems from the creation of rule-governed behavior created by self-talk, or by the escape/negative reinforcement contingency created by the self-monitoring.

Finally, the process accounting for the impact of self-talk on overt behavior remains obscure. Although multiple studies within the organizational realm have demonstrated the effectiveness of feedback and self-talk, there are numerous conflicting reports, and recent research has demonstrated deleterious effects of feedback (Haas & Hayes, 2006). Indeed, if self-talk and feedback are demonstrated to be effective, a functional account of the process and the history that gives rise to these must be explored. Relational frame theory offers one such functional account (Hayes, Barnes-Holmes, & Roche, 2001). Experimentally examining the contexts in which verbal stimuli gain controlling properties in the applied domain represents the next logical step in athletic improvement. Whether the self-talk and self-report procedures were effective because of rule generation or their participation in relational networks, iterative basic research programs are slowly informing the effective use of these verbal procedures.

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A UNIQUE PHYSICAL EDUCATION CURRICULUM – SUPPORTING CLASSROOM MANAGEMENT

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This study examined the contribution of individualized Physical Education (PE) programs in improving student behavior and consequently, in facilitating classroom management. Three highly disruptive students from three different classes in a special education school participated in the study. A unique PE-based intervention designed to reduce Inappropriate Behaviors (IBs) was employed and a concurrent multiple baseline design across participants was used to assess the effects of the intervention. Generalization procedures from the PE setting to the home-classroom were implemented as well. Results showed an improvement in the behavior of all target students during the individual PE intervention. The reduction in IBs was apparent during academic classes as well. Furthermore, a better learning climate was attained in the three classes, with improvement in the overall Learning Time (LT) for two classes and a more stable learning pattern for the third. Satisfaction surveys yielded encouraging findings for both the participating students and their homeroom teachers.

One often sees children and youth engaging in active play. These games seem to reflect real-life contingencies and social interactions (e.g., cooperation, competition, adherence to rules, effort and reward, etc.). Consequently, physical activity and play have been suggested in the general literature as a means for improving social skills and reducing behavior problems (e.g., Bay-Hinitz, Peterson, & Quilitch, 1994; Collingwood, 1997; Hastie & Sharpe, 1999; McKenney & Dattilo, 2001; Priest, Krause, & Beach, 1999). However, the relationship between engagement in physical activity and the development of socially desired behaviors has yet to be adequately explored. Thus, one cannot assume that feelings, attitudes, values, and behaviors would automatically accrue due to mere participation in active play (Hellison, 1995). Instead, it can serve as a context in which carefully designed activities exemplify the target behaviors and values being taught (Eldar, 2006, in press; Goldstein & Cisar, 1992; Rolider & Axelrod, 2000). Consistent with this notion, the current study aims to explore the contribution of a Physical Education (PE) based behavioral intervention to the promotion of classroom management.

There is a body of literature in which structured behavioral procedures were implemented in sport-related settings (Ward & Barrett, 2002). Typically, these studies showed the effect of behavioral interventions on skill acquisition and on improvement in sporting performance (Allison & Ayllon, 1980; Anderson & Kirkpatrick, 2002; Brobst & Ward 2002; Critchfield & Vargas 1991; Kladopoulos & Mccomas, 2001; Koop & Martin, 1983; McKenzie & Rushall, 1974; Smith & Ward 2006; Ward & Carnes 2002; Ziegler, 1994). Other studies investigated if behavioral principles (e.g., momentum, reinforcement rate) can explain seemingly natural sporting behaviors (e.g., Mace, Lalli, Shea, & Nevin, 1992; Roane, Kelley, Trosclair, & Hauer, 2004; Vollmer & Bourret 2000).

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Only few studies have attempted to implement behavioral interventions within a physical activity setting in order to alter behaviors that focus on appropriate social conduct. Van der Mars (1989) found that the provision of verbal praise contingent upon appropriate student conduct significantly reduced undesired off-task behaviors during PE classes. When a behavioral technology in the form of a wireless microphone was used to amplify teacher's feedback, Ormond, Imwold, and Rotunda (2002) reported a reduction in student off-task behavior in a PE setting. White and Bailey (1990) introduced a modified time-out procedure supplemented by a loss of privileges, which yielded a substantial reduction in the frequency of disruptive behaviors during PE classes. Galvan and Ward (1998) demonstrated that behavioral strategies can reduce unsportsmanlike on-court behaviors such as arguing, swearing, or throwing objects. Furthermore, Kodak, Grow, and Northup (2004) conducted functional analysis and treatment procedures for elopement during an outdoor sports activity for a child with attention deficit hyperactivity disorder.

In addition, Sharpe, Brown, and Crider (1995) implemented a class-wide physical education curriculum that focused on the development of

positive social skills. The researchers found an immediate increase in student leadership and in independent conflict resolution behaviors as well as subsequent reduction in off-task behaviors. Notably, a secondary objective of the Sharpe et al. study was to examine possible generalization effects beyond those observed in the PE classes. The findings suggested that the behaviors taught in the gym did, in fact, generalize to the educational classroom settings, as long as contingencies from the intervention settings were maintained (i.e., feedback, public posting, etc.).

The lack of substantial behavioral literature in this field is particularly surprising when one considers the potential of physical activity as a constructive setting for the implementation of behavioral principles and procedures (Eldar, 2006, in press). Physical activity consists of definite and repetitive activities that produce visible performance and outcomes. Thus, educators and clinicians can plan achievable tasks that are followed by immediate feedback and opportunities for correction (Eldar, Morris, Da Costa, & Wolf, 2006; Siedentop, 1991). Furthermore, physical activity presents ample opportunities to intersperse frustrating triggers (waiting, difficult task) within rewarding tasks (favorable activity, play with friends) and consequences (success, attention), making it possible to teach students how to successfully address their aggravation (Rolider & Axelrod, 2000). Physical games are also inherently marked by rules. These rules can then be adapted without impinging on the pleasure a game provides (Barrette, Fiorentino, & Kowalski, 1993). Such adaptations can be used to didactically structure the activity ensuring an opportunity to practice desired behaviors in the presence of challenging triggers (Hastie & Sharpe, 1999). For example, the boundaries of the goalpost can be changed in order to manipulate task level of difficulty, while the student's adherence to the task is reinforced. Similarly, one competing student may be instructed to follow more restrictive rules than their peer, creating a simulation of an unfair situation. Restraint despite these conditions can then be rewarded.

The motivation to learn may also be enhanced in the context of physical activity, as success is achieved within intense affective states caused by the strenuous effort and the competitive nature of sport. Furthermore, students generally view PE classes as a welcome break from the classroom that helps them keep fit, healthy, challenged and socially active (McKenzie, Alcaraz, & Sallis, 1994; Rice, 1988; Tannehill & Zakrajsek, 1993). Thus, these classes can serve as Establishing (or Motivating) Operations (Laraway, Snycerski, Michael, & Poling, 2003; Michael, 1993, 2000), namely, an environment that evokes positive feelings, which in turn enhances the effectiveness of reinforcement, facilitating the learning process.

The unique characteristics of physical activity as an educatory context, and the lack of substantial behavioral research in this area, raise the need for further investigation. Eldar (2006) proposed a model in which movement-related lesson plans are implemented in order to attain pedagogical and clinical objectives that emphasize behavioral change. More specifically, short teaching-segments (about 5 minutes), named PE scripts, present controlled antecedents, consequences, or both. A strenuous anaerobic effort, such as a two teams relay run, can be used to expose students to a competitive and stressful situation. During the game, the students are asked to adhere to the rules and refrain from obstructing members of the opposing team. Such a script provides the participants with the opportunity to exhibit restraint in a scenario that may simulate antecedents for difficulties in self-control. Similarly, a script that emphasizes consequence alternation may present a social play such as soccer, during which an attention-maintained behavior of peer insult is ignored, while appropriate and supportive peer interaction wins immediate attention.

In order to help the students deal with demand difficulties, the scripts are designed in a fade-in manner as the intervention progresses. Fading-in is implemented when the level of difficulty of a task is increased (more restrictive time constraints, increasing the height of the basketball rims), or when the frequency of triggers associated with problem behavior is gradually increased (more frequent terminations of favored activities, increased ratio of losses). Either way, the key to a successful behavioral outcome is to ensure high levels of appropriate behavior (rewarded success) throughout the implementation of the fading-in procedure. Stimulus or demand fading had been shown to improve compliance (e.g., Call, Wacker, Ringdahl, Cooper-Brown, & Boelter, 2004), reduce destructive behavior (e.g., Piazza, Moes, & Fisher, 1996), and even improve dietary intake (e.g., Patel, Piazza, Kelly, Ochsner, & Santana, 2001). Ultimately, this process gradually exposes the students to

challenges they were used to decline by emitting disruptive behaviors.

Problem behaviors are a growing concern in the education system. The Israeli Ministry of Education has supported students with severe behavior difficulties who were assigned to the special education system. The Special Education Law in Israel has been in effect since 1988 (Ministry of Justice, 1988). However, individual inclusion in regular education requires specific support within this system. Therefore, a supplement to the special education law was added in 2002 (Ministry of Justice, 2002). It stated that a special inclusion committee should determine the additional services to be granted to the student. These services may include additional learning, psychological consultation, and assistance in class (e.g., a helper). The educational staff is required to design an Individualized Education Program (IEP) specific to each student for the full year of study.

Surveys designed to expose behavioral trends among Israeli students (Benbenishty, Astor, & Zeira, 1998; Harel, Kinney, & Rahav, 1997) displayed an alarming picture of growing in-school violence and disruption. The call for creative and innovative interventions was loud and clear. Moreover, unmanaged problem behaviors greatly interfere with the quality of learning achieved in the classroom (Borders, Earleywine, & Huey, 2004; Lavay, French, & Henderson, **1997;** Sugai & Horner 2006), as these behaviors can consume up to 80% of a teacher's instructional time (Sugai & Horner, 1994). Overall, it has become increasingly more apparent that teachers need to acquire skills as well as practical tools in order to deal with difficult behaviors, particularly since the traditional procedures of punishing and expelling students are proving to be ineffective (Downing, Keating, & Bennett, **2005;** Mogan-D'Atrio, Northup, LaFleur, & Spera, 1996).

Colvin and Sugai (1988) noted that educators tend to take a proactive approach (e.g., initiate correction procedures, provide more practice and review) when managing instructional errors. In contrast, a more reactive response (e.g., implementing increasingly negative consequences) occurs when educators are confronted with social behavior problems. The authors suggested that social behavior problems can be addressed by conducting functional behavioral assessments followed by differential reinforcement of alternative behaviors. This can be achieved within a context designed to allow the students opportunities to practice replacement behaviors and experience success in doing so (Colvin & Sugai, 1988). Interestingly, these concepts have been clearly addressed by Skinner, who discussed the technology of teaching (1968) and the "shame of American education" (1984). It seems that only a few creative strategies have been developed since.

A practical intervention would be both cost-effective and accessible. Thus, one key is to identify the neediest group of students who are most at risk, and whose behavior change would lead to the greatest overall change (Colvin & Sprick, 1999). In the average school, nearly one quarter of the students can be expected to exhibit problem behaviors to some degree, while 3% to 7% are likely to emit chronic problems that require more directed and individualized efforts (Todd, Horner, Sugai, & Colvin, 1999). Once these students are identified, and their target behaviors selected, they can be provided with more comprehensive individualized interventions (Benazzi, Horner, & Good, 2006; Foster-Johnson & Dunlap, 1993). A second key may lie in utilizing resources that are readily available in every school. A PE-based intervention requires little more than a trained professional and access to already existing equipment (e.g., facilities, sporting equipment, etc.).

The aim of this study was to select target students and expose them to individualized PE-based behavioral intervention programs designed to reduce these students' disruptive behaviors. It was hypothesized that the intervention would reduce the frequency of the problem behavior, which in turn might improve study-related conduct within the classroom. The overall design of the study stems from an intervention model suggested by Eldar (2006). According to the model, target behaviors can be practiced in the context of physical activity and then be generalized to other settings. In the current study, the questions of interest were (a) the effect of an individualized PE intervention on defined problem behaviors emitted by the target students, and (b) the effect of an individualized PE intervention on learning time of the target students' classmates as a whole.

METHOD

PARTICIPANTS AND SETTING

Setting. Three students in a special education school in the central region of Israel, and their

classmates, participated in this study. The project was approved by the school superintendent, according to regulations formed by the region director who supervised research, data collection, and interventions implemented in schools within the region. All procedures were formed and supervised continuously in collaboration with the school principal with ongoing reports submitted to the superintendent.

The school served 70 students with severe behavior problems, many of which diagnosed with learning disabilities and/or Attention Deficit and Hyperactivity Disorder (ADHD). All of the students in the school scored in the Average to Dullness range on intelligence tests. The age range of students in the school was 6-15, and they were divided into nine classes accommodating 6-10 students each, managed by a teacher and an assistant. While a few students were integrated into regular schools every year, most students in this school did not meet the inclusion requirements due to their severe and complicated difficulties.

Overall, the school employed approximately 40 professionals including: homeroom teachers, classroom assistants, subject-matter teachers (e.g., Mathematics, English), various therapists, a psychologist, as well as administration and maintenance personnel. The school offered a variety of alternative experiences for the students, with a comprehensive PE program for all. The school's PE program was based on the core curriculum offered by the Ministry of Education (two class-wide lessons per week), supplemented with individual and small group experiences. As a result, each student had between three to six PE lessons per week, depending on their individual and class program. PE lessons were conducted in an old but well-equipped gymnasium and in a variety of open space settings available in the area.

Participants. Three target students from three different classes were the major focus of this study. Ariel was a 12 year old boy, who was placed in the school 18 months prior to the commencement of the study, due to severe behavior problems in his previous school. Ariel's class contained nine other students ranging from 10.5 to 12.5 years old. Ariel's family did not report any social or financial difficulties. His academic achievements were average but he experienced reading difficulties. The second participant, Danny, was a 10-year-old boy, referred to the school two-and-a-half years prior to the initiation of the study, due to failure to integrate into other programs. Danny had experienced behavior difficulties since attending kindergarten, and performed very poorly in all academic areas. Danny was one of nine students in a class of 8.5-10.5 year olds. The third participant, Ron, was an 11-year-old boy, whose family was supported by the municipal welfare system due to malfunctioning and family violence. Ron was assigned to the special education school 18 months before the initiation of the study, because of severe behavior problems and aggressive acts carried out in his previous school. His intelligence was evaluated in the higher part of the normal range. Ron's class consisted of nine students (self included) in the age range of 10-12.

SELECTION OF TARGET STUDENTS

The selection processes of target classes and students aimed to identify those who cause the greatest disruption. First, the school Principal selected three classes that she perceived as having the most severe difficulties. To facilitate her selection process, the Principal was asked to define the more frequent behavior problems in each class, and to describe what makes these classes stand out in terms of behavior problems. Additionally, she provided her view as to the reasons behind the difficulties in the management of these particular classes and described interventions that were attempted in the past.

Next, the homeroom teachers of these three classes each identified three students who displayed the most behavior problems and who had a highly negative influence on the performance of other students in their class. The teachers were asked to support their selections by detailing the challenging behaviors displayed by these students, the distractions they create, the reactions of their classmates, the typical antecedents of the problem behaviors, and the common responses by the teachers or their assistants.

Finally, following the teachers' selection, the researchers observed the three students in each class throughout five lessons of the homeroom teacher. During these observations the researchers recorded the frequency of the students' Inappropriate Behavior (IB). Based on these data, the target student from each class was defined as the one who displayed the most frequent problematic behavior, thus Ariel, Danny, and Ron were selected as the target students for this study.

TARGET BEHAVIORS, DATA COLLECTION, AND INTEROBSERVER AGREEMENT

Two dependent variables were measured in this study: (1) Inappropriate Behavior (IB) and (2) Learning Time (LT). IBs were measured for the target students during both their individualized PE lessons and throughout selected classroom lessons. IBs were defined as: talking without permission (verbal behavior to self or others that was not related to learning tasks and had not been approved by the teacher), verbal aggression (cursing, threatening, using offensive language), shouting (raising the voice volume beyond normal), physical violence (hitting, kicking, inappropriate touching), property destruction (throwing objects, breaking, scratching, damaging of objects), and leaving the learning position/classroom without permission. Notably, from the perspective of the target students, talking without permission may be viewed as a less serious problem behavior compared to the others listed. However, the homeroom teachers identified it as a disruptive behavior when they selected the most challenging students in their classes. Thus, for the purpose of the current study, talking without permission was treated as an IB of equal importance to the others.

Consistent with the guidelines by Cooper, Heron, and Heward (2007), event recording was used to measure the displayed IBs. That is, an occurrence was marked whenever a defined behavior took place. When two behaviors occurred simultaneously (e.g., shouting while leaving the class without permission), two separate events were recorded. Behaviors that prolonged (e.g., leavening learning positions) where also marked for length in seconds. However, since very few lengthy behaviors were recorded, it was decided to omit the duration aspect from further analyses and instead record these behaviors as reoccurring every 10 seconds. Finally, if the target students exited the classroom the observation time was paused and resumed when the student reentered. IBs were measured throughout entire lessons, which typically lasted 45 minutes. To accommodate for minor fluctuations in the duration of observation time, an IB Rate was calculated (Copper et al., 2007) in the following manner: the total number of events recorded, divided by the total number of observation minutes, multiplied by 45. Consequently, the IB Rate provided a measure of IBs per lesson (45 minutes).

The second dependent variable, LT, was measured in the regular classroom, for the classmates of the target students. Momentary time sampling was used to record LT (Copper et al., 2007) throughout the entire 45-minute lessons. The behavior of the classmates was recorded as "learning" or "not learning" during the last 5-second segment of every observed minute. The time segment was scored as "learning" if all the classmates or all except one (excluding the target student), were engaged in appropriate learning behaviors (such as looking at the teacher when the latter conveyed information, directing attention towards a peer who was given permission to speak, eyes oriented towards a given task or pencil making contact with worksheet) during the same time segment, without emitting IBs. When the definition of "learning" was not met, the time segment was marked as "not learning". The data on LT were then expressed in terms of the percentage of "learning" segments out of the total number of segments recorded.

Target behaviors were recorded during the lessons by trained observers using observation forms adapted for this study. Accuracy training was conducted prior to data collection, with videotaped examples until a minimum of 95% agreement has been achieved. Interobserver agreement data were collected by independent trained observers for at least 40% of all sessions during the baseline, intervention, and follow-up phases. Percentage agreement for the frequency of IBs was calculated by dividing the lower IB frequency recorded in a lesson (i.e., the data measured by the observer who recorded fewer IB occurrences) by the higher session frequency (i.e., the number of IBs recorded by the observer who marked more IB occurrences), multiplied by 100%. Agreement for LT was calculated by dividing the number of intervals the observers agreed on by the total number of intervals, multiplied by 100%. Mean agreement score for Ariel was 86% for IB (range, 79%-92%) and 98% for LT (range, 94%-100%). For his class (3), average agreement for IB was 92% (range, 90%-94%) and 94 % for LT (range, 85%-99%). Mean agreement score for Danny was 95% for IB (range, 94%-96%) and 93% for LT (range, 87%-100%). For his class (1), average agreement for IB was 88% (range, 86%-89%) and for LT – 92% (range, 89%-97%). Mean agreement score for Ron was 85% for IB (range, 80%-92%) and 97% for LT (range, 94%-100%). Average agreement for Ron's class (2) was 85% for IB (range, 81%-90%) and 83% for LT (range, 80%-85%).

Teacher summary survey. The three homeroom teachers completed a brief post intervention survey comprised of three open-ended questions: the survey solicited information on (a) possible changes in the functioning of the target students; (b) changes in the functioning of the classmates as a whole; and (c) it invited comments about any exceptional behaviors.

Student satisfaction survey. The target students completed three focused questions enquiring about (a) their enjoyment; (b) acquired independent studying abilities; and (c) their improvement at sports, behavior, and/or academic skills. In addition, the students where given an opportunity to add further comments.

EXPERIMENTAL DESIGN AND PROCEDURES

The study was conducted throughout an entire school-year. The first two months were dedicated to the selection of target students, training of the observers, and preparations. Baseline, intervention, and follow-up data were collected during the remaining eight months, as described below. A concurrent multiple baseline design across participants was used to evaluate the effect of an individualized PE-based behavioral program on the IB of Ariel, Danny, Ron, and the LT of their classmates. First, baseline data were collected for each participant through descriptive assessments in the regular classroom without impinging on the curriculum. For Ariel, five data points were collected throughout a month. Danny, the second participant to commence the individualized PE-based intervention, was observed for nine baseline data points, over approximately 12 weeks. Finally, 19 baseline data points were collected for Ron, throughout 16 weeks. Antecedent analyses of the baseline data revealed that the vast majority of IBs occurred during "waiting", "demand" and "independent tasks" situations, for all three target students. Following the baseline phase in the classroom, and prior to the commencement of the PE-based behavioral interventions, two baseline data points were collected within the PE context for each participant. Antecedent analyses verified the findings obtained in the classroom observations, that is, the triggers most frequently associated with problem behaviors were "waiting", "demand" and "independent tasks" situations within the PE context as well.

Next, the behavioral interventions were administered to the three target students during specially designed PE lessons. These lessons were scattered throughout the week in varying hours of the day and they increased the number of PE lessons the target students received by as many as four lessons per week. Overall, Ariel's intervention sessions incorporated 37 lessons, Danny's program included 31 lessons, and 30 sessions comprised Ron's intervention. Each program was implemented in the course of approximately four months. Throughout this time, periodical observations in the regular classroom measured the IBs of the target students and the LT of their classmates.

The intervention sessions differed from regular individual PE classes in that they followed strict lesson plans (i.e., scripts) that were designed to intersperse challenging triggers (i.e., antecedents of IBs), as identified in the descriptive assessments (For a comprehensive review of Eldar's model of "Educating through the Physical" see Eldar, 2006; Eldar, in press). For example, a three-minute "in-out-high" game (when the teacher calls "in" the student jumps into a hoop, to an "out" call, the student jumps out of the hoop, a "high" call instructs the student to climb off the ground) presents a high rate of teacher instruction within a fun context. Similarly, independent performance can be introduced through a five-minute "working stations" task, in which students record their own scores in various stations (e.g., shooting hoops, balancing a ball, sit-ups, etc.) and report to the teacher only upon task completion. Ultimately, the aim was to expose the target students to challenges they had previously declined by emitting aberrant behavior. The content of the tasks was varied and included warm-up, physical fitness drills, ball skills, and various movement games.

In order to maintain a high success rate (appropriate behaviors such as compliance, perseverance, or self control) despite "demand difficulties" (difficult tasks or little supportive attention from the teacher), the scripts throughout the intervention were designed in a fade-in manner – from simple to complex. In other words, with the progression of the individualized programs, the level of difficulty was gradually increased and the target students were exposed to tasks that required harder effort, to extended periods of independent performance, and to generalization procedures (described below).

The behavioral intervention was designed as an individualized multi-phase program. Progression from one phase to another was contingent upon meeting clear behavioral prerequisites agreed upon together by the PE teacher and each target student (e.g., completion of five lessons with no more than five IBs per lesson). The first phase of the program focused on: (a) establishing cooperation with teachers and appropriate responding to rules and routines; (b) a gradual exposure to triggers associated with the IBs, followed by consequences alteration for these behaviors; and (c) development of independent performance routines as well as increasing the duration of independent performance within the lessons. For example, the signs for the start an activity (a single whistle blow), the end of an activity (two succeeding whistles) and how to cease action (immediate pause to current activity, as prompts are placed on the floor and body posture is upright), were taught through instruction, demonstration, reminders, opportunities to practice through games, reinforcement upon compliance, and correction if necessary. Overall, phase 1 contained 15 lessons for Ariel, 10 for Danny, and 14 lessons for Ron.

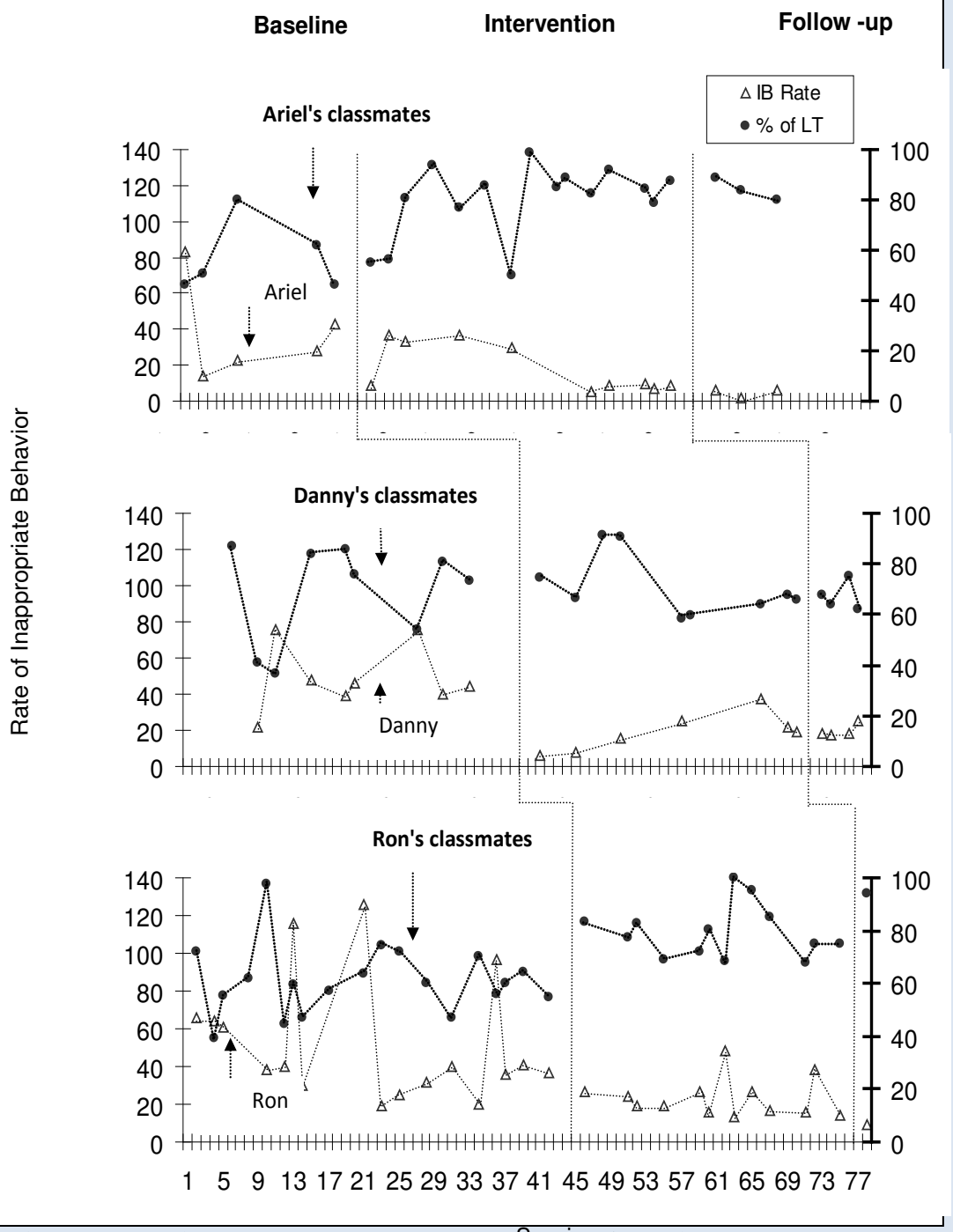
The second phase of the intervention embedded cognitive tasks within the PE-based intervention lessons. These tasks resembled classroom situations, as the students were seated on a chair in front of a table and completed reading, writing, or arithmetic assignments that prepared them for the content of the following classroom lesson. For example, when simple subtraction was the topic being taught and practiced in mathematic classes, the PE-based intervention lessons conducted during that time period, could include exercises in subtraction as assignments. Behavioral momentum (Nevin, 1996; Wehby & Hollahan, 2000) was maintained by ensuring that each academic assignment was preceded and followed by a favored physical activity task. Students were advised to request the teacher's assistance when they had difficulties, while exhibiting appropriate communication (e.g., raising a hand and waiting). This phase continues for 13, 3, and 7 lessons for Ariel, Danny, and Ron respectively.

In the third phase of the program, the Individualized PE-based behavioral intervention lessons continued in a similar manner to phase 2. However, the PE teachers joined several regular classroom lessons in order to provide a faded-out support. In these classroom lessons, target students, along with their peers, completed tasks assigned by the regular classroom teacher as part of the lesson. The PE teacher assisted the target students (i.e., answered questions) when they initiated a request for help (raised their hand and waited). The PE teachers' involvement was gradually reduced until their presence was completely terminated. During this phase of the intervention, Ariel participated in 4 individualized PE lessons and 5 supported classroom lessons. Danny received 10 PE lessons and 8 supported classroom lessons throughout this phase, and Ron took part in 3 PE lessons in addition to 6 supported classroom lessons. Once the presence of the PE teacher in the regular classroom was extinct, the intervention was complete and follow-up data were collected.

RESULTS

Figure 1 shows the IB Rates of the three target students along with the percentage of LT of their classmates – before, during, and after the intervention. The figure is plotted according to Carr's (2005) recommendation that data points on concurrent MB designs should be alternated across x-axis numbers to allow the reader to determine the order in which participants' sessions were conducted relative to each other. All measurements were conducted in the homerooms during routine classes. Overall, the results show a reduction in IB Rates for the three target students during the intervention and follow-up phases compared to baseline. Thus, their behavior in class improved and maintained itself after all generalization support was withdrawn. This follow-up data are particularly impressive since this is clearly evident for all three target students. More specifically, during baseline, Ariel's IB Rate ranged from 14 to 83, whereas measurements taken over the latter part of the intervention and the follow-up phase revealed no more then 10 IBs per lesson. Danny's behavior during baseline showed some variability (from 19 to 76) and averaged around 47 IBs per 45 minutes. The intervention and follow-up phases are characterized by greater stability throughout (IB Rate between 6 and 37) and an evident reduction in the average IB Rate (approximately 19 IBs per 45 minutes). Ron's behavior during baseline was quite erratic, with an IB Rate ranging between 19 and 126. After the commencement of the intervention his behavior both improved and stabilized (range of 9-48).

Figure 1. IB (inappropriate behaviors) rates of the target students and % of LT (learning time) of their classmates during academic classes, measured prior, during, and following the commencement of the intervention in the PE setting.

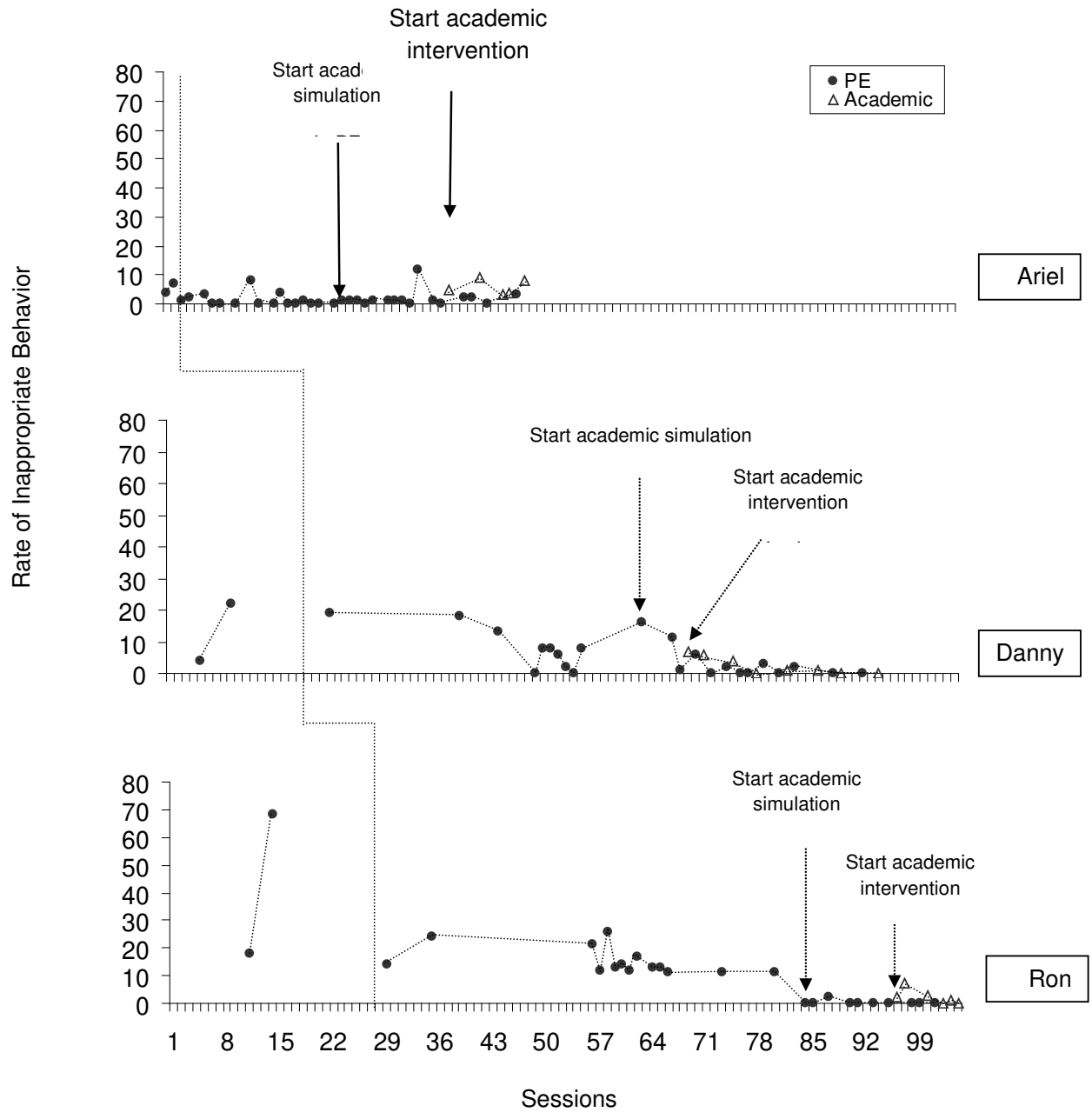


The data in Figure 1 also present positive outcomes in relation to percentage of LT. The classmates of Ariel and Ron increased their engagement in learning-related activities during intervention and follow-up phases (range 50%-99%, average 81% for Ariel; range 68%-100%, average 80% for Ron) compared to their initial baseline data (46%-80%, average 57%; range 39%-97%, average 61%, for Ariel and Ron, respectively). Danny's classmates maintained similar levels of LT throughout the study

(average of 69% for baseline and 70% for intervention and follow-up), however midway through the intervention these percentages stabilized (range of 59%-75% compared to an erratic measurements of 37%-91% prior to this point).

Figure 2 presents the IB Rates for each of the target students during their PE intervention lessons. This figure is also consistent with Carr's (2005) recommendation, as described above.

Figure 2. IB (inappropriate behaviors) rates of the three target students throughout the four stages of their individualized PE programs.



The data in Figure 2 present both a decrease and stabilization in the frequency of IB per 45 minutes throughout the intervention for the three target students. This result is particularly noteworthy since it is accompanied by a gradual increase in the level of difficulty of the scripts – as the intervention progressed the students managed tasks that were potentially more frustrating, while receiving less support and working more independently.

Two generalization phases were implemented during the intervention and are highlighted in Figure 2. The first indicates when simulation of classroom situations was introduced into the PE context. The second marks lessons in which the PE teacher offered assistance in the classroom.

Ariel's behavior stabilized on 0-1 IBs five lessons prior to the commencement of academic simulation in his PE lessons. This pattern continued, with only one marked exception, until the intervention in the classroom began. Ariel's IB Rate in the classroom phase was clearly higher (ranging from 3-9). During this time his behavior in the PE lessons had somewhat worsened as well (range of 0-3). Interestingly, parallel "ups and downs" are evident in both settings. Danny started both the academic simulation and the classroom phase at the highest IB Rate displayed in each phase (16 and 7 IBs, respectively). A similar pattern was evident in both settings, namely, some variability with an overall decrease in his IB Rates. Notably, the academic simulation commenced when Danny's data were in an upwards trend, despite low IB rates in several previous sessions. Admittedly, a better option would have been to introduce this change in treatment on a downwards trend. Ron's gradual improvement in behavior throughout the intervention had progressed further when the simulation phase began (IB Rate reducing to nearly a consistent zero). Ron's behavior in the classroom phase was somewhat more disruptive during the first three lessons (IB Rate between 2-7), but the subsequent supported classroom lessons stabilized on no more than one IB per lesson.

Qualitative analysis of the teacher summary surveys revealed that the three homeroom teachers observed improvement in the behavior of the target students as disruptions were reduced and independent work increased. Notably, the three teachers reported that the classes as a whole were easier to manage, and they attributed this change to the intervention. The teachers reported more confidence and control in managing their classes. In addition, the teachers expressed interest in acquiring class management skills that are consistent with ABA principles.

Analysis of the student satisfaction survey indicated that Ariel and Ron vastly enjoyed the individual PE classes, while Danny stated that the sessions were okay. All the target students reported improvement in their sporting and learning skills as well as in their general behavior, and specifically in their independent learning abilities.

DISCUSSION

The current study aimed to implement a behavioral intervention program in the assumingly supportive context of physical activity. The theoretical foundation of the intervention stems from a model suggested by Eldar (2006), which highlights the utility of physical activity in attaining behavior change. Indeed, the results of the current study show that IBs can be managed and reduced during specially structured PE lessons, with improvement being successfully generalized into the natural setting of the classroom. Moreover, the findings suggest that implementing a PE based intervention with one highly disruptive student could play part in improving the learning climate for the entire class. This strategy was based on the assumption that improving the behavior of a student who is at the core of disruption may be an efficient and cost-effective way to generate an overall change (Colvin & Sprick, 1999).

Descriptive assessments conducted during baseline sessions revealed that the "waiting", "demand" and "independent tasks" preceded most occurrences of IBs. This was initially observed during homeroom classes and then replicated in the PE setting. Consistent with the notion that physical activity can be used for behavioral assessment and intervention (Eldar, 2006, in press; Eldar et al., 2006; Galvin & Ward, 1998; Sharpe et al., 1995; Van der Mars, 1989), these challenging triggers were then practiced in the individualized PE lessons designed for each student. The data from the PE setting show that the behavior of all target students during the structured PE lessons, both improved and stabilized as the programs progressed. Interestingly, the level of difficulty of the PE tasks was continuously increased. This may explain

the variability in the data, especially during the first few intervention sessions. The target students attempted to negotiate task difficulty - attempts that diminished when the lesson plans continued to incorporate similar challenges. Notably, conducting only two baseline sessions within the PE setting, places some is a limitations on the interpretation of these data in isolation. Yet, the practical requirements of the school took preference and the researchers commences with the intervention as soon as the antecedent analyses during PE lessons yielded similar triggers to those observed in the academic classroom.

The generalization of appropriate behavior into the classroom commenced with the introduction of classroom simulation in the PE lessons. The behavior of one student temporarily deteriorated, while overall this phase was characterized by a further decrease and/or stabilization in the target students' IB Rates. This is a particularly encouraging finding as the target students did not show any resentment to the cognitive tasks, even though they resembled a classroom situation associated with ongoing history of failure. Thus, the potential strength of PE as a learning context is demonstrated. On one hand it differs from the academic settings in which misbehaviors have been acquired and maintained, while on the other hand it can be easily adapted to intersperse challenging scenarios.

The encouraging progression in the target students' behaviors marked the initiation of the next phase of the study, namely, the generalization to the classroom. Research examining the generalization of acquired behavior from the PE setting to other settings is extremely rare. Sharpe et al. (1995) measured incidental generalization from the PE classes to cooperative learning sessions held in the afternoons. According to their findings, learned behaviors were maintained when similar contingencies occurred across settings. The current study presented a planned generalization (i.e., the PE teachers accompanied the target students in the regular classroom) that aimed to promote behavior change in the regular classroom. Indeed, similar patterns of behavior were observed in the continuing PE lessons and in the parallel supported academic classes. Thus, it was evident that the three target students cooperated with the progressing interventions.

The follow up data provide further grounds for optimism, as the target students maintained low IB Rates without the mediation of the PE teachers. This finding is consistent with the reports of the homeroom teachers, who stated that the classes became easier to manage as the interventions progressed. Indeed, the overall data for LT indicate a better learning climate for the classes as a whole during the implementation as well as during the follow-up phases. Nonetheless, the intervention implemented in this study did not aspire to improve skill deficits per se, but rather it focused on IB control. Thus, academic deficits that are skill based (rather than motivational) may need to be addressed in order to gain full advantages of the intervention suggested. This was beyond the scope of the current study, and it may be considered a major limitation.

It is likely that the achievements observed in this study stem from the direct effect of the intervention, and even go beyond it. Being exposed to the principles of the ABA intervention and experiencing the improvement in the target students' behavior, was likely to affect the homeroom teachers' own behavior. These changes, in turn, may have facilitated and maintained the improvements in both IB and engagement in learning-related tasks. The present study did not measure the direct correspondence between teachers' actions and students' reactions, yet the teachers' reports suggest that initial frustration and a "giving up" approach were transformed into a "second wind" in assuming accountability for their classes. Thus, it seems that the direct success of the intervention served as Motivating Operations (Laraway et al., 2003) for the teachers who began to implement simple, but effective, ABA procedures themselves, while expressing interest in acquiring more comprehensive ABA skills.

The current study was initiated as a result of an urgent cry for help in the school where the intervention took place. Previous interventions that failed, paved the way for non-conventional solutions. The program presented in this study requires a single, trained ABA professional with some knowledge in PE. This human resource concentrates solely on one student who is highly involved in conflict in classroom, and utilizes equipment that is readily available in every school. The potential benefits encompass the target student as well as the entire class, without a major interruption to the teaching process. Furthermore, such an intervention may prove to be an effective ABA assimilation tool, capturing the attention of teachers and decision makers.

Finally, it should be noted that the PE aspects of the intervention had no direct effect on behavior change. Despite frequent claims attesting to the potential of physical activity as a rehabilitative tool (e.g., Collingwood, 1997; McKenney & Dattilo, 2001), it merely served as a context for applying behavioral procedures. Nonetheless, PE may very well be a particularly useful setting for this purpose. Thus, replications of PE-based interventions are called for as a means of validating the "marriage" between PE and ABA.

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