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INSTRUCTION MATTERS: INFLUENCE OF INSTRUCTION ON MOTOR SKILL LEARNING ACROSS DIFFERENT MASTERY MOTIVATIONAL CLIMATE CONDITIONS

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Abstract:
Research suggests that both practice and reinforcement are necessary for skill learning. In school settings however, there is typically only one teacher per class, and by consequence, providing individual feedback and reinforcement to all students is more challenging. Thus, the design of the task in schools/classes is extremely critical to maximize opportunities for practice and feedback. The purpose of this study was to examine the effects of different teacher behaviors (i.e., explicit instruction and feedback) within mastery climates on motor skill performance. 99 Preschool age children (M_{age}= 4.75 years) participated in a mastery motivational climate physical play programme intervention bi-weekly for 7 weeks. Children were randomly assigned to a motor skill condition, physical activity condition, mixed condition, or a free play control group. Analysis of covariance (ANCOVA) with pre-test scores as the covariate were conducted to determine the effects of condition on post-test motor skill scores. Results indicated that the children from the motor skill and mixed conditions showed significantly greater improvements than the other two groups. These findings suggest that instruction matters in learning motor skills. In the two conditions where children were given explicit instructional cues and feedback about performing tasks, they showed far superior gains than those children where the lesson focus was simply just on physical activity or when no instruction was given at all.

Keywords: feedback, cues, intervention, motor development

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1. Introduction

Research suggests that both practice and reinforcement are necessary for skill learning. In particular, practice trials in controlled situations result in better learning. For example, Silverman (1985) examined the relationship between engagement and practice trials with achievement in a swimming task. The findings from this study found appropriate practice trials to be positive predictors of improvement in skill, but also found that inappropriate practice trials were negative predictors of improvement. In school settings however, there is typically only one teacher per class, and by consequence, providing individual feedback and reinforcement to all students is more challenging. Thus, the design of the task in schools/classes is extremely critical to maximize opportunities for practice and feedback.

Mastery motivational climates are designed to motivate children to consistently engage in motor skill learning. Interventions employing this type of climate have resulted in numerous positive outcomes including increases in fundamental motor skill learning (Hastie, Rudisill, & Wadsworth, 2013; Martin, Rudisill, & Hastie, 2009), improved physical activity behaviors in comparison to free play (Parish & Rudisill, 2014; Parish, Rudisill, & St. Onge, 2007), higher levels of engagement (Hastie, Rudisill, & Boyd, 2016) and increases in perceived physical competence (Valentini & Rudisill, 2004a; 2004b). Overall, interventions employing these climates have been proven very effective for young children.

The purpose of this study was to examine the effects of different teacher behaviors (i.e., explicit instruction and feedback) within mastery climates on motor skill performance. To manipulate the amount of instruction participants received, there were three different conditions; mastery without explicit instruction, mastery with fifty percent instruction and fifty percent focus on physical activity engagement, and a traditional mastery climate with an emphasis on instruction and feedback on skills. A control group that participated in free play and did not receive any instruction served as a fourth condition.

2. Method

2.1 Participants

All participants (N = 99) were preschoolers, ages 3 to 5 (M = 4.75 years) who attended a local Head Start centre in a small southeastern American rural town. The centre serves mostly African-American children with low socio-economic status who are at-risk for developmental delay and poor health. Informed consent was obtained from the

custodial caregiver(s) of each child, and approval for the study was obtained from the authors' Institutional Review Board for Human Subjects Research, as well as the Board of Directors and Parent Advisory Council of the Head Start centre.

2.2 Mastery motivational climate physical play programme intervention design

This study utilized a pretest-posttest experimental design. Six intact classes were randomly assigned to one of three groups that participated in a bi-weekly (Tuesdays and Thursdays) movement programme for 7 weeks. The children participated in a total of 13 sessions. Each session was scheduled for 30 min for a total of 390 minutes of instruction over the course of the intervention. Each day consisted of six to eight stations in which children could be physically active and practice a variety of motor skills. Stations were designed based on the skills that existed on the TGMD-3 (Test of Gross Motor Development-3; Ulrich, 2013). Other stations (e.g., jumping inside cloth sacks) were also included as they promoted foundational abilities that are necessary to perform motor skills and be physically active, such as leg strength and balance. The mastery climate incorporated the recommended six TARGET structures of a mastery climate that promotes motivation for the children to achieve (Ames, 1992a, 1992b; Epstein's, 1988, 1989). These classroom structures include task, authority, recognition, grouping, evaluation, and time. Incorporating these structures, the instructor organized all lessons in a station format for this study. The children had complete autonomy over which stations they participated in, how long they stayed at these stations, as well as who they played with (if anyone) while visiting these stations. The stations were also designed so that both the lowest and highest skilled children could be successful.

2.3 Experimental Condition Descriptions

Although the TARGET structures of mastery motivational climates remained consistent throughout each play session, the researchers did manipulate the focus of the instruction between groups.

A. Motor skill focus condition. Two classrooms received implicit instruction pertaining to motor skills only during their play sessions. In this group, the focus of instruction was on teaching the children to learn their motor skills by providing instruction and feedback regarding to the children's form and technique at the skill stations. During the short introductions (5 min) before each class, the physical education teacher emphasized the importance for the children learning their motor skills if they wanted to grow up and participate in sports. The teacher also reviewed techniques for how to perform motor skills during the introduction and then followed up with a quick demonstration of the stations and their purpose for the day. For example, during the

introduction, the teacher would ask the children to show her how to hop on one foot, with reminders to lean forward when hopping and to keep the foot lifted off the ground behind the body. Following the introduction, children were encouraged to visit the stations, practice the skills, and receive motor skill instruction while engaged in practice. For instance, a child in this condition had the option to visit the overhand throwing station, where the instructor would provide them with cues such as "reach your arm back" and "step with the opposite foot." The importance of throwing was also reiterated by reminding the children that it was necessary to throw to play sports like baseball and softball. The instructors never focused on the importance of physical activity to the children in this condition.

B. Physical activity focus condition. Two further classrooms received implicit instruction pertaining to an accumulation of physical activity only. In this group, the instructors encouraged the children to get as much physical activity as possible, regardless of whether they were correctly performing their motor skill. During the short introductions before each class, the physical education teacher emphasized the importance for the children to engage in physical activity and exercise to grow up and become healthy adults. During the introduction, the teacher would ask the children to warm up and would then engage in physical activities as a group by running in place or performing aerobics activities. The teacher then introduced the stations for the day, which included the same activities as the motor skills focus condition but were modified to emphasize physical activity rather than motor skill learning. Following the introduction, children were encouraged to visit the stations and engage in physical activity. Reinforcements were based on the amount of physical activity the children were engaged in during their play. Children were not given motor skill instruction during this condition. For example, at that same overhand throwing station mentioned above, the children were encouraged to throw the ball, but the focus of the station was on chasing the ball as fast as they could and retrieving it to exercise their heart and get physical activity.

C. Motor skill and physical activity focus condition. The children from two further **c**lassrooms received instruction pertaining to both motor skills and the accumulation of physical activity. In this group, the instructors equally encouraged the children to perform their motor skills correctly but also encouraged children to get as much physical activity as possible. During the short introductions before each class, the physical education teacher not only emphasized the importance of physical activity and exercise, but also addressed the importance of motor skill development. During the introduction, the teacher reviewed techniques for how to perform motor skills as well as engaged in warm-up and physical activities. The teacher then introduced the stations

for the day, which included the same activities as the motor skills focus condition and the physical activity focus condition. Reinforcements were based on motor skill practice and the amount of physical activity the children were engaged in during their play. Children were given motor skill instruction during this condition. For example, a child at the throwing station was given cues such as "turn to the side before you throw", but was also encouraged to retrieve the ball as quickly as possible after each throw. During this condition, the instructors gave cues and feedbacks while encouraging the children to engage in as much physical activity as possible.

D. Free play comparison condition. Two classrooms from the same Head Start centre served as a comparison group. These children participated in unstructured free play on the same days of the intervention. The playground was equipped with the traditional equipment found in early education settings equipment such as swings, tricycles, sand boxes with sand toys. The children in this condition did not receive any formal instruction through a mastery motivational climate from the researchers. Instead, they played on the playground in the same manner that all classrooms did on non-intervention days.

2.4 Validation of Conditions

To validate the difference between the conditions in this study, a member of the research team analyzed the verbal prompts from the teacher during four randomly selected lessons. During the motor skill condition, 94% of the teacher's prompts pertained to motor skills, while for the physical activity group, the teacher during the reinforced motor skill learning within less than 5% of all prompts. Finally, the researcher presented 53% of instructional prompts towards motor skill development and 47% of prompts towards physical activity participation during condition two.

2.5 Instrumentation

Motor skill competence was assessed prior to, and following the movement programme intervention, using a validated assessment.

A. Motor skill competence. Children's motor skill competence was assessed using the Test of Gross Motor Development - 3rd edition. The TGMD-3 is a quantitative assessment that qualitatively measures criterion elements of fundamental motor-skill competence in children ages 3 to 10. The 13-item test consists of two subscales: six locomotor skills (i.e., run, gallop, hop, slide, jump, and skip) and seven ball skills, formerly known as object control skills (i.e., forehand strike, two-hand strike, overhand throw, underhand throw, dribble, catch, and kick). During this assessment, a researcher demonstrated the proper execution of the skill and the children were then allowed one

practice and two formal trials. Each trial was videotaped and coded through video analysis. According to the TGMD-3, each skill has a set of performance criteria that was evaluated. A score of zero was given for each criterion that was not performed during a trial, and a score of one was given for each criterion that was performed during each trial. The raw scores for each skill were reported for scoring purposes given the interest in motor skill improvement and not normed comparisons. Inter-rater reliability was established between two researchers at .90.

B. Inter-rater reliability. A single researcher coded all TGMD-3 assessments for all groups. All trials were videotaped. To confirm the reliability of these data, an independent rater coded a random selection (30% of participants) from all groups. The responses were calculated into percent agreement. Inter-rater reliability for these trials produced a reliability of 92% agreement.

2.6 Data analysis

Analysis of covariance (ANCOVA) with pre-test scores as the covariate were conducted to determine the effects of three different mastery climate interventions (motor skill focus, physical activity focus, and combined motor skill and physical activity focus) and a free play condition on post-intervention TGMD scores. All statistics were run in SPSS 23.0. Level of significance was set at .05, a priori.

3. Results

Figure 1 provides the estimated marginal means of the post-test locomotor skills for each of the four conditions. ANCOVA analysis revealed that following adjustments for pre-test locomotor scores, there was a statistically significant difference in post-test locomotor scores between the conditions, $F(3,91) = 52.40$, $p < .001$, partial $\eta^2 = .633$. Post hoc analysis shows that in this case, the post-intervention scores were significantly higher in both motor skill groups versus both the physical activity ($p = .001$) and control group ($p < .001$). The physical activity group also had significantly higher improvement in locomotor skills versus the control group ($p < .001$).

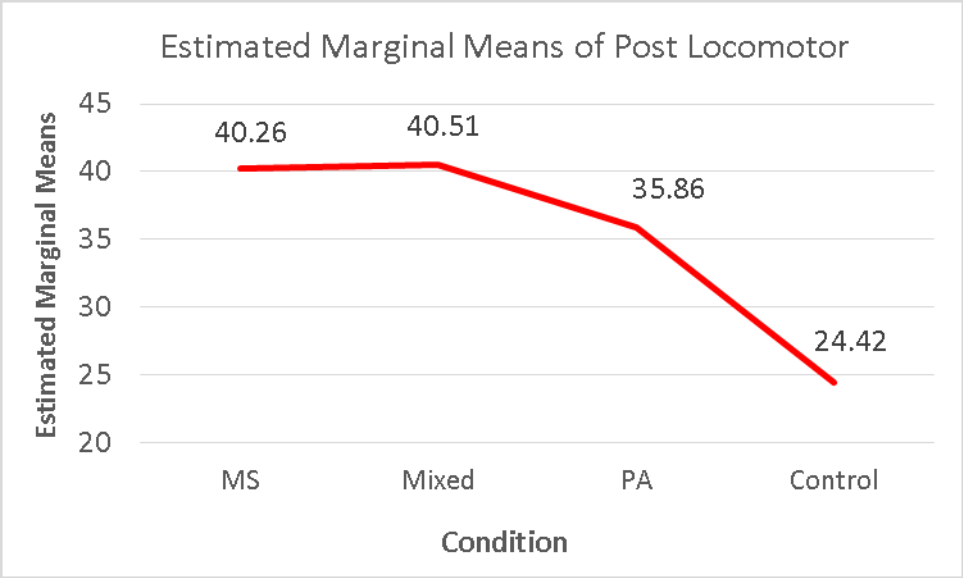

Figure 1: Covariates appearing in the model are evaluated at the value of Pre Locomotor = 24.02

Figure 2 provides the estimated marginal means of the post-test balls skills for each of the four conditions. ANCOVA analysis revealed that following adjustments for pre-test locomotor scores, there was a statistically significant difference in post-test locomotor scores between the conditions, $F(3,94) = 50.403$, $p < .001$, partial $\eta^2 = .617$. Post hoc analysis shows that similar to the case of locomotor skills, the post-intervention scores were significantly higher in both motor skill groups versus both the physical activity (p <.001) and control group ($p < .001$). The physical activity group also had significantly higher improvement in ball skills versus the control group (p =.031).

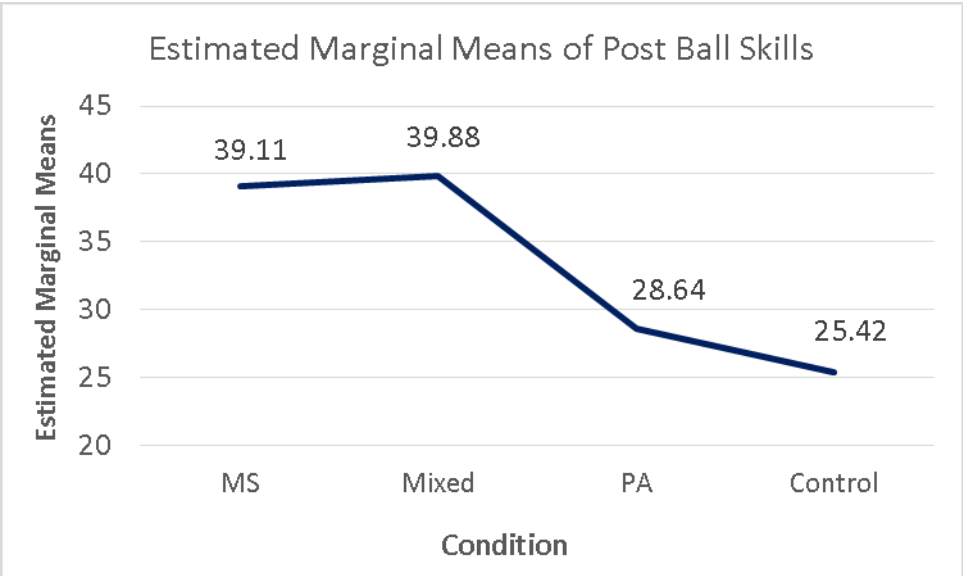

Figure 2: Covariates appearing in the model are evaluated at the value of Pre Ball Skills = 22.27

4. Discussion

The results of this study clearly show that instruction matters in learning motor skills. In the two conditions where children were given explicit instructional cues and feedback about performing tasks, they showed far superior gains than those children where the lesson focus was simply just on physical activity or when no instruction was given at all. Of particular relevance is that this relationship holds true for both locomotor and ball skill subscales. One may have expected that the children in the physical activity group condition would show similar post-test score gains in locomotor skills to the children in the skill focused groups. These results show that even for skills like running and jumping, students benefit from teachers reinforcing the key components of those skills, providing children with feedback about their performance, and scaffolding the learning tasks so that they show improvement.

These results mirror those of previous motor skill interventions versus free play outcomes (Logan, Robinson, Wilson, & Lucas, 2012). Nonetheless, it must be noted that in these other studies the free play condition was not conducted under a mastery motivational climate. What was unique about this study and separates it from the previous work is that in this case we focused specifically on teacher behaviors during a mastery climate. This is the first such study in which that investigation has taken place. The results of this focus on teacher behavior show that simply setting up an instructional climate that implements the TARGET structures (e.g., authority and freedom of time) alone does not guarantee that children will receive the information necessary for them to modify their practice behaviors in such a way as to promote skill learning.

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