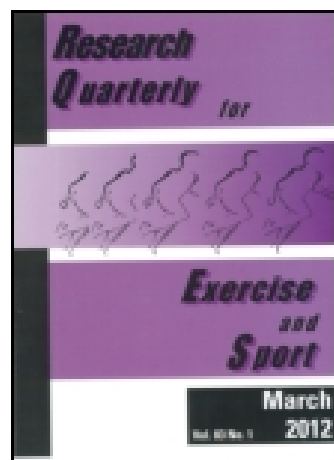




Research Quarterly for Exercise and Sport

Publication details, including instructions for authors and subscription information:

<http://www.tandfonline.com/loi/urqe20>

Instructional Climates in Preschool Children Who Are At-Risk. Part I

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Published online: 23 Jan 2013.

To cite this article: Leah E. Robinson & Jacqueline D. Goodway (2009) Instructional Climates in Preschool Children Who Are At-Risk. Part I, Research Quarterly for Exercise and Sport, 80:3, 533-542, DOI: [10.1080/02701367.2009.10599591](https://doi.org/10.1080/02701367.2009.10599591)

To link to this article: <http://dx.doi.org/10.1080/02701367.2009.10599591>

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Instructional Climates in Preschool Children Who Are At-Risk. Part I: Object-Control Skill Development

Leah E. Robinson and Jacqueline D. Goodway

Part I of this study examined the effect of two 9-week instructional climates (low autonomy [LA] and mastery motivational climate [MMC]) on object-control (OC) skill development in preschoolers (N = 117). Participants were randomly assigned to an LA, MMC, or comparison group. OC skills were assessed at pretest, posttest, and retention test with the Test of Gross Motor Development–2nd Edition. A significant Treatment $\times$ Time interaction ($p < .001$) was present, supporting the effectiveness of both OC instructional climates in improving OC skills over time, while the comparison group resulted in no changes. The authors conclude that developmentally and instructionally appropriate climates are beneficial to OC skill learning, along with the need for “planned” movement experiences in motor learning environments.

Key words: low autonomy, fundamental motor skills, mastery climate, motor skill instruction

Fundamental motor skills (FMS) are basic movement skills (i.e., throwing, kicking, catching, running, jumping, and hopping) that are considered the building blocks for more advanced movement (Clark & Metcalfe, 2002; Seefeldt, 1980). These skills allow children to function fully and independently in their environment and contribute to cognitive, social, motor, and physical growth (Clark, 2007; Clark & Metcalfe). It is vital that children develop basic competency in FMS early in life in order to break through a hypothetical “proficiency barrier” (Clark) and to experience successful engagement in various forms of sports and physical activities (Clark & Metcalfe; Seefeldt). However, children do not automatically perform FMS at proficient levels (Goodway & Branta, 2003). Like many other skills in life,

FMS must be taught, learned, and reinforced (Connor-Kuntz & Dummer, 1996; Goodway & Branta; Hamilton, Goodway, & Haubenstricker, 1999; Valentini & Rudisill, 2004a, 2004b).

Early childhood is the commonly accepted time to develop FMS (Clark, 2007; Clark & Metcalfe, 2002). In recognition of this critical time for FMS development, the National Association of Sport and Physical Education (NASPE) developed physical activity and movement guidelines for children from birth to 5 years of age (NASPE, 2002). The *Active Start* guidelines advocate the importance for children to have a solid foundation that enhances the acquisition of FMS and increases their ability to engage in and apply appropriate motor patterns (NASPE). Despite NASPE’s efforts to promote motor skill development in young children, some populations of children do not receive the appropriate kinds of movement experiences (Connor-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Hamilton et al., 1999; Valentini & Rudisill, 2004b). These movement programs include: (a) no planned instruction, (b) no clear goals or objectives, (c) inadequate time to practice motor skills, (d) lack of demonstration and modeling, and (e) inadequate equipment (Goodway & Branta; Rink, 2006). Research supports that these children have a greater risk of starting kindergarten developmentally delayed in their motor skill ability (Goodway & Branta). This was seen in some

Submitted: March 22, 2008

Accepted: September 1, 2008

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Black preschoolers from disadvantaged environments, who face adverse circumstances that contribute to poor motor skill competence (Goodway & Branta; Goodway & Smith, 2005; Hamilton et al.; Valentini & Rudisill, 2004b). These children are considered at risk for developmental delays and poor health. Recently, the federal government identified this population as needing early intervention due to various biological and environmental factors that may hinder their growth and development (Individuals with Disabilities Education Improvement Act of 2004 [IDEIA], 2004). Research has shown that children who are disadvantaged or at-risk do not develop proficient levels of motor competency (Connor-Kuntz & Dummer; Goodway & Branta; Hamilton et al.). Thus, it is important to examine the role of early motor skill intervention programs in the remediation of developmental delays in young children who are at-risk of poor health and from underserved environments.

From a theoretical perspective, FMS develop in a dynamic system (Thelen, 1983; Thelen & Ulrich, 1991) influenced by constraints from the learner (i.e., preschooler), the task, and the environment (Newell, 1984, 1986; Thelen & Ulrich). That is, the nature of a demonstrated movement pattern results from interactions of constraints imposed by a preschooler with particular characteristics, performing a specific FMS task in a given environment. Additionally, instruction within motor skill learning environments can elicit specific motor behavior and movement responses (Conner-Kuntz & Dummer, 1996; Gagen & Getchell, 2006; Goodway & Branta, 2003; Hamilton et al., 1999; Martin, Rudisill, & Hastie, 2009; Valentini & Rudisill, 2004a, 2004b). One powerful constraint is the influence of instruction on FMS development (Conner-Kuntz & Dummer; Goodway & Branta; Martin et al., 2009; Valentini & Rudisill, 2004a, 2004b).

A number of instructional climates have been investigated, but two that have received much attention are the low-autonomy (LA) or teacher-centered approach (Conner-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Hamilton et al., 1999; Valentini & Rudisill, 2004b) and the mastery motivational climate (MMC) or student-centered approach (Martin et al., 2009; Theeboom, De Knop, & Weiss, 1995; Valentini & Rudisill, 2004a, 2004b). In an LA instructional climate, the learning environment is characterized by teacher control and direction over organization and decisions, where students follow the guidance and directions of the instructor (Rink, 2006). In contrast, MMC (Ames, 1992a, 1992b; Epstein, 1988) shifts control to the learner, who independently navigates through a planned learning environment built on the TARGET dimensions (task, authority, recognition, grouping, evaluation, and time) developed by Ames (1992b). Within MMC, learners can choose their skill, level of task difficulty, and the amount of time they engage in a particular skill or activity.

Both the LA and MMC climates have been found to be effective in promoting motor skill development in at-risk populations. Goodway and Branta (2003) compared the effects of a 12-week LA ($n = 31$) motor skill intervention with a control group ($n = 29$) of preschoolers ($Mean = 48.74$ months, $SD = 7.4$). The intervention resulted in significant pretest-posttest gains in FMS development of preschoolers who received motor skill instruction. The experimental participants received a total 420 min of object-control (OC) skill instruction and 130 min of locomotor instruction to bring about these changes. Valentini and Rudisill (2004b) examined the effects of both MMC ($n = 19$) and LA ($n = 20$) motor skill instructional climate in kindergarteners classified as disadvantaged. The participants' mean age was 60.43 months ($SD = 6.6$). Participants received 720 min of motor skill instruction over 12 weeks, and the results showed that both climates resulted in positive pretest-to-posttest changes in OC skill development, but only the MMC participants demonstrated significant gains in their locomotor skills (Valentini & Rudisill, 2004b). Valentini and Rudisill (2004b) also incorporated a 6-month follow-up test to assess the long-term effect of the intervention on skill development and learning, which is not commonly seen in motor development studies. Over time, the mastery-climate participants maintained their positive changes in skill development. Martin et al. (2009) replicated Valentini and Rudisill's (2004b) study in a naturalistic physical education environment with physical education teachers as instructors. The results demonstrated that MMC was more beneficial in promoting FMS development in kindergarteners compared to more traditional LA instructional approaches.

Prior studies have compared MMC to an LA instructional climate (Martin et al., 2009; Valentini & Rudisill, 2004a, 2004b). These studies implemented a performance-oriented, low-autonomy, instructional climate where children's performance outcomes were compared to others within the intervention and were based on a competitive model (e.g., instructors, in front of the class, would recognize a child who outperformed others and experienced great success). This LA performance-oriented climate does not align with the notion of effective instruction as seen in the pedagogical literature (Rink, 2006).

Given that preschool children who are at-risk are delayed in FMS development (Goodway & Branta, 2003; Hamilton et al., 1999; Valentini & Rudisill, 2004b), it is imperative to better understand the influence of various instructional climates in remediating FMS development. Clearly, MMC has the potential to promote motor skill development, but to date no motor skill intervention studies have explored the effects of MMC in preschool-age children. The purpose of this study was to investigate the effects of two 9-week (18 sessions, 30 min per session) instructional climates, LA and MMC, on OC skills in preschoolers who were at-risk of developmental delays and

poor health. Based on the literature, it was hypothesized that (a) participants would demonstrate developmental delays in OC skills before the motor skill intervention, (b) both the LA and MMC group participants would demonstrate significantly better OC skill scores than the comparison participants over time (i.e., from pretest to retention test), and (c) the MMC participants would demonstrate significantly better OC skills scores following the intervention and over time compared to the LA and comparison participants. This study is vital because no studies have examined the effect of a MMC motor skill intervention in a preschool setting. It is also unique because a retention test was incorporated to assess the effectiveness of the motor skill intervention over time.

Method

Settings and Participants

This study took place in two accredited Head Start (National Association for the Education of Young Children) centers that were part of the same Head Start program in a large urban Midwestern city. Two separate centers were used to avoid intervention contamination effects between the intervention groups and the comparison group (intervention site, $n = 84$, and comparison site, $n = 40$). Each site had identical admission requirements based on (a) scores on the preschool readiness test, (b) socioeconomic status, and (c) the number of risk factors presented by the participant. Eligibility criteria for the compensatory program were in line with State Board of Education guidelines, with preschoolers demonstrating a variety of child risk factors (e.g., single-headed household, poverty, parental unemployment, low parental educational attainment, lack of a stable home environment or homelessness, prenatal drug exposure, incarceration of a parent, and loss of parent/sibling). These risk factors contributed to the preschoolers being considered at-risk of developmental delays if early intervention was not provided (IDEIA, 2005).

A total of 124 preschoolers participated in this study. Over the course of the intervention, four (i.e., 1 MMC, 3 LA) preschoolers withdrew from the preschool program and thus the study. Later, from posttest to the 9-week retention test, three more participants (from MMC group) withdrew from the preschool program, resulting in a total of 117 participants completing the entire study from pretest to retention test. At the intervention site, preschoolers were randomly assigned to one of two instructional approaches (LA or MMC). The LA intervention participants who completed the study ($n = 38$) consisted of 18 girls and 20 boys (M age = 46.6 months, $SD = 5.9$), and the MMC intervention participants who

completed the study ($n = 39$) consisted of 20 girls and 19 boys (M age = 47.6 months, $SD = 7.5$). At the comparison site, 40 preschoolers consisting of 16 girls and 24 boys (M age of 48.3 months, $SD = 5.0$) made up the comparison group. There were no significant age differences between groups, $F(2, 114) = 3.22$, $p = .077$.

Instrumentation

The dependent variable for the study was OC skill scores as assessed through the OC subscale test of the Test of Gross Motor Development–2nd Edition (TGMD-2; Ulrich, 2000). The TGMD-2 is a well validated criterion- and norm-referenced standardized test that quantitatively assesses the FMS performance of children between the ages of 3 and 10 years (Ulrich). All participants were videotaped performing two trials of the six skills (i.e., catch, dribble, kick, overhand throw, strike, and underhand roll) that make up the TGMD-2 OC subscale. Each skill was evaluated on three to five performance criteria. For example, one performance criterion for kicking was a rapid and continuous approach to the ball. If participants demonstrated the behavior, they received a 1; if they did not demonstrate the behavior, they received a 0. The lowest possible raw score was a 0 and the highest was 48. OC skill raw scores were used for data analyses, because the participants were of similar age. Higher raw scores represent better developed OC skills, while lower raw scores indicated the absence of critical elements.

OC raw scores were converted to percentile ranks based on the participant's raw score, sex, and age. The percentile ranks indicated whether participants were developmentally delayed in OC motor skill proficiency. According to federal guidelines, ranks at or below the 30th percentile indicate developmental delays (IDEIA, 2005). Standardized procedures for the TGMD-2 were followed for each participant. The primary researcher coded all of the TGMD-2 OC performances through videotape analysis, and interrater reliability checks were randomly completed on 33% of the pretest, posttest, and retention test data by a trained, blinded (not aware of group membership or testing interval), independent rater. Interrater reliability was 98.0% for pretest, 97.6% for posttest, and 97.9% for retention test. In addition to interrater reliability, the primary researcher also conducted intrareliability checks on 33% of the data. Intrarater reliability was 99% for pretest, 98.8% for posttest, and 98.7% for retention test.

Design and Intervention Implementation

All children in the LA, MMC, and comparison groups participated in the same Head Start curriculum. The curriculum consisted of instruction to improve social/emotional growth, motor skills, cognitive ability,

and language and literacy development. In terms of motor skills, the content heavily focused on fine motor skills (i.e., scissor cutting, handwriting, and drawing) and an unstructured recess session with no formal instruction in gross motor skills. Gross motor activity consisted of playground recess activity, such as swinging, climbing, and playing with balls.

Comparison Group Sessions. Preschoolers in the comparison group participated in the typical Head Start curriculum. They received 30 min of unstructured recess 2 days per week for 9 weeks, totaling 18 sessions. The free play sessions took place on a playground with various types of playground equipment (e.g., slides, balance beams, monkey bars, balls, and swings) and did not involve any kind of instruction or direction from the teacher. During unseasonable weather, the session occurred inside the center's multipurpose room. This unstructured recess session was part of the typical Head Start curriculum. The primary researcher was present for observation of all sessions to ensure that no form of instruction was occurring and to minimize potential experimenter effects.

OC Interventions. The participants at the intervention site received a 30-min LA or MMC OC skill intervention 2 days per week for 9 weeks, totaling 18 motor skill sessions. Each session consisted of a 2–3 min warm-up activity, followed by 24 min of motor skill instruction, and 2–3 min closure activity. The total amount of time for motor skill instruction across the 9 weeks was 432 min. This allocation of instructional time aligns with the time identified by previous motor skill studies to promote OC skill change (Conner-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Hamilton et al., 1999).

To examine the influence of the instructional climate on OC skill development, many aspects of the LA and MMC were kept identical. The LA and MMC instructional approaches used identical lesson content, task progressions, motor skill activities, critical cue words, instructors of the same sex and race, instructional facilities, and equipment. The instructors for both interventions were the primary investigator and a doctoral student in motor development. In an attempt to control for experimenter effects, instruction was counterbalanced, resulting in each instructor teaching each OC skill three times across the intervention. Both motor skill interventions were designed to ensure high-quality instruction. The creation of lesson plans for the intervention took a developmental approach for each task, reflecting the participants' current level of development. Additionally, content analysis (a process of breaking down the task through extension, refinement, and application) was used to establish task progression (Rink, 2006). The content analyses ensured that the motor skill intervention maintained the relationship among efficiency, effectiveness, and adaptability to meet the needs of the participants and the goals of the study (Rink, 2006). For each lesson, the primary researcher developed

a series of task progressions, which included three levels of progression (i.e., low, medium, and high) for each skill. For example, a task progression for striking might have entailed (a) striking a balloon with the palm of the hand (low), (b) striking a stationary ball with a foam bat (medium), and (c) striking a ball suspended in the air or a tossed ball with a bat (high). Thus, within an individual lesson, children could participate in two different skills, each with three levels of progression.

The primary researcher developed all lesson plans for the intervention and external evaluators ensured the quality of content and validity of the task progressions. The lesson plans were also pilot tested in various motor skill intervention studies and lab settings for preschool-age children before the start of the intervention.

Low-Autonomy Instructional Climate. The LA instructional climate was characterized by the students following the guidance and directions of the instructor. After the warm up was completed, the LA participants were randomly assigned, in order to minimize group effects, to one of the two daily skill stations for 12 min. At each skill station, the instructor introduced the activities by providing clear directions, teacher-student demonstration, and cue words for the task or activities that aligned with the critical elements to be performed as written in the lesson plan. Within this climate, children were assigned to a specific level of task progression by the teacher, who based the progression on the child's current OC skill performance. The children moved from one task to another when the teacher perceived that he or she was ready to move to the next level. When the station time expired, the learners were cued to clean up their station and proceed to the next station. The procedure was then repeated for the other skill station. Overall, each child received 12 min of instruction for two OC skills on each day of instruction. By the end of the intervention, the participants received 72 min of instruction for each of the six OC skills (totaling 432 min of instruction). The implementation of the LA climate was focused on meeting what the pedagogical literature would call high-quality instruction or best practice in physical education (Rink, 2006).

Mastery Motivational Climate. The MMC was identical to the LA instructional approach in terms of lesson content, task progressions, motor skill activities, critical cue words, instructors, instructional facilities, and equipment, but differed according to its delivery and instructional alignment with the TARGET dimensions. Mastery motivational climate is a "student-directed" approach that allowed students to navigate independently through activity stations for a period of 24 min. Each participant had the opportunity to participate in the identical activity stations that were present in the LA instructional climate. However, the learners were able to independently choose a skill, level of difficulty within the activity, and the amount of time they engaged in a particular skill.

Learners experienced independence, while the instructor served as a facilitator of learning (Ames, 1992b). Following the warm-up activities, participants were dispersed and independently navigated through the MMC OC skill intervention for a total of 24 min.

The MMC instructional approach aligned with the instructional strategies consistent with the dimensions of TARGET (Ames, 1992b). The task aspect of TARGET involved the content and sequencing of the motor curriculum, as well as the difficulty of the task. A variety of developmentally appropriate motor activity stations with various levels of challenge were provided in both climates, the participants in the MMC groups were given the opportunity to independently modify or extend a task to meet their needs. Students were challenged, and tasks reflected the array of the learners' ability. This enabled students to move up and down task continua/progressions to meet their interests and developmental needs. During an MMC instructional session, students had the option to engage in one of two OC skill stations, each with three activities at different levels of difficulty, resulting in a total of six activity choices. Regarding the authority dimension, participants in the MMC were allowed to independently choose activities and to actively participate in the process of establishing rules and decision-making. Learners chose where they went, how long they stayed, and with whom they engaged. In relation to the recognition structure, emphasis was placed on student progress, effort, and improvement. Feedback was provided by the teacher and externally through the motor activity. For example, if a child threw a ball and hit the target, a noise would sound. A unique form of recognition that MMC participants received included the use of the stickers for their portfolio booklet. As the children accomplished the critical element of a skill, they placed a sticker on the corresponding element in their portfolio. Grouping, the fourth aspect of TARGET, was established by the children having the freedom to work in heterogeneous small groups, with peers, or individually. They changed their grouping structure as often as they liked. The group was not rigidly set, but was constantly adaptive as children selected different activities and choose with whom they wanted to work. The students also received weekly evaluation of accomplishments, efforts, and performance. Each participant was provided with a booklet that contained diagrams of the six OC skills. The booklet served as an evaluation of student progress. At the end of the week, a sticker was placed on the diagram to evaluate and reward successful demonstration of a skill's critical elements. For example, the critical elements of throwing included stepping with opposition, trunk rotation, and a backswing. When a participant displayed any of these actions, a sticker was placed on the corresponding area of the diagrams. The time dimension of TARGET pertained to the amount of time allocated to learning select OC skills, which was a

total of 24 min per intervention session. By the end of the intervention, the participants received a range of 0–144 min of instruction for each of the six OC skills (totaling 432 min of instruction).

Manipulation Checks

Manipulation checks were conducted to ensure that the two interventions were delivered according to a set of desired specifications for effective instruction and TARGET structure of MMC (Martin et al., 2009; Valentini & Rudisill, 2004a, 2004b). A fading schedule was followed. All intervention sessions were videotaped. Intervention integrity data were collected at every station and at every lesson for the first 2 weeks of the intervention and then again in Weeks 5 and 9. Integrity checks occurred on 8 (45%) of the 18 OC skill instructional sessions. Checks occurred through videotape analyses and revealed that the instructional sessions aligned with the set lesson plans/objectives, goals of the intervention, and elements of effective instruction. The mean agreement across the fading schedule was 98% for LA and 97% for MMC. The only adjustment variation within the instructional climates resulted from the shortening or eliminating of the warm-up or cool-down activities to ensure that a total of 24 min of motor skill instruction was provided. There was 100% agreement for the TARGET structures within the instructional climates.

Feedback is another critical component of motor skill learning (Rink, 2006). For the purpose of the study, the learner was provided with five different types of feedback (i.e., general, positive, specific, modeling, and manual manipulation). To ensure that both the LA and MMC groups received equal amounts of feedback, each instructor wore a wireless microphone during the motor skill instructional session that recorded their vocal expression. A tally system then was used to code the total amount of feedback and the total percentage for each instructional climate. In all, feedback for 8 (45%) of the 18 OC skill instruction sessions was coded. Multivariate analysis confirmed that nonsignificant differences were present between the amounts and type of feedback received by the LA or MMC groups, $F(1, 10) = .00, p < .98, \eta^2 = .00$. According to the findings, the LA and MMC groups received statistically similar amounts of feedback.

Research Design. The research design for this study was pretest-posttest randomized comparison group design with a retention test. Participants at the intervention site were randomly assigned to an LA or MMC instructional climate. Several other measures were taken to ensure randomization of participants during this study at the intervention site. Due to the number of participants in each intervention group, two LA and two MMC OC skill sessions were conducted each day of the study. This also fulfilled the mandated teacher-to-student ratio require-

ment for instruction in the Head Start center (1:12). Participants from each intervention group were randomly assigned on a day-to-day basis to one of the two LA and MMC 30-min OC skill sessions. Additionally, on each day of the intervention, LA participants were randomly assigned to one of the two OC skill task stations to eliminate group effects. Within the MMC approach, randomization occurs naturally through the alignment of the instructional climate to authority and grouping within the TARGET structure, where participants independently decided their own grouping behaviors.

Procedures

After we received permission from the city's Head Start council the center directors, classroom teachers, and the Institutional Review Board for Research Involving Human Subjects to conduct the study, we obtained informed parental consent and participant assent for the 124 children. Participants were assessed using the OC subscale of the TGMD-2 before starting the intervention. This was followed by the 9-week LA or MMC OC skill intervention as described. Posttest data were collected in the week following the 9-week intervention. Nine weeks following the LA or MMC OC skill intervention, retention tests were completed on the participants' OC skill performance. During the course of this study, all intervention and testing sessions were videotaped and the standardized testing protocol of the TGMD-2 was followed (Ulrich, 2000).

Data Analysis

Descriptive statistics (means, standard deviations, percentiles, and frequencies) were used to assess the

initial developmental status of participants' OC skills. A 3 Treatment (LA, MMC, Comparison) $\times$ 3 Time (Pre, Post, Retention) analysis of variance (ANOVA) with repeated measures on time was conducted to examine the influence of the motor skill intervention, LA and MMC, on OC skill development. Where a significant interaction effect was reported, a follow-up Tukey analysis was performed. If significant, simple main effects follow-up tests were completed to examine whether there were significant differences between groups and significant differences within groups over time. Statistical Package for the Social Sciences (SPSS) 15.0.1 for Windows (SPSS Inc., Chicago, IL) was used, and alpha was set at $p = .05$ for all analyses.

Results

Baseline Measures

Figure 1 displays the OC skill subscale raw scores for the pretest, posttest, and retention test for the three treatments. These raw scores were translated into percentile ranks, and they show that groups demonstrated developmental delays (at or below the 30th percentile; IDEIA, 2005) in OC skill proficiency before the intervention. Mean OC skill percentile ranks were the 23rd percentile for the LA group, 19th percentile for the MMC participants, and 18th percentile for the comparison participants. A review of the frequency data revealed that, overall, 81% of the preschoolers were developmentally delayed in their OC skills. The specific breakdown across the instructional climates and comparison group were as follows: 76% of LA, 86% of MMC, and 82% of the comparison group.

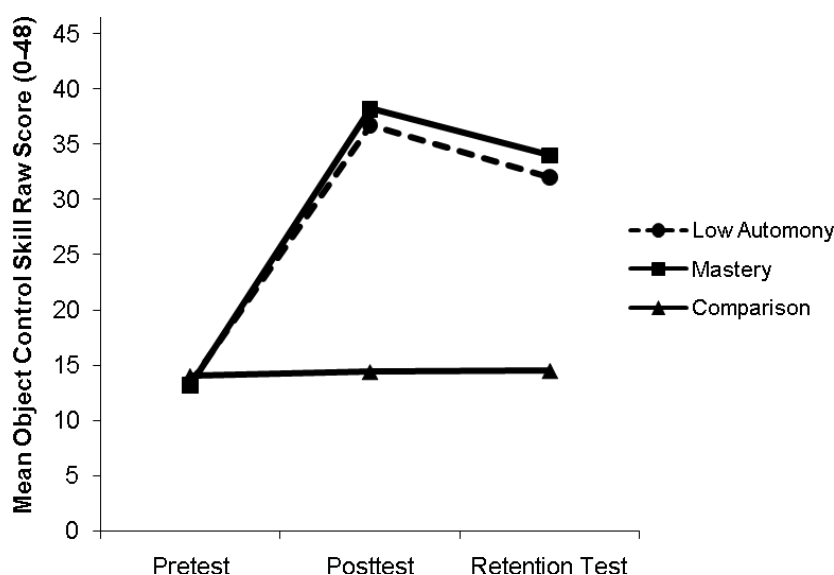


Figure 1. Changes in mean object control skill raw score over time by treatment.

Influence of Instructional Climates on OC Skill Devolvement

The ANOVA revealed significant main effects of time, $F(2, 228) = 647.96, p = .001, \eta^2 = .85$; treatment, $F(2, 114) = 76.83, p = .001, \eta^2 = .57$; and a significant Treatment $\times$ Time interaction, $F(4, 228) = 156.13, p = .001, \eta^2 = .73$ (see Figure 1). In regard to the Treatment $\times$ Time interaction, 73% of the pretest to retention changes in OC scores was attributed the OC skill instructional climate.

Between-Group Differences. The simple main-effects tests revealed that no statistically significant differences, $F(2, 114) = .28, p = .76$, were present before the start of the intervention between LA ($M = 13.39, SD = 6.34$), MMC ($M = 13.14, SD = 5.03$), and comparison ($M = 14.00, SD = 4.58$) participants. At the posttest, statistically significant differences were found in OC scores, $F(2, 114) = 156.56, p = .001$. Post hoc Tukey analysis confirmed that LA ($M = 36.72, SD = 8.09$) and MMC ($M = 38.19, SD = 7.21$) participants were not statistically different ($p = .60$) posttest OC scores, and those scores were significantly better than those of the comparison participants ($p = .001; M = 14.38, SD = 4.51$). Main effects analysis was also conducted on retention test scores. These findings revealed statistically significant differences for retention test scores, $F(2, 114) = 96.06, p = .001$, between groups. The post hoc Tukey analysis demonstrated that LA ($M = 32.00, SD = 8.43$) and MMC ($M = 33.97, SD = 7.18$) participants were not statistically different ($p = .42$) in OC scores and those scores were significantly higher than the comparison group ($p = .001; M = 14.48, SD = 4.60$).

Within-Group Differences. In addition to examining group differences in OC skills, it was valuable to examine changes in OC skills from pretest to posttest, posttest to retention test, and pretest to retention test using paired sample t tests. A Bonferroni adjustment of the alpha was calculated at .016 ($p/3$) to control for a Type I error. Paired sample t tests revealed that OC scores improved significantly from pretest to posttest for both the LA, $t(37) = -23.09, p = .001$, and MMC, $t(38) = -25.56, p = .001$, participants, while the comparison group demonstrated no change in OC scores over time, $t(39) = -1.403, p = .17$. The LA and MMC interventions were effective in improving the participants' OC skill scores, while no changes were present in the comparison group. As expected, the comparison group OC scores remained the same from posttest to retention test, $t(39) = -.12, p = .90$. However, examination of posttest to retention test OC scores for the LA and MMC groups revealed some interesting findings. Both the LA, $t(37) = 7.61, p = .001$, and MMC, $t(38) = 7.16, p = .001$, group OC scores significantly decreased from posttest to retention test, indicating a drop in OC performance from the end of the intervention to the retention test. As the LA and MMC scores dropped from posttest to retention test, it was necessary to examine whether OC scores

were significantly different from pretest to retention test, thus indicating that the intervention was effective overall. Paired sample t tests from pretest to retention test revealed that there were significant improvements in OC scores for both the LA, $t(37) = -18.79, p = .001$, and MMC, $t(38) = -21.48, p = .001$, participants, while no differences were present from pretest to retention test for the comparison group, $t(39) = -.57, p = .57$. Specifically, LA participants' OC scores improved from pretest ($M = 13.50, SD = 6.45$) to retention ($M = 32.00, SD = 8.43$), and similar positive changes occurred for the MMC participants from pretest ($M = 13.49, SD = 5.06$) to retention test ($M = 33.97, SD = 7.18$).

Discussion

Baseline Measures of OC Skills

The findings from this study support our first hypothesis, that participants were "below average" in terms of their OC skill proficiency, characterizing them as being developmentally delayed (IDEIA, 2005). In terms of percentile ranks, 81% of the preschoolers demonstrated OC skill percentiles below the 30th percentile compared to their same-age peers. This was not surprising given that developmental delays in FMS have been found in similar populations (Conner-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Hamilton et al., 1999; Valentini & Rudisill, 2004a). The literature reports that children who are disadvantaged and at-risk have limited places in their communities and homes for play and physical activity (Branta & Goodway, 1996; Goodway & Smith, 2005). These environmental constraints could have a detrimental effect on children's OC development. Informal observations by the researcher and anecdotal reports from the classroom teachers indicated that environmental constraints could be a factor that led to delayed motor development in the participants. The Head Start centers (a) lacked appropriate motor skill equipment that would assist with the acquisition of OC skills, (b) had no structured physical activity or movement experience integrated into the curriculum, and (c) had classroom teachers who provided little, if any, instruction or feedback related to motor skill development during recess. Additionally, reports from the classroom teachers suggested that many of the participants lived in unsafe communities where outside play was limited. These factors may have contributed to the preschoolers' current OC skill development and should lead future researchers to investigate the underlying mechanisms that account for these developmental delays along with potential connections between environmental constraints and skill development.

The Influence of Instructional Climates on OC Development

Based on the literature (Goodway & Branta, 2003; Hamilton et al., 1999; Martin et al., 2009; Valentini & Rudisill, 2004a, 2004b) it was hypothesized that (a) both the LA and MMC instructional climates would result in more proficient OC skill scores compared to the participants in the comparison group, and (b) MMC participants would demonstrate significantly better OC skill scores compared to the LA group. The first hypothesis was supported, but the second one was not. Both the LA and MMC instructional climates were equally beneficial in terms of OC skill learning. Martin et al. explored instructional climates in naturalistic settings and found that an MMC instructional climate resulted in more proficient OC skills compared to an LA or teacher-centered climate. Valentini and Rudisill (2004b) also found that a mastery climate was more beneficial in terms of locomotor skill development. The findings from this study demonstrated that significant motor development gains are obtained from well-designed and developmentally appropriate motor skill interventions regardless of instructional climate. Specifically, the LA and MMC participants' OC scores increased on an average of 18.50 points and 20.48 points on the TGMD-2, respectfully. At the retention test, the LA and MMC participants no longer demonstrated developmental delays in their OC skill proficiency. At pretest, the LA participants demonstrated an OC skill rank at the 19th percentile, but by the retention test they ranked in the 77th percentile. MMC participants improved from the 18th percentile to the 84th percentile.

Few motor skill development studies in this population have examined motor skill learning over time (Valentini & Rudisill, 2004b). From a learning perspective, this decrease should be seen as "practically insignificant" due to the changes seen across the intervention. Overall, the participants demonstrated significant improvements over time. The effect size confirms that 73% of the variance associated with OC skill scores were attributed to the LA and MMC instructional climates and intervention. Over time, the LA and MMC participants demonstrated significant improvements in their OC skill development following instruction. It was speculated that the children's motor skill performance decreased over the 9-week period due to a lack of opportunity to practice. The literature illustrates that practice is vital as it relates to motor skill learning (Wulf, 1991). Following the intervention, the children were on winter break for 3 weeks, and on their return from the break, they received no opportunity to practice in a motor learning setting before the retention test.

Our findings showed that the comparison learning environments (i.e., unstructured recess), do not result in OC skill learning. Participants were given the opportunity to interact with various types of equipment that can promote motor skill development, but they demonstrated no

positive or developmental gains in OC skill scores over time. This finding, along with the decrease seen in the LA and MMC participants' scores from posttest to retention test, adds evidence for the need for early learning centers to provide regular, planned, and well-designed movement programs.

This study aligned with the *Active Start* guidelines, which recommend structured and planned movement experiences that promote motor skill development and physical activity in these settings (NASPE, 2002). Overall, the instruction that was implemented in the study would be considered high-quality and developmentally appropriate, which seems to be the key to motor skill learning. Preschoolers received a total of 432 min of motor skill instruction across a 9-week period that used a task progression (Rink, 2006) to design instruction to meet the developmental needs of participants. Each lesson had a goal and objective and included all of the critical components (i.e., critical cue words, clear instructions, demonstration and modeling, checking for understanding, and feedback) for an effective movement program (Gagen & Getchell, 2006; Goodway & Branta, 2003; Martin et al., 2009; Rink; Valentini & Rudisill, 2004b). The present findings support the idea that planned, teacher-facilitated instruction that is developmentally and instructionally appropriate leads to skill learning regardless of instructional climate. Therefore, in order to remediate potential delays in motor skill proficiency, it is imperative that early childhood teachers and administrators know the need for, and design of, planned and structured early-movement programs. Early-learning centers should consider the implementation of policies that mandate appropriate movement experiences for young children.

It should be noted that the present study (Part I) examined the effect of an MMC or LA instructional climate on one "isolated variable," OC skill learning. However, this paper may not present the entire picture relative to MMC. Ames (1992a) suggested that MMC promotes independence within a learner, leading to various positive psychological responses. Weiss (1995) supports the idea that MMC provides learners the opportunity to enjoy movement experiences while feeling better about their competence. Others researchers have found similar psychological benefits relative to MMC (Parish & Treasure, 2003; Solmon, 1996; Treasure & Roberts, 2001). Part II of this study examined the effect of instructional climates on psychological responses in this population (Robinson, Rudisill, & Goodway, 2009).

Future Research and Conclusions

This study and other motor intervention studies (Conner-Kuntz & Dummer, 1996; Goodway & Branta, 2003; Hamilton et al., 1999; Valentini & Rudisill, 2004a, 2004b) used instructors who were experts in the field of

motor development and who are highly experienced in motor skill interventions. While the quality and impact of these intervention programs is clear, it may be difficult to generalize the findings to more typical motor development programs with regular teachers. Martin et al. (2009) demonstrated that it is possible to use classroom teachers in naturalistic settings in motor skill development research. Thus, it is imperative for future research to examine the influence that trained preschool teachers have on providing high-quality motor skill instruction and the impact this has on motor skill development of at-risk preschoolers.

In terms of skill learning and development, it may be beneficial to explore the relationship between different instructional climates and sex on FMS development in addition to participants' engagement in motor learning environments (e.g., opportunities to respond or successful and unsuccessful practice trials). This could be extremely important in MMCs where children independently decide their learning pathways related to time, task, and groups. By tracking children during motor skill instruction, researchers would get an understanding of how and where each child spends time and engages in skill learning. Lastly, most motor skill interventions assess the overall change in performance over time (Conner-Kuntz & Dummer, 1996; Hamilton et al., 1999; Martin et al., 2009; Valentini & Rudisill, 2004a, 2004b) and not the specific changes within each skill. Future studies should address how, as a result of an intervention, a learner improves within each specific skill (i.e., changes in specific performance criteria for the TGMD-2).

Overall, this study expands the motor development and pedagogical literature by demonstrating that effective instruction leads to student *learning* regardless of an LA or MMC instructional climate. If preschoolers who demonstrated developmental delays in their OC skill proficiency can acquire positive developmental changes with 432 min of OC skill instruction, the possibilities are endless as it relates to movement educators who see children on a regular basis. Most importantly, early childhood administrators need to be aware of the need for early movement experiences in young learners. "FMS are the ABCs of movement" (Goodway & Robinson, 2006, p. 2), and it is essential that children acquire a strong foundation motorically (Clark, 2007). If children are unable to move with proficiency, they might experience problems later in life related to their ability to engage in various forms of games, sports, and physical activity.

References

- Ames, C. (1992a). Achievement goals, motivational climate, and motivational processes. In G. C. Roberts (Ed.), *Motivation in sport and exercise* (pp. 161–176). Champaign, IL: Human Kinetics.
- Ames, C. (1992b). Classrooms: Goals, structures, and student motivation. *Journal of Educational Psychology*, 84, 261–271.
- Branta, C. F., & Goodway, J. D. (1996). Facilitating social skills in urban children through physical education. *Peace and Conflicts: Journal of Peace Psychology*, 2, 305–319.
- Clark, J. E. (2007). On the problem of motor skill development. *Journal of Physical Education Recreation & Dance*, 78(5), 39–44.
- Clark, J. E., & Metcalfe, J. S. (2002). The mountain of motor development: A metaphor. In J. E. Clark & J. H. Humphrey (Eds.), *Motor development: Research and review: Vol. 2* (pp. 62–95). Reston, VA: National Association for Sport and Physical Education.
- Conner-Kuntz, F., & Dummer, G. (1996). Teaching across the curriculum: Language-enriched physical education for preschool children. *Adapted Physical Activity Quarterly*, 13, 302–315.
- Epstein, J. (1988). Effective schools or effective students? Dealing with diversity. In R. Hawkins & B. MacRae (Eds.), *Policies for America's public schools* (pp. 89–126). Norwood, NJ: Ablex.
- Gagen, L. M., & Getchell, N. (2006). Using "constraints" to design developmentally appropriate movement activity for early childhood education. *Early Childhood Education Journal*, 34, 227–232.
- Goodway, J. D., & Branta, C. F. (2003). Influence of a motor skill intervention on fundamental motor skill development of disadvantaged preschool children. *Research Quarterly for Exercise and Sport*, 74, 36–47.
- Goodway, J. D., & Robinson, L. E. (2006). SKIPPING toward an active start: Promoting physical activity in preschoolers. *Beyond the Journal: Young Children*, 61, 1–6.
- Goodway, J. D., & Smith, D. W. (2005). Keeping all children healthy: Challenges to leading an active lifestyle for preschool children qualifying for at-risk programs. *Family and Community Health*, 28, 142–155.
- Hamilton, M., Goodway, J. D., & Haubenstricker, J. (1999). Parent-assisted instruction in a motor skill program for at-risk preschool children. *Adapted Physical Activity Quarterly*, 16, 415–426.
- Individuals With Disabilities Education Improvement Act of 2004. (2004, December 3). 108th Congress, P.L. 108-446, 118 Stat. 2647.
- Martin, E. H., Rudisill, M. E., & Hastie, P. A. (2009). Motivational climate and fundamental motor skills performance in a naturalistic physical education setting. *Physical Education and Sport Pedagogy*, 14, 227–240.
- National Association for Sport and Physical Education. (2002). *Active start: A statement of physical activity guidelines for children birth to five years*. Reston, VA: Author.
- Newell, K. M. (1984). Physical constraints to development of motor skills. In J. Thomas (Ed.), *Motor development during preschool and elementary years* (pp. 105–120). Minneapolis, MN: Burgess.
- Newell, K. M. (1986). Constraints on the development of coordination. In M. G. Wade & H. T. A. Whiting (Eds.), *Motor development in children: Aspects of coordination and control* (pp. 341–360). Dordrecht, The Netherlands: Nijhoff.

- Parish, L. E., & Treasure, D. C. (2003). Physical activity and situational motivation in physical education: Influence of the motivational climate and perceived ability. *Research Quarterly for Exercise and Sport*, 74, 173–182.
- Robinson, L. E., Rudisill, M. E., & Goodway, J. D. (2009). Instructional climates in preschoolchildren who are at-risk. Part II: Perceived physical competence. *Research Quarterly for Exercise and Sport*, 80, 543–551.
- Rink, J. E. (2006). *Teaching physical education for learning* (5th ed.). New York: McGraw-Hill.
- Seefeldt, V. (1980). Developmental motor patterns: Implications for elementary school physical education. In C. Nadeau, W. Holliwell, K. Newell, & G. Roberts (Eds.), *Psychology of motor behavior and sport* (pp. 314–323). Champaign, IL: Human Kinetics.
- Solomon, M. (1996). Impact of motivational climate on student's behaviors and perceptions in a physical education setting. *Journal of Educational Psychology*, 88, 731–738.
- Theeboom, M., De Knop, P., & Weiss, M. R. (1995). Motivational climate, psychological responses, and motor skill development in children's sports: A field-based intervention study. *Journal of Sport & Exercise Psychology*, 17, 294–311.
- Thelen, E. (1983). Learning to walk is still an "old" problem: A reply to Zelazo. *Journal of Motor Behavior*, 15, 139–161.
- Thelen, E., & Ulrich, B. D. (1991). Hidden skills: A dynamical systems analysis of treadmill stepping during the first year. *Monographs of the Society for Research in Child Development*, 56, (1, Serial No. 223).
- Treasure, D. C., & Roberts, G. C. (2001). Student's perceptions on the motivational climate, achievement beliefs and satisfaction in physical education. *Research Quarterly for Exercise and Sport*, 72, 165–175.
- Ulrich, D. A. (2000). *The test of gross motor development* (2nd ed.). Austin, TX: Pro-ed.
- Valentini, N. C., & Rudisill, M. E. (2004a). An inclusive mastery climate intervention and the motor skill development of children with and without disabilities. *Adapted Physical Activity Quarterly*, 21, 330–347.
- Valentini, N. C., & Rudisill, M. E. (2004b). Motivational climate, motor skills development, and perceived competence: Two studies of developmental delayed kindergarten children. *Journal of Teaching in Physical Education*, 23, 216–234.
- Weiss, M. R. (1995). Children in sports: An educational model. In S. M. Murphy (Ed.), *Sport psychology interventions* (pp. 36–69). Champaign, IL: Human Kinetics.
- Wulf, G. (1991). The effect of type of practice on motor learning in children. *Applied Cognitive Psychology*, 5, 123–134.

Authors' Notes

This manuscript is based on a doctoral dissertation completed by the first author as partial fulfillment of the requirements for the Doctor of Philosophy degree at The Ohio State University (OSU). This study was financially supported by the Pi Lambda Theta Educational Endowment and OSU's Alumni Grants for Graduate Research and Scholarship. A portion of this study was presented at the 2007 conference of the North American Society for the Psychology of Sport and Physical Activity, San Diego, CA. A special "thank you" is directed to the head start centers, teachers, children, and graduate/undergraduate students (Frankie Collins, Talitha Crile, Lori Devin, Robin Dunn, Erica N. Johnson, O'Bryan Landry, and Youg Yuan) who contributed so much of their time and energy to this project. Thanks also go to the first author's colleagues at Auburn University, Nancy Getchell, and two anonymous reviewers for their helpful comments on this manuscript. Please address all correspondence concerning this article to Leah E. Robinson, Department of Kinesiology, Auburn University, Auburn, AL 36849-5323.

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