

Effects of Motor Skill Instruction on Fundamental Motor Skill Development

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The influence of a 9-week instructional program on locomotor and object control skill development of preschoolers who are at risk of developmental delay was investigated. The motor skill instruction group ($n = 33$) received 18, 35-min lessons; the comparison group ($n = 30$) received the regular prekindergarten program. Pre and posttest scores on the locomotor and object control subscales of the Test of Gross Motor Development (Ulrich, 1985) were obtained. A Group by Gender MANOVA with repeated measures yielded a significant Group by Time interaction. The intervention group performed significantly better than the comparison group from pre to posttest for both locomotor and object control skills. Additionally, this group had significantly higher posttest scores than the comparison group.

Children who grow up in poverty in disadvantaged environments constitute 19% of children in the United States of America (AECF, 2002). These children often face many challenges to graduate from school and meet typical developmental outcomes (AECF, 2002). Many young children who grow up in poverty are eligible for compensatory educational services through funding of at-risk programs for preschool children. Public Law 105-17, the Individuals with Disabilities in Education Act (IDEA, 1997), mandates that services be provided for disadvantaged individuals who are at risk of having substantial developmental delays if early intervention services are not provided. Specifically, the law identifies a need to improve outreach to low-income, minority, rural, and other underserved populations eligible for assistance. Incorporated within this legislation is the notion that a child who is exposed to risk factors may demonstrate a greater probability of developmental delay or educational failure.

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Risk is a probabilistic concept and fluid phenomenon suggesting that the presence of one or more variables results in a higher likelihood that a particular child outcome will occur (AECF, 2002; Hrcir & Eisenhart, 1991; Kazdin, 1995). Risk factors are often composed of child factors such as low birth weight, small for gestational age, prenatal exposure to drugs or alcohol, limited prenatal care, and excessive irritability or tremulousness on the part of the child (Kazdin, 1995). Environmental risk factors include family factors such as low maternal education, poverty, lack of stable residence or homelessness, and history of abuse or acute family crisis (Kazdin, 1995). Kazdin (1995) also suggests that school factors should be considered in determining at-risk status including issues such as poor setting or reduced access to school programs. The influence of risk factors on child development can be both cumulative and have intergenerational transmission (Kazdin, 1995; Ramey & Ramey, 1990). For example, a child who is raised in poverty by a single parent with low educational achievement often goes on to become an uneducated young mother raising her own child in poverty.

The Centers for Disease Control and Prevention (CDCP) have identified that children who live in poverty and/or are from minority populations (including those at risk of developmental delay) are underserved by current physical activity programming and a target population for which more information is needed (USDHHS, 1995, 1996, 2000). National physical activity data suggests that income (low) and race (Hispanic and/or African American) are associated with higher levels of sedentary behaviors and chronic disease rates (USDHHS, 1995, 1996, 2000). Given these data, it would seem that young Hispanic children who are at risk of developmental delay may face challenges to appropriate motor development and later physical activity.

Fundamental motor skills are commonly considered the building blocks to more advanced movement skills and specific sport skills (Burton & Miller, 1998; Haywood & Getchell, 2002; NASPE, 2002; Payne & Isaacs, 2002; Seefeldt, 1980). Fundamental motor skills help children control their bodies, manipulate their environment, and form complex skills and movement patterns involved in sports and other recreational activities (Davis & Burton, 1991; Payne & Isaacs, 2002; Seefeldt, 1980). Seefeldt has hypothesized that if competency is not attained in fundamental motor skills, children will not be able to break through a hypothetical "proficiency barrier" and engage in sports and games. That is, poor performance in these skills may jeopardize future physical activity. Thus, fundamental motor skills should be the major focus of primary physical education (NASPE, 1995) and the early childhood years (NASPE, 2002).

Fundamental motor skills do not simply develop as a result of age; they must be instructed and practiced (Haywood & Getchell, 2002; Payne & Isaacs, 2002). From a dynamic systems theoretical perspective, fundamental motor skills do not naturally "emerge" during early childhood; rather, they are the result of many co-operating subsystems influencing a child's motor skill development (Newell, 1984, 1986; Thelen, 1995). Newell (1984, 1986) proposed a constraints model suggesting that motor skill development is dynamic and based upon the interaction between constraints from the task, the learner, and the environment. That is, fundamental motor skills emerge within a dynamic system consisting of a specific task, performed by a learner with given characteristics, in a particular environment. The resulting performance is a product of the interaction within and between the many cooperating subsystems a child possesses. For example, subsystems

such as motivation, strength, equipment, and prior experience will influence a child's motor development. Given the dynamic nature of motor skill development, it may be hypothesized that certain populations of children may be influenced by constraints that retard the development of fundamental motor skills in early childhood. Preschoolers who are identified as at risk of developmental delay could be one such group, as they present both environmental and child risk factors that may constrain their motor performance in the identification of their at-risk status.

Children who are at risk of developmental delay have been found to demonstrate developmental delays in fundamental motor skill development (Connor-Kuntz & Dummer, 1996; Goodway & Rudisill, 1997; Hamilton, Goodway, & Haubenstricker, 1999). Goodway and Rudisill (1997) reported that 59 African American male and female preschoolers who were at risk of developmental delay were at the 5th and 9th percentiles respectively for locomotor skills and at the 16th and 5th percentiles respectively for object control skills. A similar study by Hamilton et al. (1999) found that 27 African American three to five year-old children who were at risk of developmental delay were below the 20th percentile for object control skill performance.

There is an emerging literature base to show the positive effects of early motor skill programs on motor skill development for young children, including those who are at risk (Connor-Kuntz & Dummer, 1996; Hamilton et al., 1999; Kelly, Dagger, & Walkley, 1989; Miller, 1978; Valentini, 1997; Zittel & McCubbin, 1996). Instructional programs as short as eight weeks and encompassing (a) direct instruction (Connor-Kuntz & Dummer, 1996; Kelly et al., 1989), (b) more indirect child-centered approaches (Valentini, 1997), and (c) parents as teachers (Hamilton et al., 1999) have all yielded positive changes in motor skill development. These interventions have used a variety of instructional approaches to bring about change in motor skill development.

National standards for physical education (NASPE, 1995) and physical activity guidelines for birth through five years (NASPE, 2002) provide guidance to teachers about the content of instruction for young children in physical education and other settings. Other literature suggests pedagogical strategies for developmentally appropriate and instructionally appropriate practice (COPEC, 1992; Graham, Holt/Hale, Parker, 2001; Rink, 1996; Zittel & Houston-Wilson, 2000). Dynamic systems theory, specifically Newell's (1984, 1986) constraints model, can also help teachers conceptualize and plan instruction. It is important for teachers to understand child and environmental factors influencing the child's developmental status. The teacher can accommodate for the child's developmental level by manipulating the instructional environment and equipment and modifying the task. In this manner, effective instruction can be provided. Despite the body of knowledge on effective instructional strategies, teachers of young Hispanic children who are at risk do not have empirical evidence about their population upon which to base their instruction. Given the Hispanic population is one of the largest growing segments of society (U.S. Census Bureau, 2000), there is a clear need for more information on this population of children.

The purpose of this study was (a) to assess the developmental status of the locomotor and object control skill performance of a population of Hispanic preschool children who were identified as at risk of developmental delay, (b) to investigate gender differences in pretest locomotor and object control skills, (c) to examine the influence of a 9-week motor skill instructional program on loco-

motor and object control skill development, (d) to examine the influence of gender on the attainment of locomotor and object control skills as a result of a 9-week instructional program, and (e) to investigate developmental change in individual skills as a result of the instructional program. It was hypothesized that all children would demonstrate developmental delays in locomotor and object control skills prior to instruction with no significant differences in locomotor skills between gender and males outperforming females in object control skills prior to instruction (Haywood & Getchell, 2002; Payne & Isaacs, 2002). It was also hypothesized that the children who received instruction would demonstrate greater gains in locomotor and object control skills than a comparison group would. It was further hypothesized that there would not be a significant group by gender interaction as a result of the instructional program. Finally, it was hypothesized that children receiving instruction would show improvement on all skills as a result of the instructional program.

Method

Setting

This study was conducted in a large multiethnic city in a large urban school district in the southern United States. The study took place in an elementary school in a low income, predominantly Hispanic neighborhood. The school serves a student body consisting of 661 students from Pre-Kindergarten (Pre-K) to 5th grade (approximately 4 to 11 years). The majority of children in the school were Hispanic (95.4%); the remainder were Caucasian (6.7%), African American (1.2%), and Asian (.5%). The elementary school served a disadvantaged population of children with 90.6% of the children receiving free and reduced lunch, 72.1% being identified as at risk, and 66.7% of the children considered Bilingual/English as a Second Language. These demographics resulted in the school receiving 100% Title 1 funding (aid for schools serving low income children).

Participants

Participants for the study were enrolled in a compensatory Pre-Kindergarten (Pre-K) program for children who were developmentally delayed and/or at risk of developmental delay. Medical caregivers, social workers, community workers, teachers, and parents were able to refer children to the compensatory program for screening to enter the program. The purpose of the program was to provide early intervention services in order to remediate developmental delays demonstrated by the children and to assist them in developing the prerequisite "readiness" skills for kindergarten. The ethnicity of the children enrolled in the Pre-K program consisted of 73.8% Hispanic, 13.8% African American, 8.8% White, and 3.8% Asian. Prior to acceptance into the program, the children were screened for possible child and environmental risk factors identified previously. Children selected for this program demonstrated the highest number of risk factors (out of a possible 28) and the lowest scores on a school-based developmental readiness test. The risk factors commonly reported by the children and the children's parents were English as a second language, low family income, low parental education, family history of delinquency, and prenatal drug exposure.

Once identified for the program, children attended a half-day (2.5 hour) program, five days per week. Instruction was provided by certified, bilingual early childhood teachers and bilingual paraprofessionals. Class size ranged from 18 to 21 students per teacher and paraprofessional. The primary instructional focus of the regular Pre-K program was the development of cognitive (e.g., alphabet, colors, numbers) and social (e.g., listening, cooperating, following directions) skills necessary for success in kindergarten. Motor objectives were part of the curriculum but direct instruction was biased toward fine motor skills such as scissor cutting, manipulating objects, and handwriting. The gross motor component consisted of outdoor free play. There were a total of four Pre-K classes in the school; two were randomly assigned to a motor skill instruction group, and the remaining two were assigned to the comparison group.

Motor Skill Instruction Group. The group receiving instruction were referred to as the SKIP group (Successful Kinesthetic Instruction for Preschoolers). The SKIP group consisted of 16 girls and 17 boys with 84.8% of the children being Hispanic, 6.1% being African American, and 9.1% Caucasian. The mean age of the group was 4.9 years ($M = 59.2$ months, $SD = 4.6$). The average number of risk factors per child was 4.4 ($SD = 1.5$). A large percent (85.3%) of the children had unemployed parents, and 91.2% of the children's families were receiving welfare.

Comparison Group. The comparison group consisted of 18 girls and 12 boys, with 61.3% of the children being Hispanic, 22.6% being African American, 9.7% being Caucasian, and 6.6% Asian. The mean age of the group was 5.0 years ($M = 60.3$ months, $SD = 4.3$). The average number of risk factors per child was 4.4 ($SD = 2.4$). A large percent (88.9%) of the children had unemployed parents, and 87.1% of the children's families were receiving welfare.

Informed Consent. Informed consent was obtained from the custodial caregiver(s) of each child participating in the study. Assent was obtained from each child by verbally asking the child in his/her native language if he/she would like to participate in a physical education class. Teachers and paraprofessionals of the participants also consented to the study. Approval was obtained from the author's Institutional Review Board and school district.

Instrumentation

The Test of Gross Motor Development (Ulrich, 1985) was selected for the study as it provided a valid and reliable measure of fundamental motor skill performance for preschool-aged children (these data were collected prior to the TGMD-2). Mean test-retest reliability coefficients were .96 for locomotor skills and .97 for object control items (Ulrich, 1985). Interrater reliability coefficients were at a similar level. Content validity for the scale was established via assessment by three experts, and construct validity was established via factor analysis (Ulrich, 1985). The original scale was validated on 909 children aged 3 to 10 years living in 8 states and stratified by gender, race, residency, and geographic region. Thus, the TGMD was considered an appropriate instrument for Hispanic preschool children. The comparison of this study's data to the TGMD norms was considered acceptable, as no normative data were available specific to Hispanic children. Additionally, understanding these children's motor skill development relative to a normative sample gave the investigators a sense of the extent of developmental delay and the degree of improvement made by the instructional program.

The TGMD (Ulrich, 1985) evaluated performance of seven locomotor (i.e., run, gallop, leap, jump, hop, skip, slide) and five object control (throw, catch, kick, strike, bounce) skills for children ages 3-10 years. The total subscale raw scores for locomotor skills ranged from 0-26 points and 0-19 points for object control skills. Percentile ranks were calculated from the TGMD.

The TGMD was administered one week prior to and following the instructional program to both the SKIP and comparison groups. All children were videotaped performing three trials of each task, and the presence or absence of designated criterion elements of form were evaluated from the videotape performance. A child who demonstrated a criterion element of form for 2 of the 3 trials received a score of 1 for that element. All skills had 4 criterion elements of form except for skip, leap, and bounce, which had 3 criterion elements of form. Test administration was given in the child's native language and took approximately 15-25 min per child. Equipment and assessment protocols were standardized for all children as per Ulrich (1985).

Procedures

This study utilized a pretest-posttest quasi-experimental design. The dependent measures were TGMD locomotor and object control subscale scores. The independent variable was the SKIP (motor skill instruction) program. Because of disruption to the educational environment, it was not possible to randomize participants to group. Thus, intact classes were randomly assigned to group. The SKIP group received the 9-week instructional program during the time allotted to the regular Pre-K program; the comparison group received the regular Pre-K program. The first author was the test administrator and collected all data.

Comparison Condition. Participants in the comparison group received the typical Pre-K program involving outdoor free play and no formal instruction in fundamental motor skills. The typical Pre-K session consisted of the following types of daily routines: free play in centers (e.g., manipulation, reading, art), circle time (e.g., numbers, story time, alphabet) directed play in centers, table work (e.g., writing, math), outdoor free play, and snack time. The outdoor free play consisted of supervised play outside on the playground for 15 to 20 min most days. Students engaged in self-initiated activities using hoops, balls, and bats. The playground consisted of a cement and grass area with no playground equipment.

SKIP Condition. Participants in the SKIP group also received the typical Pre-K program, as did the comparison group. However, the SKIP group participated in the nine-week instructional motor skill program two days per week. The SKIP program was developed from a preschool physical education curriculum (Dummer, Connor-Kuntz, & Goodway, 1995). Students received test and curriculum instructions in both Spanish and English. The goal of the program was to elicit improvement in fundamental motor skills via developmentally appropriate instruction and practice. Instructional skills and objectives were selected based upon data about the age at which 60% of children were able to perform at a specific developmental level for fundamental motor skills (Seefeldt & Haubenstricker, 1982). All students participated readily, and no child was coerced to participate. Students were taught the mature elements of form for fundamental motor skills, but given their age, mastery of all form elements were not expected (Seefeldt & Haubenstricker, 1982; Ulrich, 1985). This motor skill curriculum had been successfully implemented with a developmentally delayed African American preschool population (Goodway & Branta, 2003).

The SKIP program consisted of instructional sessions two times per week for 35 min each session for nine weeks, resulting in 10.5 hours (630 min) of instruction. The children in the SKIP group attended on average 98% of all intervention sessions ($SD = 5.3$). Out of a possible 630 min of instructional time, the following reflects the time spent instructing individual skills: (a) ball bouncing, 80 min; (b) striking, 80 min; (c) kicking, 80 min; (d) catching, 80 min; (e) throwing, 80 min; (f) running, 20 min; (g) galloping, 40 min; (h) skipping, 40 min; and (i) jumping, 40 min. The first author was the lead instructor for the SKIP program, with the classroom teacher and paraprofessional being responsible for instructing at one of the three skill stations. Prior to the SKIP program, the teacher and paraprofessional received limited training in motor development including topics such as principles of motor development, stages of FMS, and types of feedback (Graham et. al, 2001; Payne & Isaacs, 2002). Prior to each instructional session, the investigator, teacher, and paraprofessional received the day's lesson plan and discussed key elements of instruction (e.g., key words, relevant feedback). At the end of the lesson, the investigator reviewed the activities with the teacher and paraprofessional and made instructional decisions for the next lesson based on their feedback from that lesson.

Each instructional session lasted 35 min and consisted of three, 10-min periods of skill instruction along with time for introduction and transition. Each session adhered to the pedagogy of effective instruction using developmentally and instructionally appropriate practice (COPEC, 1992; Graham, Holt/Hale, & Parker, 2001; Rink, 1996; Zittel & Houston-Wilson, 2000). The lead teacher briefly explained the three skills to be taught that day, demonstrated each skill, and provided cue words. Children were then randomly assigned to three groups and directed to a skill station. At the skill stations, the instructors (investigator, teacher, or paraprofessional) used a direct instructional approach to teach one fundamental motor skill. A progression of 3 to 4 instructional activities were presented that represented a developmental task analysis of the skill and the children's current level of development. The instructor provided clear directions and demonstrated each activity. Consistent cue words were used (in English and Spanish) to assist the children in remembering the critical skill elements. These cue words were reinforced throughout the activities. Systematic feedback in terms of positive-specific and positive-corrective feedback were consistently used. Activities were individualized to challenge all children at their own level. The pedagogical strategies above reflect indices of effective instruction as described by Rink (1996). For example, at a catching station, the children might start by tapping a balloon in the air and catching it, then toss a large bean bag vertically up and catch it, and then catch a partner/teacher tossed 8 in. (20.6cm) foam ball from a close distance. The instructor allowed children to progress at their own rate through these activities and modified the task, equipment, and feedback provided appropriate to the level of the individual child. All children had their own equipment.

Data Analyses

Parametric statistics were used to analyze these data. Box plots of the dependent variables indicated these data were normally distributed (Green, Salkind, & Akey, 2000). The participant was used as the unit of analysis. A dynamic systems perspective would contend independence of intervention effects as each child is

unique resulting from the many different cooperating subsystems operating within the child (Newell, 1984, 1986; Thelen, 1995).

Descriptive statistics and frequencies of the dependent variables were determined. A Group by Gender MANOVA on pretest locomotor and object control raw scores examined group and gender differences prior to the instructional program. A Group by Gender by Time MANOVA with repeated measures on the last factor was then conducted in order to determine the influence of the instructional program on locomotor and object control skill development. Post-hoc analyses of the MANOVA with repeated measures consisted of a two-part process. First, univariate ANOVAs were conducted with a Bonferroni adjustment of the alpha level ($\alpha = .025$) for each of the dependent variables. When a significant univariate test was reported, follow-up *t*-tests were conducted (Green, Salkind, & Akey, 2000).

Mean individual skill totals by group prior to and following the instructional program were provided. A gain score was calculated for each skill with respect to group (gain score = posttest score minus pretest score). The maximum possible gain score for all skills is 4, except for leap, skip, and bounce, which is 3 points.

Results

Developmental Status of Hispanic Preschool Children Who Are Developmentally Delayed

Based upon the pretest data, females and males in the SKIP and comparison groups demonstrated developmental delays at or below the 25th percentile. Table 1 shows the pre and posttest locomotor and object control raw scores and percentile ranks for the SKIP and comparison groups by gender. The percentage of children in the SKIP group demonstrating developmental delay (at or below the 25th percentile) for locomotor skills was 94.7% and 86.8% for the comparison group. The corresponding data for object control skills was 93.5% of the SKIP group and 77.4% of the comparison group showed developmental delay prior to the instructional program.

Group and Gender Effects in Pretest Locomotor and Object Control Skills

A Group by Gender MANOVA on pretest locomotor and object control raw scores showed a nonsignificant Group effect, $F(2, 58) = 1.58, p = .22$ and a significant Gender effect, $F(2, 58) = 11.21, p < .001, \eta^2 = .28$. Post-hoc univariate ANOVAs showed that there were no significant differences between gender for locomotor skills, $F(1, 61) = .19, p = .67$, but there were significant differences between gender for object control skills: $F(1, 61) = 15.30, p < .001$. The Group by Gender interaction was not significant, $F(2, 58) = 1.93, p = .16$, indicating that the gender findings were similar between groups.

Influence of the SKIP Program on Locomotor and Object Control Skills

A Group by Gender MANOVA with repeated measures on the last factor revealed a significant Group by Time interaction for locomotor and object control skill development: $F(2, 58) = 91.76, p < .001, \eta^2 = .76$. Post-hoc univariate ANOVA

Table 1 Pretest-Posttest Locomotor and Object Control Raw Scores and Percentile Ranks by Group and Gender

Variable	Group	Gender	Raw Scores				Percentile			
			Pretest		Posttest		Pretest		Posttest	
			M	SD	M	SD	M	SD	M	SD
Locomotor Skills	SKIP	F	8.56	2.68	16.00	2.63	7.00	9.25	50.06	24.16
		M	8.53	3.08	16.24	3.33	6.20	11.77	50.41	28.57
		Total	8.55	2.85	16.12	2.97	6.59	10.47	50.24	26.11
	Comp.	F	8.89	2.95	9.50	3.54	6.94	11.51	9.50	12.17
		M	9.83	3.74	9.17	3.19	8.50	11.58	4.58	4.94
		Total	9.27	3.26	9.37	3.35	7.57	11.36	7.53	10.10
Object Control Skills	SKIP	F	8.74	2.79	12.56	4.52	6.97	10.35	28.59	27.64
		M	9.07	3.37	13.31	4.78	7.16	11.54	31.44	31.68
		Total	8.90	3.08	12.93	4.65	7.06	10.94	30.04	29.66
	Comp.	F	2.12	1.45	8.06	2.35	6.50	10.00	52.50	27.82
		M	3.35	2.23	10.00	3.59	15.94	19.58	71.12	19.23
		Total	2.76	1.97	9.06	3.16	11.36	16.17	62.09	25.24
Object Control Skills	SKIP	F	2.06	1.17	2.78	1.83	4.52	5.83	9.19	14.68
		M	5.25	3.05	5.50	3.03	25.25	19.97	28.42	24.50
		Total	3.33	2.62	3.87	2.70	12.81	16.67	16.88	21.11
	Comp.	F	2.09	1.29	5.26	3.38	5.46	8.00	29.57	30.72
		M	4.14	2.72	8.14	4.01	19.79	19.94	40.56	32.49
		Total	3.11	2.00	6.70	3.69	12.62	13.97	35.06	31.60

Note. SKIP = instructional group (n = 33), Comp. = comparison group (n = 30), F = female (n = 34), M = male (n = 29).

tests revealed a significant Group by Time interaction for both locomotor, $F(1, 61) = 101.04, p < .001, \eta^2 = .63$ and object control, $F(1, 61) = 99.05, p < .001, \eta^2 = .63$, skills, indicating that the SKIP group performed significantly better than the comparison group from pretest to posttest for both locomotor and object control skills.

Post-hoc *t*-tests were conducted to examine the differences among means for locomotor skills. Paired sample *t*-tests showed that the SKIP group significantly improved locomotor skills from pre to posttest: $t(32) = -19.71, p < .001$ (2-tailed). In contrast, the comparison group did not show significant pre to posttest gain: $t(29) = -.15, p = .88$ (2-tailed). An independent sample *t*-test supported the hypothesis that the SKIP group had significantly better posttest locomotor scores than the comparison group: $t(61) = 8.49, p < .001$ (2-tailed).

Post-hoc *t*-tests were also conducted to examine the differences among means for object control skills. A paired sample *t*-test showed that the SKIP group improved significantly in object control skills from pre to posttest: $t(32) = -13.60, p < .001$ (2-tailed). As with locomotor skills, the comparison group did not reveal significant pre to posttest gains in object control skills: $t(29) = -1.68, p = .10$ (2-tailed). An independent sample *t*-test supported the prediction that the SKIP group had significantly better posttest object control scores than the comparison group: $t(61) = 6.98, p < .001$ (2-tailed).

The SKIP program effects can be seen clearly by examining changes to percentile ranks across the instructional period. Locomotor skills showed an improvement in percentile rank from the 7th percentile to 50th percentile for the SKIP group. In contrast, the comparison group only changed from the 7th to 8th percentile. For object control skills, the SKIP group improved from the 11th to the 60th percentile and the comparison group from the 13th to the 17th percentiles (see Table 1).

Influence of Gender on the Attainment of Locomotor and Object Control Skills Over the Instructional Program

The lack of a significant Group by Gender by Time interaction for locomotor and object control skill development, $F(2, 58) = .95, p = .39$, suggests that gender did not influence the instructional gains in locomotor and object control skills as a result of the instructional program. Interestingly, ANOVAs on posttest scores of the SKIP group showed that there were no significant differences between gender for locomotor, $F(1, 61) = .05, p = .82$, and object control, $F(1, 61) = 3.32, p = .08$, skills. This is in contrast to the pretest where males outperformed females in object control skills.

Pretest to Posttest Changes in Individual Skill Development

Table 2 shows the mean individual skill totals by group prior to and following the instructional program. Figures 1 and 2 show the mean gain scores for locomotor and object control skills for the SKIP and comparison groups. For locomotor skills, running improved the most and hopping improved the least for the SKIP group. However, all skills improved approximately one criterion form element. In contrast, the comparison group showed little change over time with 4 of the 7 skills showing a slight decline in performance. All five object control skills improved from pre to posttest with all but one skill (kicking) showing an improvement of at least one criterion form element. Bouncing improved the most, and kicking im-

Table 2 Pretest-Posttest Individual Skill Mean Scores and Standard Deviations by Group

Skill (Max. score)	Pretest				Posttest			
	SKIP		Comparison		SKIP		Comparison	
	M	SD	M	SD	M	SD	M	SD
Run (4)	1.97	.73	2.37	.99	3.67	.48	2.23	1.14
Gallop (4)	1.73	.94	1.97	1.03	2.70	.59	2.20	.89
Leap (3)	.82	.58	1.00	.53	1.76	.61	.73	.78
Jump (4)	.82	.58	1.10	.80	1.79	.99	1.07	.52
Hop (4)	.88	.49	.60	.50	1.70	.64	1.00	.69
Skip (3)	.49	.62	.37	.56	1.36	.90	.47	.57
Slide (4)	2.12	1.08	1.90	1.49	3.12	.86	1.73	1.36
Strike (4)	.85	.78	1.00	.98	2.21	.69	.87	.97
Bounce (3)	.27	.62	1.82	1.14	.30	.75	.40	.81
Catch (4)	1.29	.63	1.47	.73	2.68	.64	1.77	.90
Kick (4)	.12	.33	.23	.43	.97	.67	.27	.45
Throw (4)	.24	.55	.33	.61	1.56	1.28	.57	.97

Note. SKIP = Motor skill instruction group ($n = 33$), Comparison Group ($n = 30$). The number in parentheses following the skill indicates the number of criterion elements of form for that skill.

proved the least. In contrast, the comparison group showed little change over time with striking performance showing a slight decline in performance.

Discussion

Developmental Delays in Fundamental Motor Skills and Gender

Prior to the instructional program, all children demonstrated developmental delays in FMS (at or below the 7th percentile for locomotor skills and below the 13th percentile for object control skills). The developmental delays were so consistent across children that 95% of children performing locomotor skills and 87% of children performing object control skills were at or below the 25th percentile for same-age peers (Ulrich, 1985; see Figures 1 & 2). The delays reported in this study for a group of Hispanic preschool children who are at risk reflect delays found for African American preschool children who are at risk (Goodway & Rudisill, 1997; Hamilton et al., 1998). The salient issue here is not one of ethnicity, rather the similarities between the children in the present study and those in the literature in the identification of at-risk status and the poverty level.

Despite the developmental delays, gender differences were found for object control skills prior to the instructional program. This is in line with motor development literature (Payne & Isaacs, 2002; Thomas & French, 1985) illustrating males outperformed females for object control skills. Females were at the 6th percentile as opposed to males who were at the 20th percentile for object control skills. Gender differences present challenges to teachers as they plan instruction to accommodate all levels of learners.

Anecdotal observations revealed that the children in this study had limited access to outside play due to the risky nature of their yards and parks. We propose that the environments in which these children are growing up constrained the development of fundamental motor skills. Further research should use a dynamic systems framework to examine the environmental factors that constrain such developmental delay and consider ways in which to promote physical activity in these schools and communities. The delays demonstrated by the children are problematic because the children lacked the physical activity experiences to support timely motor development. As such, these children were not meeting the national physical activity guidelines identified in Active Start (NASPE, 2002). Teachers were not providing necessary and appropriate services to meet their needs. Clearly, administrators of Pre-K programs serving young children who are at risk must be informed of these data. Such programs should implement motor skill programs using the tenants of developmentally and instructionally appropriate practice in order to remediate the developmental delays found.

Benefits of Motor Skill Instruction on Fundamental Motor Skill Development

The effect size for the instructional program was strong ($\eta^2 = .75$) with children in the SKIP group improving from the 7th to 50th percentile for locomotor skills and the 11th to 60th percentile for object control skills. In contrast, the comparison group showed little change. At the posttest, only 24% of the SKIP group were below the

25th percentile for locomotor skills as compared to 93% of the comparison group. For object control skills, only 15% of the SKIP group in contrast to 80% of the comparison group were below the 25th percentile. Clearly, children who received motor skill instruction in the form of best practice benefited greatly showing improved abilities to demonstrate skills with proficiency and efficiency. Models of motor development such as those by Seefeldt (1980) might suggest that these improved levels of fundamental motor skills could then be applied to successful participation in sports and games. This issue warrants future research.

The SKIP program was effective in bringing about positive changes in both locomotor and object control skill development. Developmentally appropriate practice in terms of considering the developmental status of the children, individualizing instruction, and using a variety of tasks was used in the SKIP program (COPEC, 1992; Rink, 1996; Zittel & Houston-Wilson, 2000). Developmental task analysis and arranging instructional tasks from simple to more complex, allowed the instructors to tailor activities to each child's developmental needs. Instructionally appropriate practice in terms of opportunities to practice, cue words, and feedback were also provided (Rink, 1996). These instructional factors, along with a consistent physical education program offered twice weekly, resulted in improvement. Additionally, the curriculum was developed by an expert in motor development with experience in instructing preschool children who are at risk. Prior experience with this population also resulted in an understanding of the cultural issues involved. All of these factors resulted in a curriculum that closely matched the students' developmental needs. Program organization was effective with the children enjoying rotating to skills stations and being able to attend for the entire 30-min period.

Program instruction was presented in both English and Spanish so that children could understand directions. Even the non-Spanish speaking lead instructor learned many of the Spanish terms for the cue words of the skills taught. Cue words seemed to be particularly valuable to the children in remembering the critical skill elements. Children were often heard repeating these cue words both in Spanish and English and they began to cue each other using these words as instruction progressed. Future research should examine the use and types of cue words in the development of fundamental motor skills. In addition, the teacher provided a demonstration. As would be expected with such a young and novice population, the quality of the demonstration was very important and influenced the pattern of the motor skill performance (Rink, 1996; Zittel & Houston-Wilson, 2000). The lead instructor worked closely with the classroom teacher and paraprofessional in order to provide an accurate demonstration.

The gender differences present prior to the program for object control skills were no longer evident for the SKIP group at the end of the instructional program. That is, there were no significant differences between girls and boys for object control skills once the nine-week instructional program had been provided. Future research should examine the role of instruction in eliminating gender differences in motor skill development.

Influence of Instruction on the Performance of Individual Fundamental Motor Skills

Each of the seven locomotor skills and five object control skills improved as a result of the SKIP program. Running improved the most. This was not surprising given that the children had opportunity to practice this skill and that developmen-

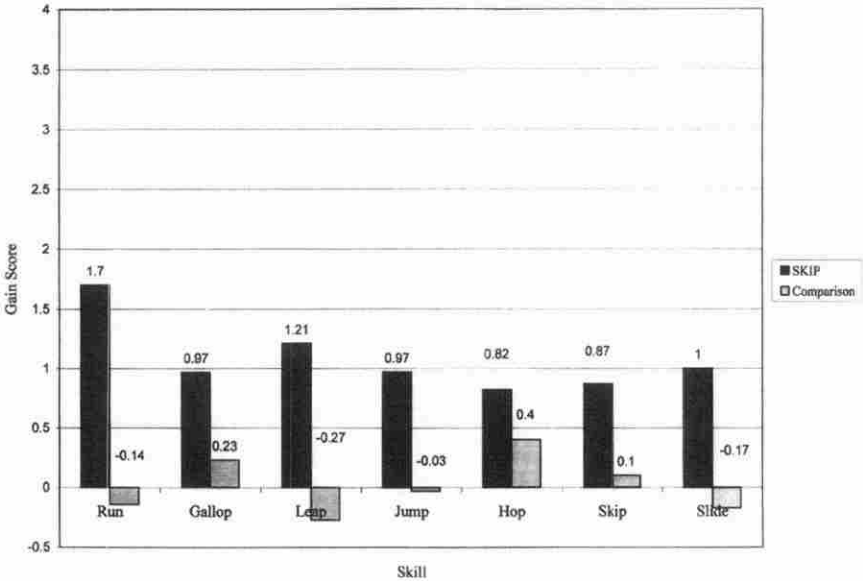


Figure 1 — Mean gain scores for individual locomotor skills by group.

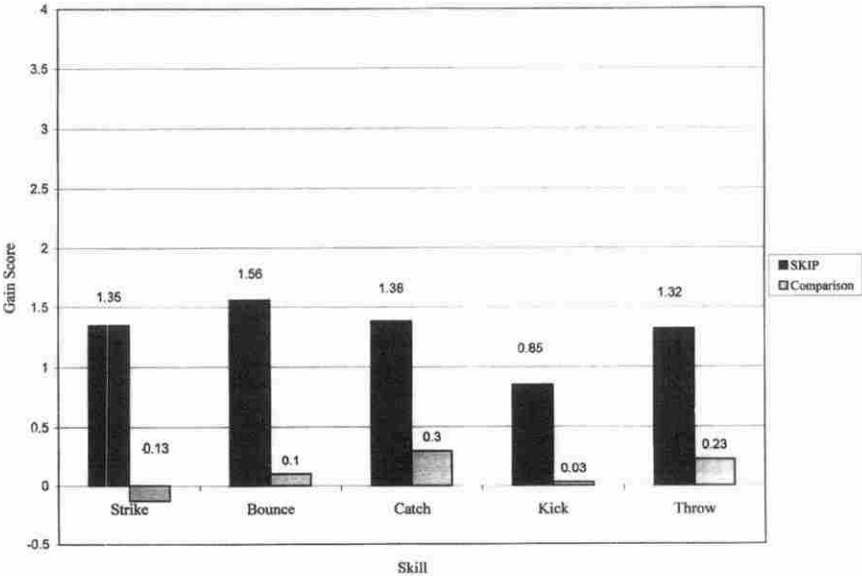


Figure 2 — Mean gain scores for individual object control skills by group.

tally, this is one of the earliest maturing skills (Seefeldt & Haubenstricker, 1982; Payne & Isaacs, 2002). Hopping improved the least. Again, this was not surprising, as hopping is a complex skill requiring a considerable degree of strength and coordination, and it is a later maturing skill (Payne & Isaacs, 2002). With respect to object control skills, bouncing improved the most and kicking the least. Again, these findings are not surprising given mature kicking performance would not be expected in such young children (Seefeldt & Haubenstricker, 1982; Payne & Isaacs, 2002; Ulrich, 1985). As a group, children improved at least one skill element in all skills.

This study's findings support the limited literature suggesting that motor skill instruction can have positive impact on fundamental motor skill development (Connor-Kuntz & Dummer, 1996; Hamilton et al., 1999; Kelly et al., 1989; Valentini, 1997; Zittel & McCubbin, 1996). However, due to the small sample size, the unique nature of the population studied, and the lack of a randomized sample, generalizability is limited. It is important to note that this study represents the second time that this curriculum has been successfully implemented with a Pre-K population who was developmentally delayed. The previous population was a population of African American preschool children who were at risk of developmental delay (Goodway & Branta, 2003). The fact that the present Hispanic population and the African American population both yielded significant improvements in fundamental motor skills lends credence to the generalizability of this curriculum across populations.

A limitation of this study was the lack of follow-up procedures. It still remains to be determined if the skill improvements gained from instruction were maintained over time. Future research should attempt to longitudinally track children receiving such instruction.

The findings from this study support the notion that fundamental motor skills must be taught and practiced if children are to learn. The children in the comparison group made little improvement in their fundamental motor skills despite outdoor free play with appropriate equipment. The children in this population were very delayed in their fundamental motor skill development, yet with as little as 9 weeks and 630 min of instruction, significant improvements were made. These findings have implications for the implementation of Pre-K physical education programs. Policy makers of such Pre-K programs should ensure that all children in these compensatory programs receive physical education services as a regular part of the Pre-K curriculum.

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Acknowledgments

The authors gratefully acknowledge the financial support of this work from a Motor Development Academy grant by the National Association of Sport and Physical Education of the American Alliance for Health, Physical Education, Recreation and Dance. They also wish to thank the teachers and children who contributed to this project.

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