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EFFECT OF A 9-WK. AFTER-SCHOOL MULTISKILLS CLUB ON FUNDAMENTAL MOVEMENT SKILL PROFICIENCY IN 8- TO 9-YR.-OLD CHILDREN: AN EXPLORATORY TRIAL [1]

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Summary.—This exploratory study examined the effects of a 9-wk. after-school multiskills club on fundamental movement skill proficiency in 8- to 9-yr.-old children. Two schools were randomly assigned to either a control ($n = 15$ children) or multiskill club ($n = 19$ children) condition. The multiskill club received 18 coaching sessions designed to improve fundamental movement skills. The control group followed normal routines. 7 skills were assessed using process-oriented measures with video analysis. Participation in the multiskill club yielded significant improvements in proficiency at posttest only in static balance, while potentially practically important improvements were observed in performance of the catch, throw, and kick skills. The after-school multiskill club offered a viable opportunity for movement skill acquisition, but any such programme would need to run for a longer duration to assess whether this type of activity could benefit all skills.

Fundamental movement skills are the foundation for participation in popular types of physical activities and sports (Payne & Isaacs, 2002; Haywood & Getchell, 2005). According to Gallahue and Donnelly (2003), a fundamental movement skill is "an organised series of basic movements that involve the combination of movement patterns of two or more body segments" (p. 52). These movements may be categorised as stability, locomotor, or manipulative skills. Stability skills include static or dynamic balance, dodging, and turning. Locomotor skills include sprinting, jumping, and leaping, whilst examples of manipulative skills are kicking, catching, throwing, and striking.

Childhood is a sensitive learning period for motor skill development (Gallahue & Donnelly, 2003). In order to develop, these skills need to be taught and practiced (Payne & Isaacs, 2002), with between 240 and 600 min-

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utes of instruction time required to reach proficiency (Department of Education and Training, NSW, 2000). Such skills emerge within a dynamic system that is affected by interactions between the task, the learner, and the environment (Newell, 1986). Personal characteristics, motivation, prior experience, community and cultural values, and other factors can all affect the learning of fundamental movement skills (Gallahue & Ozmun, 1998).

Failure to master motor skills may prevent participation in physical activity and sport during childhood and later in life (van Beurden, Barnett, Zask, Dietrich, Brooks, & Beard, 2003). Children who are not proficient in these skills may have lower perceptions of competence and self-esteem, which is likely to have adverse effects on motivation and enjoyment (Ulrich, 1987). Competence is also associated with important health benefits, as increased proficiency in the skills is positively correlated with cardiorespiratory fitness (Okely, Booth, & Patterson, 2001), and inversely related to body composition (Okely, Booth, & Chey, 2004).

Recent descriptive research has raised concerns regarding low motor skill competence in children (van Beurden, Zask, Barnett, & Dietrich, 2002; Okely & Booth, 2004). Yet more research is needed to examine what should be done to increase skill proficiency. Interventions usually involve changes to physical education programmes and some have been successful. The "Move It Groove It" intervention (van Beurden, *et al.*, 2003) involved 1,045 Australian children ages 7 to 10 yr. The 12-mo. programme delivered significant improvements in proficiency in each of the eight skills assessed compared to a control group. In a sample of 545 Scottish preschool children, a 6-mo. intervention produced similar findings (Reilly, Kelly, Montgomery, Williamson, Fisher, McColl, *et al.*, 2006). In a small study of Greek young children, a 12-wk. programme involving self-testing activities significantly improved movement skills when compared to a control group that followed standard physical education programmes (Karabourniotis, Evaggelinou, Tzetzis, & Kourtessis, 2002).

Out-of-school programmes may provide a conducive environment for acquiring movement skills in children (Raudsepp & Päll, 2006). However, little is known about the efficacy of fundamental movement skill interventions in noncurricular settings. Therefore, the purpose of this exploratory study was to examine the efficacy of an after-school multiskill club designed to increase fundamental movement skill proficiency, in order to inform a subsequent definitive trial. It was hypothesised that participation in the 9-wk. multiskill club would increase the likelihood of attaining proficiency in all of the seven skills practiced when compared to the control condition, with process-oriented measures used to evaluate proficiency. This research can inform practitioners about the viability of such clubs to improve skills in and out of school settings.

Method

Participants

Following ethical approval from the University Ethics Committee, two primary schools in northwest England were invited to participate in the study. Selection criteria included school size (number of children enrolled >400), availability of school sports facilities accessible for intervention, and no current after-school club programmes for year 4 children. Both schools were located in areas of high deprivation—unemployment was significantly higher than the national average, and over 30% of children at each school were eligible for free school meals. One school was randomly assigned to each condition and, therefore, the equivalence of groups at baseline is not secure. To address this threat to validity, the selected schools were matched for each of the above characteristics as closely as possible (Varnell, Murray, & Baker, 2001).

All children from year 4 (ages 8 to 9 years) were invited to participate in the study via a letter of information and an informed consent form sent home to parents. Children who agreed to participate were selected if they were healthy and had no known medical conditions that could affect motor proficiency. Sixty-one children consented to participate in the study, with 47 children meeting the selection criteria. The intervention condition comprised 26 children; 21 children comprised the control group. At posttest, the intervention and control group had lost seven and six children, respectively. Reasons for the losses at follow-up included absence from school on testing days due to illness or holidays. Only those children who took part in the baseline and follow-up examinations were included in this study. This final sample represented 72% of the original group: 15 children (9 girls, 6 boys; *M* age = 9.1 yr., *SD* = .3) in the control group, and 19 children (12 girls, 7 boys; *M* age = 9.2 yr., *SD* = .3) in the intervention group. The sample data were not separated by sex due to the small sample size, and because preliminary analysis revealed no significant sex interaction with the effects of the intervention programme.

Assessment of Fundamental Movement Skills

The seven skills assessed were the vertical jump, leap, sprint run, kick, catch, throw, and static balance. The skills were considered age-appropriate and varied enough to eliminate sex bias (Hands & Larkin, 1997). The skills were assessed using process-oriented measures that focus on the way the skill is performed. Process-based measures were used to identify technical proficiency and thus offer useful guidance for intervention strategies (Knudson & Morrison, 1997). Assessment procedures involved using video analysis to check each performance of the skills against a checklist of components specific to each skill. These checklists were derived from an existing assessment tool (Department of Education and Training, NSW, 2000), and such procedures have established validity and reliability (Okely & Booth, 2000). This assessment tool enabled direct comparisons with recent research (Van Beurden, *et al.*, 2002; Okely & Booth, 2004). Table 1 provides an example of the skill components that were assessed in the vertical jump and overhand throw. Children were given a verbal description and single demonstration of the skill. Each child then performed five trials of each skill with the exception of the sprint run, in which three trials were performed. Recordings of all participants were taken from identical angles and distances, with the video camera placed on a tripod during the testing. The data was then converted to DVD format for analysis. If the skill component was checked as being present on four out of five trials (two out of three for sprint run) then the child was marked as possessing that skill component. A trained assessor conducted all fundamental movement skill assessments and subsequent video analysis. Intrarater reliability was established in a 1-wk. test-retest study of 20 children (10 boys, 10 girls) randomly selected from the sample (kappa = .87; 90% CI = .83 to .91).

TABLE 1

EXAMPLES OF REQUIRED COMPONENTS FOR MOTOR SKILL PROFICIENCY: VERTICAL JUMP AND THROW

Skill	Component
Vertical Jump	1. Eyes focused forward or upward throughout the jump
	2. Crouch with knees bent and arms behind the body
	3. Forceful upward thrust of arms as legs straighten to take off
	4. Legs straighten in the air
	5. Contact ground with front part of foot, bending knees to absorb force of landing
	6. Balanced landing with no more than one step in any direction
Throw	1. Eyes are focused on target throughout the throw
	2. Stand side-on to target
	3. Arm moves in a downward and backward arc
	4. Step towards target with foot opposite throwing arm during throw
	5. Hip rotates forward, then shoulders
	6. Throwing arm follows through down and across the body

Note.—Modified checklist developed using Department of Education and Training, NSW (2000).

Procedure

This study used a pretest–posttest experimental design. Assessment was conducted at baseline (mid-April 2006) and immediately following the intervention (late June 2006). The two schools were randomly allocated to either intervention or control groups, using the computer equivalent of a coin flip.

Intervention: Multiskill Club

The 9-wk. multiskill club intervention consisted of a semiweekly after-school club located within the intervention school. Each 1-hr. session focused on improving two fundamental movement skills from the vertical jump, leap, sprint run, kick, catch, throw, and static balance. Contact time therefore totalled 18 hr., with each skill being covered in two sessions. Three sessions included a multiskill circuit with activity stations to improve all the skills. Each session was delivered by experienced coaches who held several sports coaching qualifications and had attended Sports Coach UK workshops on delivering multiskill clubs prior to the intervention programme. The intervention programme was planned using activity resources designed by the Youth Sports Trust (Hanford, Haskins, Hawkins, Haydn-Davies, Morley, & Stevenson, 2005), with each session designed to maximise participation and enjoyment, consisting of a variety of games, drills, and self-learning activities offering numerous opportunities for practice. Skill components were taught to the children using simple learning cues (in kicking, "eyes on the ball" was used to try to get the children to keep their eyes on the ball during the kicking action), and skill questions were used to develop purposeful feedback, e.g., "Where did your throwing arm finish when you released the ball?" Children attended on average 80% of the sessions (range 72–100%).

Control Group

The control group did not receive the after-school multiskill club intervention. All children were asked to follow their normal routines and not engage in additional sport programs during the intervention period. The school agreed not to alter their current after-school club programme or to enhance their curricular programme for fundamental movement skills during this time.

Statistical Analyses

Each skill was scored by creating a binary outcome variable, scored 1: Proficient or 0: Nonproficient. The number of required components of each skill correctly demonstrated by each child was summed to give a score for each skill. Proficiency was defined as demonstration of all or all but one of the listed skill components. Failure to achieve this standard was rated nonproficient, i.e., given a score of zero.

Frequency statistics were used to report the proportion of participants achieving proficiency for each skill at baseline and posttest. Binary logistic regression analysis techniques were used to calculate the effects of the intervention on attainment of proficiency at posttest for each skill. For this, the posttest score was entered as the dependent variable, with group and baseline scores (to control for baseline differences between groups) as independent variables (Everitt & Pickles, 2004). This method provides an odds ratio for the effect of the intervention (compared to control) adjusted for baseline differences. To facilitate interpretation, adjusted odds ratios were converted to relative risk estimates with 90% confidence intervals using the formula provided by Zhang and Yu (1998). Following Van Beurden, *et al.* (2003), the smallest practically important effect was defined as a 10% increase in the proportion attaining proficiency at posttest. This effect size approximates to an odds ratio of 1.5, a relative risk of 1.2, and a standardised mean effect (Cohen's d) of 0.2 between-subject standard deviations (Chinn, 2000). This smallest practically worthwhile effect thus represents a 'small' effect size according to Cohen's (1988) scale of magnitudes. All data analyses were conducted using SPSS Version 14.0 and alpha set at .05. The mean effects of the intervention are reported for each variable of interest, together with 90% confidence intervals as suggested by Sterne and Davey Smith (2001). In line with the recommendations of Perneger (1998), Bonferroni corrections for multiple outcomes were not applied.

Results

Table 2 shows the proportion of children in each group that attained proficiency in the skills at baseline and posttest. At baseline, the proportion of children in both groups achieving proficiency was lowest in the static balance, kick, throw, and catch. The vertical jump and sprint run represented the skills with the highest proportion of children rates as proficient.

TABLE 2
PROPORTION (%) PARTICIPANTS ACHIEVING RATINGS OF PROFICIENCY AT BASELINE AND POSTTEST

Skill	Control ($n=15$)		Multiskill Club ($n=19$)	
	Baseline	Posttest	Baseline	Posttest
Balance	33.3	40.0	36.8	89.5
Leap	46.7	53.3	42.1	63.2
Vertical Jump	73.3	80.0	84.2	89.5
Sprint Run	86.7	60.0	68.4	57.9
Kick	6.7	13.3	31.6	52.6
Catch	0.0	26.3	26.7	63.2
Throw	6.7	20.0	21.1	42.1

Note.—Proficiency is defined as demonstration of all or all but one required component for a skill.

Table 3 shows the results of the binary logistic regression, controlling for differences in baseline proportions of proficiency. The findings indicate that being in the multiskill club significantly increased the likelihood of attaining proficiency at posttest in only one skill, the static balance. Specifically, children who participated in the intervention programme were on average more than twice as likely to attain proficiency in the static balance than children in the control group. There were no other statistically significant group effects.

TABLE 3
BINARY LOGISTIC REGRESSION ANALYSES, ADJUSTED FOR BASELINE DIFFERENCES BETWEEN GROUPS

Skill	β	*SE*	Adjusted Odds Ratio	Adjusted Relative Risk	90% CI	*p*
Balance	2.56	0.92	12.92	2.24	1.64–2.44	.005
Leap	0.41	0.70	1.51	1.19	0.66–1.59	.56
Vertical Jump	0.64	1.01	1.89	1.10	0.74–1.22	.53
Sprint Run	0.30	0.78	1.35	1.12	0.59–1.47	.70
Kick	1.63	0.98	5.09	3.29	1.01–5.99	.097
Catch	1.01	0.79	2.75	1.87	0.80–2.98	.20
Throw	0.78	0.96	2.18	1.76	0.51–3.63	.42

Note.—β = regression coefficient; *SE* = standard error; 90% CI = confidence intervals for adjusted relative risk

Although on the majority of fundamental movement skills there was no statistically significant group effect, this exploratory trial was likely not powered to identify small effects, and thus the nonsignificant findings still may have practical relevance. Using a relative risk value of 1.2 as a marker of the smallest practically important effect, results indicated that in addition to static balance, the point estimate of the relative risk surpassed 1.2 for the kick, overhand throw, and catch skills. These findings indicate the multiskill club may have practically important implications, particularly for manipulative skills.

DISCUSSION

This appears to be the first exploratory study to examine the effects of an after-school multiskill club on the development of fundamental movement skills. Results indicate that, compared to the control group, 9 wk. of training in the multiskill club significantly increased the likelihood of attaining proficiency at posttest in only one skill, the static balance. However, though not statistically significant, performance improvements of potential practical importance were also observed in the kick, throw, and catch skills. These findings await confirmation in a subsequent definitive trial. It appears that a 9-wk. after-school multiskills club can produce modest improvements in several skills; however, the magnitude of the improvements may have been limited by, *inter alia*, the relatively short duration of the intervention.

With the exception of the vertical jump and sprint run, the results revealed worryingly low proficiency in each skill at baseline. The 2002 Health Survey for England (Sproston & Primatesta, 2003) found that only 70% of boys and 61% of girls met the recommended guidelines for participation in physical activity. It is possible that children in this study may not have participated in sufficient amounts of physical activity to practice and nurture these skills, which may explain the low proficiency. In addition, poor skill development could also suggest that the provision and quality of teaching of fundamental movement skills within physical education curricula is not sufficient to reach proficiency. This appears to support the need for additional opportunities for acquisition of movement skills in children (Raudsepp & Päll, 2006).

Balance is a stability motor skill that forms the basis for all other fundamental movement skills (Gallahue & Donnelly, 2003). Being able to maintain stability affects quality and accuracy in performance of many skills as well as the ability to undertake everyday tasks. Participation in the multiskill club significantly improved performance of this skill, with participants more than twice as likely to reach proficiency as their control counterparts. As balance forms an integral part of any skill, such improvements may assist in the development of other skills in the longer term.

Static balance was the only skill significantly influenced by participation in the multiskill club. However, it is important to consider potentially practically meaningful effects in an exploratory trial of this type. Using a threshold value for a minimum worthwhile effect, it was found that participation in the multiskill club was associated with potentially important practical benefits in three manipulative skills: the kick, overhand throw, and catch. This finding compares favourably with a 6-mo. physical education programme that significantly improved performance of the catch and throw, but not the kick (McKenzie, Alcaraz, Sallis, & Faucette, 1998). These positive improvements are encouraging given the low proficiency in each of these skills at baseline and likely reflect meaningful relationships between instruction, practice, and performance. However, locomotor skills such as the leap, sprint run, and vertical jump were not associated with performance improvements. The "Move It Groove It" intervention (van Beurden, *et al.*, 2003) delivered substantial improvements in all eight skills assessed, including the sprint run, side gallop, jump, and hop, following a year-long programme. Locomotor skills are complex total body movements and these results suggest that an after-school multiskill club would need to run for a longer period in order to benefit all forms of fundamental movement skills.

This research supports the contention that after-school multiskill clubs could complement school curricular programmes by allowing additional opportunities for development of fundamental movement skills. The implementation and delivery of the intervention programme was completed successfully and the club was well attended. A subsequent trial with a longer term intervention should be conducted in a larger, more representative sample. Additionally, follow-up studies would prove useful in assessing whether skill improvements as a result of any intervention are maintained, or whether the control group would eventually catch up. Furthermore, as children are likely to practice skills in various environments, researchers should strive to quantify opportunities for development of fundamental movement skills that are external to the intervention programme, including physical education (quality and quantity), and children's participation in extracurricular activities and sports.

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