Mastery of Fundamental Motor Skills among New South Wales School Students: Prevalence and Sociodemographic Distribution

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Mastery of fundamental motor skills among children and adolescents is a potentially important contribution to satisfying participation in sports, games and other physical activities and may enhance the development of an active lifestyle. However, few attempts have been made to determine the prevalence of fundamental motor skill mastery among young Australians. The NSW Schools Fitness and Physical Activity Survey, 1997 (N=5518) randomly selected schools proportionally from all three education sectors and selected students in Years 4, 6, 8 and 10. Performance on six fundamental motor skills (run, vertical jump, catch, overhand throw, forehand strike and kick) was assessed qualitatively. The prevalence of mastery and near mastery of each skill and mastery of each skill component is reported for boys and girls in each school year. The findings indicate that the prevalence of mastery and near mastery of each of the fundamental motor skills was generally low. There were no differences between students from urban or rural schools and the prevalence of skill mastery was directly associated with socioeconomic status more consistently among girls than among boys. Greater curriculum time and resourcing and training of teachers is required to increase the proportion of students who have mastered the skills fundamental to common sports, games and other physical activities.

Introduction

The development of mastery of fundamental motor skills among children and adolescents through quality physical education is a potentially important contributor to successful and satisfying participation in sport and other physical activities. Fundamental motor skills are motor activities with specific observable patterns and are prerequisites to the advanced skills employed in sports, games, dance, gymnastics and other physical activities (Buschner, 1994; Gallahue & Ozmun, 1995; Wichstrom, 1983). The development of these skills is considered by many as a key objective of physical education programs (Graham, 1987) because it increases the options for participation in games, sports and other physical activities.

Those who lack fundamental motor skills are likely to experience frustration and difficulty in learning more advanced skills, reducing their enjoyment of sports and other activities. In addition, those who lack fundamental motor skills are

more likely to experience the consequences of "public failure" or ridicule from peers (Rose et al., 1994) encouraging them to avoid participation in organised sports and possibly reducing the likelihood of the development of a physically active lifestyle (US Department of Health and Human Services, 1997).

This study assessed the qualitative performance of six fundamental motor skills (run, vertical jump, catch, overhand throw, forehand strike and kick) in a randomly-selected sample of New South Wales (NSW) students in school years 4, 6, 8 and 10. These six skills were selected, from among eleven fundamental skills for which standardised tests were available, as being essential to many of the sports and other physical activities in which many young people participate. For example, the overhand throw is directly related to skills such as the tennis serve, javelin throw, the baseball pitch and throwing in sports such as cricket, softball, baseball and basketball. Although other fundamental motor skills are also important, standardised tests are not yet available for some fundamental motor skills (such as rhythm and balance) and, in any case, the available funding would not support the assessment of more skills. It has been suggested (Department of Education, Victoria, 1996) that most of the skills included in the survey should be mastered by Year 4, with the forehand strike being mastered by Year 5.

This paper presents findings on skill Mastery (displaying correct performance on all components of a fundamental motor skill) and Near Mastery (displaying correct performance of all but one of the components of a fundamental motor skill) for boys and girls in Years 4, 6, 8 and 10 and results of the comparisons between students in rural and urban schools and across tertiles of socioeconomic status (SES). This study provides: the first comprehensive indicators of the proportion of children and adolescents in NSW who have mastered key motor skills; a benchmark against which progress may be measured; and, data to allow us to determine if resources should be directed differentially to certain groups of young people.

Methods

Sample selection

Proportional stratified random sampling of NSW primary and high schools was conducted by the Australian Council for Educational Research, excluding special schools, schools with enrolments of less than 180 students and schools in the remote rural regions of NSW (telephone area codes 050, 075 and 080). Despite the exclusions, the target population comprised 86% of the primary school population and 97% of the high school population.

Forty-five primary schools and 45 high schools were selected, stratified by education sector (Department of School Education, Catholic Education Commission and Association of Independent Schools). The number of schools selected in each stratum was proportional to the number of students enrolled in that education sector and the likelihood of a school being selected in each stratum was proportional to the size of the student enrolment.

The Australian Council for Education Research provided a list of all schools, sorted by education sector and postcode, with the selected schools marked. Selected schools which declined to participate in the survey were replaced with the next school on the list. Once a school agreed to participate, classes were selected at random to participate. A member of the study team contacted the school to establish the basis on which classes were formed and the number of classes in each relevant year group. Where possible, mixed-ability class groupings

were used, usually a roll class. The class groups were identified (composite classes were combined as necessary) and a class was then chosen at random by referring to a random number table which had been prepared for each school. Within each selected school, one class was chosen at random from each of Years 2, 4, 6, 8 and 10. Year 2 children were included only for the purpose of measuring adiposity and fundamental motor skills were not assessed in this year group.

Data collection

The data were collected by four teams of four field officers (one team of four per school), consisting of fourteen teachers seconded from NSW primary and high schools, plus two research officers. All members of the field team underwent two weeks of orientation and training prior to data collection, which included three days of training in the assessment of fitness and fundamental motor skills. Although the field team were well-trained and had several opportunities to refine their skills, inter-rater reliability for fundamental motor skills assessments was not assessed.

The data were collected during school weeks three to eight (17 February to 27 March 1997) of the first NSW school term of 1997. Data collection took place concurrently in primary schools and high schools, in schools from each education sector and in urban and rural schools in order to prevent potential bias due to seasonal effects and the effects of progression through the school term.

The study was approved by the University of Sydney Human Ethics Committee. Each school and student was informed that their participation in the study was entirely voluntary and that they were free to withdraw from the study at any time. Active consent from parents/carers was required for students to participate in the survey.

Fundamental motor skill measurement

Six fundamental motor skills were assessed: run, vertical jump, catch, overhand throw, forehand strike and kick. The methods for the assessment of these fundamental motor skills have been described in detail elsewhere (Department of Education, Victoria, 1996). Qualitative, rather than quantitative, assessment of fundamental motor skills was employed because qualitative assessment methods are not influenced by the strength of the student and allow identification of problems with the execution of the fundamental motor skill. The qualitative components of each of these skills (see Table 3) were assessed by members of the field team by scoring each of the components as present or absent on four out of five trials (Holland, 1986). That is, if the student demonstrated the skill component on four of five trials they were recorded as possessing that skill component.

The conventional method of reporting the results of fundamental motor skill assessments is to report the proportion of students who have mastered all components of the skill (Walkley et al., 1993). One shortcoming of this reporting format is that it is difficult to judge what proportion of the students might be close to achieving Mastery. Consequently, we have created another reporting format (Near Mastery) in which the proportion of students who have mastered all but one of the components of each skill is reported. For the purpose of making comparisons between urban and rural students and across tertiles of socioeconomic status, those who displayed Mastery or Near Mastery were combined into a single group and identified as possessing Advanced Skills.

For the purpose of planning skill development or educational programs it can be helpful to know the proportion of students who displayed each component of each skill. These two presentation formats (overall skill mastery/near mastery and skill component mastery) compliment each other and both will be used here.

Sociodemographic measures

All students were asked for information on their age, school year, sex, suburb and postcode of residence. Postcode of residence was used as a proxy for socioeconomic status. The Australian Bureau of Statistics (ABS) Index of Relative Socioeconomic Disadvantage (Australian Bureau of Statistics, 1993) was used to give an SES score for each postcode area, allowing students to be ranked according to socioeconomic status. Based on this score, students were grouped into tertiles of SES. Students were identified as resident in urban regions if their school was situated in the Sydney metropolitan area, the adjacent Blue Mountains region, the cities of Wollongong and Newcastle or the Central Coast region.

Data entry and analysis

Students' performance was recorded as either displaying or not displaying each component of each fundamental motor skill. The records were double entered by a commercial data entry organisation. Data analyses were undertaken using SAS (SAS Institute Inc., 1990) and STATA (Statacorp, 1997). Analyses were not weighted because the sampling method adopted was designed to provide an approximately self-weighted sample. Prevalence estimates were computed for each year group separately for boys and girls. Confidence intervals take into account the design effect resulting from the cluster sampling and are thus wider than would be the case under the usual assumption of simple random sampling. Tests of significance (to test for differences by geographical region and SES) were used to determine whether observed differences were larger than would be expected through random variability. These tests were performed by fitting logistic regression equations to the data using Generalised Estimating Equations (GEEs) to take into account the clustering by school. Separate models were fitted for boys and girls, and year group (coded as a categorical variable) was adjusted for in each model. Each model was tested for an interaction between year group and the explanatory variable of interest using $P<0.01$ as the criterion of statistical significance. The Wald test was used to assess significance across SES tertiles and between urban and rural groups.

Results

Response rates

Of the 90 schools (45 primary, 45 high) initially invited to participate in the survey, five declined the invitation (one primary, four high schools). The primary school and three of the high schools were replaced with alternative schools. Data collection (N=5518) was completed before a replacement for one high school could be found. The response rates by sex and year group for primary school students were all close to 90% and in excess of 80% for Year 8 and Year 10 boys and Year 8 girls. The response rate for Year 10 girls was 71%. The majority of cases of non-participation (>70%) were due to absenteeism on the day of testing, rather than refusal to participate. The mean ages of students in school years 4, 6, 8 and 10 were 9.3, 11.3, 13.3 and 15.3 years respectively. Fifty-three percent of the students were male and 70% of students attended urban schools.

Mastery/Near Mastery

School year group and sex

Figure 1 shows the proportion of boys and girls in school years 4, 6, 8 and 10 who displayed Mastery or Near Mastery of each of the six fundamental motor skills and Table 1 shows the proportion (95%CI) of boys and girls in each school year who displayed Advanced Skills (Mastery or Near Mastery).

Run

Among boys, 24% of Year 4 showed Mastery, increasing to 40% in Year 10. Among girls, 24% also showed Mastery in Year 4, increasing to 31% in Year 10. Approximately 30% of both boys and girls in each year showed Near Mastery. Although there was a modest increase with age in Mastery among boys, the increase among girls was small and the proportion showing Near Mastery did not increase among either boys or girls.

Vertical jump

Approximately 20% of Year 4 students (both boys and girls) displayed Mastery of the vertical jump, increasing to 35% of Year 10 boys and girls. Between 30% and 40% of boys and between 20% and 30% of girls in each Year showed Near Mastery of the vertical jump. Overall, the pattern of Mastery was similar for boys and girls, with slightly more boys than girls showing Near Mastery in each school year.

Catch

Mastery of the catch increased from 13% in Year 4 to 37% in Year 10 among boys and from 8% in Year 4 to 19% in Year 10 among girls. Twenty-three percent of Year 4 boys showed Near Mastery and slightly more than 30% showed Near Mastery in Years 6-10. Among girls, between 16% and 35% showed Near Mastery in each year.

Overhand throw

Eighteen percent of Year 4 boys showed Mastery of the overhand throw, increasing to 44% of Year 10 boys. Four percent of Year 4 girls displayed Mastery of the overhand throw, increasing to 18% in Year 10. Approximately 20% of boys in each year and between 8% and 13% of girls in each year displayed Near Mastery.

Forehand strike

Mastery and Near Mastery of the Forehand Strike was generally low. Among boys, Mastery ranged from 8% in Year 4 to 27% in Year 10 and among girls Mastery ranged from 3% in Year 4 to 8% in Year 10. Near Mastery among boys ranged from 13% in Year 4 to 21% in Year 10 and from 6% in Year 4 to 16% in Year 10 among girls.

Kick

Mastery of the kick ranged from 8% of Year 4 boys to 38% of Year 10 boys, with a further 10% to 16% of boys showing Near Mastery. For girls, Mastery ranged from 1% to 4% with between 2% and 4% of girls showing Near Mastery.

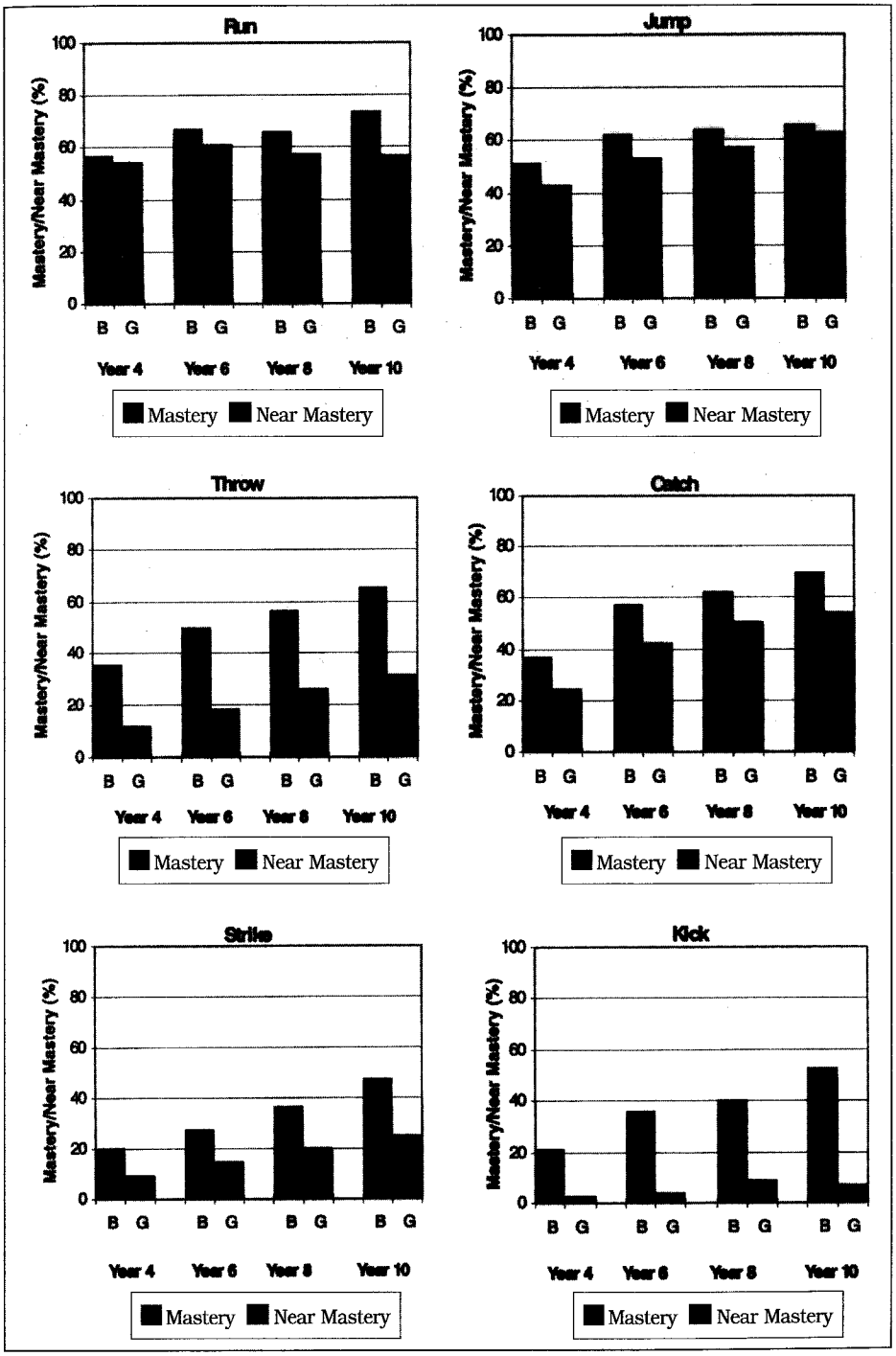
Urban/rural location

There were no statistically significant differences in the proportion of urban and rural boys or girls who displayed Advanced Skills for any of the six fundamental motor skills assessed. The interaction between school year group and urban/rural location was not significant, indicating that there were no differences in the prevalence of Advanced skills between urban and rural students in any of the year groups.

Table 1: Proportion (%) and 95% confidence intervals of boys and girls in each school year who displayed advanced skills (Mastery or Near Mastery) of each fundamental motor skill.

	Boys				Girls			
	Yr 4	**Yr 6**	**Yr 8**	**Yr 10**	**Yr 4**	**Yr 6**	**Yr 8**	**Yr 10**
Run	57.7 (53.0-62.4)	67.4 (61.6-73.1)	67.5 (62.0-73.1)	75.6 (70.0-81.3)	55.1 (49.2-61.0)	63.3 (57.9-68.8)	58.8 (52.8-64.8)	59.7 (52.3-67.0)
Vertical jump	52.5 (45.3-59.6)	62.2 (57.1-67.4)	65.6 (59.4-71.8)	67.1 (59.7-74.5)	43.3 (36.1-50.5)	53.6 (46.2-61.1)	59.0 (52.3-65.7)	64.6 (56.1-73.1)
Catch	38.5 (31.6-45.4)	57.5 (50.6-64.4)	63.8 (58.3-69.4)	69.8 (63.4-76.2)	24.8 (19.4-30.3)	42.6 (36.7-48.6)	51.7 (46.2-57.2)	55.8 (47.3-64.2)
Overhand throw	36.4 (30.6-42.2)	52.1 (46.3-57.9)	58.4 (51.3-65.5)	65.6 (59.8-71.4)	12.0 (7.9-16.1)	18.4 (13.1-23.8)	26.5 (21.3-31.7)	32.7 (26.4-39.0)
Forehand strike	20.4 (14.8-25.9)	29.5 (23.1-35.9)	37.6 (30.4-44.8)	49.5 (42.3-56.7)	9.1 (5.4-12.9)	15.0 (9.6-20.5)	21.3 (15.2-27.4)	25.5 (19.8-31.1)
Kick	21.5 (16.9-26.2)	38.2 (32.9-43.4)	42.5 (37.3-47.8)	55.8 (51.0-60.6)	2.5 (1.0-4.0)	4.3 (2.3-6.2)	8.7 (5.0-12.5)	7.3 (4.2-10.4)

Figure 1: Proportion of boys (B) and girls (G) displaying skill Mastery and Near Mastery in each school year.



Socioeconomic status

Table 2 shows the proportion of boys and girls in each SES tertile who displayed Advanced Skills in each of the fundamental motor skills. Among boys, there was a statistically significant association between SES tertile and Advanced Skills was significant for the run and forehand strike. Among girls, there were significant associations between SES tertile and Advanced Skills for the vertical jump, the catch, the overhand throw and the kick. The association approached significance for the run, but was clearly not significant for the forehand strike. That is, Mastery or Near Mastery of these fundamental motor skills generally increased with increasing socioeconomic status among girls, with a less evident relationship among boys.

Skill component mastery

The proportion of girls and boys in each school year who mastered each skill component is shown in Table 3.

Run

Clearly, most boys and girls possessed components 1, 2 and 5 and 50% to 60% of boys and girls displayed components 3 and 4. For many of the components of this skill, the proportion of students who performed the skill only increased slightly between Year 4 and Year 10. Focussing attention on the third and fourth components for both boys and girls should result in a very high proportion of girls and boys displaying Mastery of this skill.

Vertical jump

There were only small differences between boys and girls in the proportion who correctly performed each component of the vertical jump. Most students correctly

Table 2: The proportion of boys and girls in each socioeconomic status (SES) tertile who displayed Mastery or Near Mastery (Advanced Skills) of each fundamental motor skill.

	Low SES (% Advanced Skills)	Med SES (% Advanced Skills)	High SES (% Advanced Skills)	Wald statistic based on GEE model for year group (2 df)
Boys				
Run	64	66	70	X^2=7.4, P=0.02
Vertical jump	62	57	67	X^2=4.7, P=0.09
Catch	56	59	57	X^2=0.9, P=0.6
Overhand throw	52	53	53	X^2=0.4, P=0.8
Forehand strike	31	31	38	X^2=11.0, P=0.004
Kick	38	41	38	X^2=0.7, P=0.7
Girls				
Run	54	59	65	X^2=4.8, P=0.09
Vertical jump	45	51	69	X^2=20.2, P>0.001
Catch	37	44	48	X^2=7.5, P=0.02
Overhand throw	19	19	28	X^2=11.4, P=0.003
Forehand strike	16	16	20	X^2=2.6, P=0.3
Kick	4	6	7	X^2=7.5, P=0.02

performed components 1 and 5, a little more than 60% performed component 2 correctly and about half correctly performed components 3 and 4. There was generally only a small increase between Year 4 and Year 10 in the proportion of students who correctly performed each of the components. A focus on components 2, 3 and 4 is clearly required in skill development programs.

Catch

Most students performed components 1, 2, 3 and 5 correctly, although more attention could be given to practising component 5 among Year 4 students. Only a minority of students correctly performed components 4 and 6, although these results may have been influenced by the test criteria and the method of test administration. With regard to component 4 (correct positioning of the hands and fingers) students were only scored correct if the hands were held side-by-side and touching. The field staff noted that many students used a "catch-and-trap" style (common in softball and baseball) in which the ball is received in one hand while the other hand closes over the ball to "trap" it. It is possible that the criteria for the correct performance of this component are too strict.

With regard to the sixth component (elbows bend to absorb the force of the ball), it should be noted that a tennis ball was used for this test so many students may not have felt a need to absorb the force of the ball by moving their arms. However, it is good practice to move the arms when receiving a ball under all circumstances and should be done habitually.

Overhand throw

Almost all students correctly performed the first component and the majority correctly performed the fourth component (with fewer girls than boys showing correct performance). Although most boys correctly performed components 2 and 6, substantially fewer girls did so. Although components 2, 4 and 6 require some attention, particularly among girls, components 3 and 5 clearly need the greatest development, again with more attention to the needs of girls.

Forehand strike

Component 1 was performed correctly by almost all boys and girls. About 80% of boys performed component 2 correctly, and although fewer girls performed this component correctly, by Year 10 almost as many girls as boys performed the component correctly. Similarly, by Year 10, about 70% of girls and boys correctly performed component 4. There were substantial differences in the proportion of girls and boys who correctly performed components 3, 5, 6 and 7. Approximately 60% of boys and 40% of girls correctly performed components 3 and 6, and about 80% of boys and 60% of girls correctly performed component 7. However, only very small proportions of both girls and boys correctly performed component 5. A comprehensive skills development program is required to improve performance in the forehand strike, as with the kick.

Kick

Almost all students correctly performed component 1 and the majority of boys (and somewhat fewer girls) correctly performed components 2 and 3. About 70% of boys correctly performed component 7 and about 50% of boys correctly performed components 5 and 6. However, only small proportions of girls correctly performed components 5, 6 and 7. A minority of both boys and girls correctly

Table 3: Proportion (%) of boys and girls in each school year who correctly performed each component of each fundamental motor skill.

	Boys				Girls			
	Yr 4	Yr 6	Yr 8	Yr 10	Yr 4	Yr 6	Yr 8	Yr 10
Run								
1 Eyes focussed forward throughout the run	88.3	87.2	93.1	94.0	88.5	92.5	93.4	94.1
2 Knees bent at right angles during the recovery phase	75.1	81.4	85.5	87.7	78.4	83.9	81.8	76.8
3 Arms bend at elbows in opposition to legs	52.5	60.8	57.6	63.7	49.7	49.9	45.0	51.3
4 Contact ground with front part of foot	53.2	66.5	62.0	71.0	50.0	56.4	59.0	61.9
5 Body leans slightly forward	90.0	92.9	91.3	91.8	86.8	88.3	88.8	87.5
Vertical Jump								
1 Eyes focussed forward or upward throughout the jump	83.1	92.9	91.3	94.7	89.9	95.2	94.0	96.2
2 Crouch with knees bent and arms behind body	67.0	73.9	73.0	69.9	50.1	60.3	64.6	67.9
3 Forceful upward thrust of arms as legs straighten to take off	50.1	57.5	60.3	65.6	41.6	49.3	51.0	56.9
4 Contact ground with front part of feet and bend knees to absorb landing	45.7	47.3	57.3	62.9	56.4	58.8	61.4	66.5
5 Balanced landing with no more than one step	91.3	94.5	96.9	97.1	95.3	95.0	98.0	98.1
Catch								
1 Eyes focussed on ball throughout the catch	97.9	99.9	100.0	100.0	98.5	99.4	99.6	100.0
2 Preparatory position with elbows bent, hands in front	79.7	84.1	92.3	92.3	86.9	95.5	92.5	93.8
3 Hands move to meet the ball	81.3	89.3	91.2	91.4	68.6	87.9	87.1	94.7
4 Hands and fingers positioned correctly to catch the ball	39.3	44.2	45.5	51.4	23.6	33.8	37.9	41.0
5 Catch and control the ball with hands only	70.1	91.1	93.9	96.6	51.1	76.1	88.9	94.2
6 Elbows bend to absorb the force of the ball	32.8	51.8	54.3	64.6	23.5	30.8	39.3	38.9
Overhand throw								
1 Eyes focussed on target throughout the throw	94.9	98.1	99.6	99.6	97.5	99.1	99.8	99.5
2 Stand side-on to target	68.0	76.2	79.6	84.8	33.1	40.6	59.6	64.1
3 Throwing arm nearly straightened behind body	48.6	59.3	60.3	65.9	18.4	27.5	30.2	37.8
4 Step toward target with foot opposite throwing arm	77.7	87.2	88.5	91.9	56.1	70.2	77.9	77.4
5 Marked sequential hip to shoulder rotation	25.6	40.0	47.2	56.3	7.8	15.0	19.7	24.6
6 Throwing arm follows through down and across the body	73.5	84.0	88.5	93.6	46.5	56.4	67.4	75.9

	Boys				Girls			
	Yr 4	Yr 6	Yr 8	Yr 10	Yr 4	Yr 6	Yr 8	Yr 10
Forehand strike								
1 Eyes focussed on ball throughout the strike	97.6	98.9	99.3	99.4	96.4	98.7	99.0	98.6
2 Stand side-on to target with bat held in one hand	61.4	80.6	79.9	84.7	31.0	50.7	65.6	74.1
3 Striking hand nearly straightened behind shoulder at end of swing	40.2	55.5	55.9	66.8	18.8	31.8	39.8	42.2
4 Step toward target with foot opposite striking arm during strike	53.8	59.0	75.6	73.5	49.1	58.1	59.2	65.7
5 Marked sequential hip to shoulder rotation during the strike	12.0	17.2	26.1	37.8	4.4	8.7	11.5	13.2
6 Ball contact made opposite front foot with straight arm	48.0	62.6	60.7	74.3	24.5	32.8	44.0	46.2
7 Follow through toward the target then around the body	66.4	77.6	86.4	89.4	39.2	48.8	63.5	66.2
Kick								
1 Eyes focussed on ball throughout the kick	99.7	99.7	99.4	100.0	98.9	100.0	99.8	99.8
2 Step forward with non-kicking foot placed near ball	66.4	74.4	80.7	86.6	38.8	45.2	58.7	61.8
3 Bend knee of kicking leg during the backswing	66.5	77.0	75.0	82.9	47.3	56.6	64.5	70.1
4 Hip extension & knee flexion >90 degree during prelim. kicking movement	17.4	30.6	42.3	52.2	2.3	5.0	9.7	14.0
5 Contact the ball with the top of the foot	38.4	57.1	58.8	70.0	11.6	19.2	26.6	30.0
6 Forward and sideway swing of arm opposite kicking leg	39.8	56.3	60.0	64.4	8.5	11.5	16.4	14.3
7 Kicking leg follows through toward the target after ball contact	53.3	68.9	72.4	83.2	22.1	26.1	40.4	42.0

performed component 4. Like the overhand throw, the proportion of students who correctly performed many of these components increased between Year 4 and Year 10.

Components 4 to 7 clearly need attention in a skill development program if Mastery is to be achieved by a large proportion of students. It is not surprising that fewer girls than boys correctly performed many of the components of the kick in light of the fact that many fewer girls typically participate in sports or games requiring kicking.

Discussion

For boys and girls in all year groups the proportion of students who displayed Mastery of a skill did not exceed 40% for five of the six fundamental motor skills.

This finding indicates only a moderate level of fundamental motor skill mastery among NSW school students. A similar study of fundamental motor skill mastery among Victorian students aged five to 12 years found a generally lower prevalence of skill mastery than found in this survey (Walkley et al., 1996). There are two possible explanations for this difference. First, the Walkley et al. study videotaped students and scored the tests in a laboratory. This methodological difference may account for the different findings of the two studies. Second, the difference may be real, possibly arising from different approaches to physical education or sports coaching in the two states. Regardless of the differences between the two studies, it is clear that fundamental motor skill proficiency among Australian school children is far lower than is desirable and achievable.

The high proportion of students who displayed Near Mastery in the run, the vertical jump and the catch suggests that the number of students displaying Mastery of these skills could be increased without great effort. However, it is clear that much more effort will be required to increase the proportion of students displaying Mastery of the forehand strike and kick. It is reasonable to believe that most students, given appropriate instruction, feedback on performance and practice opportunities, would be able to master these (and other skills) before the end of primary school. These skills can be learnt through participation in appropriate training which most children would find enjoyable. Fundamental motor skill mastery is the basis of satisfying participation in a wide range of physical activities.

There are several clear patterns in the data on the relationships between the demographic variables and Advanced Skills. First, there were no substantial or consistent differences for either boys or girls between those in urban or rural schools. Second, for many of the fundamental motor skills the proportion of girls with Advanced Skills increased with increasing socioeconomic status. This relationship was not as strong among boys. This clear finding suggests that programs to improve the fundamental motor skills among girls should have a particular focus on schools within lower and middle socioeconomic areas.

For each of the fundamental motor skills we assessed, significantly fewer girls than boys (adjusted for year groups) displayed Mastery or Near Mastery. Boys and girls showed similar patterns of Mastery and Near Mastery for the run and vertical jump and only slightly fewer girls showed Mastery and Near Mastery on the catch. However, substantially fewer girls displayed Mastery for the overhand throw, the forehand strike and the kick. These findings do not suggest, of course, that girls have inherently poorer skills, but are likely to reflect differences in the sports and games in which boys and girls choose to participate and, perhaps, that boys may receive greater attention from parents and teachers in skill development. That is, the skills (e.g., balance, coordination and rhythm) developed through the activities in which more girls participate (gymnastics and dance) are not represented among the tests administered in this survey. At present, there do not appear to be standardised tests for these skills and there is clearly a need for their development and for greater recognition of the potential gender bias in current fundamental motor skill tests (Hands & Larkin, 1997).

We suggest that sufficient curriculum time and appropriately trained and resourced staff need to be made available to support fundamental motor skill development among primary school children. The experience of one of the authors (BH) in delivering fundamental motor skill training programs is that

approximately 10 hours of instruction is required for most children to master a fundamental motor skill. Providing one hour a week during the early years of primary school (kindergarten to Year 3 or 4) will ensure sufficient learning experience for children to master most, if not all of the key fundamental motor skills. At least over the next few years, until more highly skilled children start entering high schools, programs should also be delivered in high schools to improve the skills of those students. We also recommend that teacher training institutions consider modifying their curricula to include teaching skills for fundamental motor skills for all early childhood- and primary-trained teachers. Finally, community sporting organisations and the Department of Sport and Recreation may consider placing less emphasis on competitive games for young children and placing greater emphasis on skill development. It is not suggested that competition be abandoned, but that more opportunity be made available for skill development.

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