Fundamental Movement Skills

among children in New Zealand

March 2012

SPORT NEW ZEALAND

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Any enquiries should be sent to: maea.hohepa@sportnz.org.nz

Note: SPARC became Sport New Zealand on 1st February 2012.

Contents

About this Report

More young people playing and enjoying sport is a key outcome for Sport New Zealand[1].

Many factors shape young people's engagement with and enjoyment of sport. One factor considered critical is the development of fundamental movement skills (FMS). By helping young people develop their locomotive skills (e.g. walking, running), stability skills (e.g. landing, balance, rotation) and manipulative skills (e.g. throwing, catching, striking a ball), we give them an opportunity to grow their love of sport and recreation.

While we know FMS are important, there is little published information about the current skill levels of children in New Zealand. To help fill part of this evidence gap, this report provides some insights about movement abilities of Kiwi children.

In this report, a national picture of movement skills among Year 4 and Year 8 students is provided, as well as an examination of whether skill levels have changed over time between 2002 and 2006.

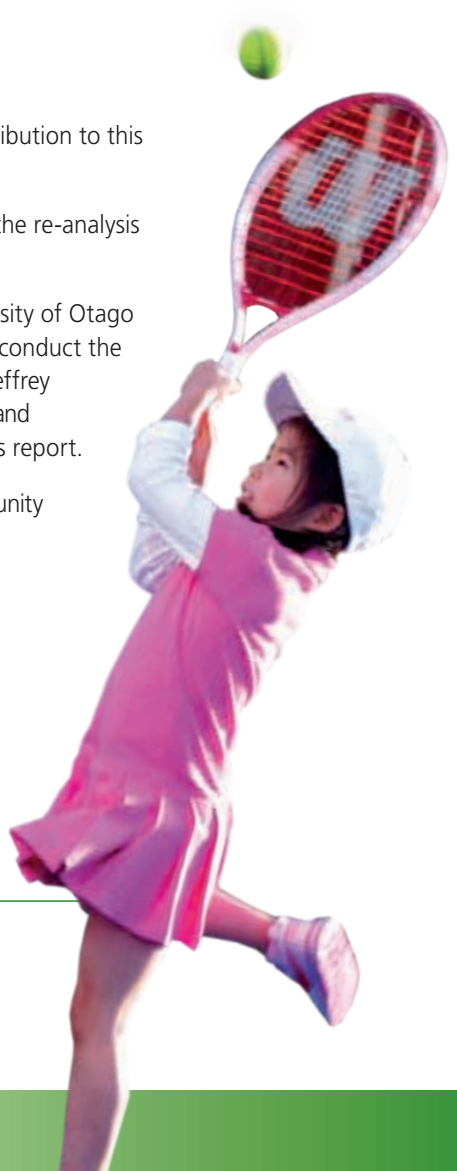
The findings reported are based on data collected by the National Education Monitoring Project (NEMP). A small selection of skills were assessed with a group of Year 4 children and Year 8 children in 2002. Some tasks were then tested again in 2006 with a *different group* of Year 4 and Year 8 children.

Acknowledgements

Sport NZ acknowledges the following people and organisations for their contribution to this report. In particular we would like to thank:

- The Ministry of Education for providing access to the NEMP dataset for the re-analysis of the motor skills and movement concept data.
- The team at the Educational Assessment Research Unit (EARU) at University of Otago who managed the NEMP project and whom Sport NZ commissioned to conduct the analysis reported in this document. Special thanks to EARU co-directors Jeffrey Smith and Alison Gilmore who lead this piece of work with great enthusiasm and to Jeffrey for reviewing the analyses and interpretations presented in this report.
- Members of the Sport NZ Research, Policy and Evaluation team and Community Sport and Recreation team for their input and review of this report.

Sport NZ
March 2012



[1] SPARC became Sport New Zealand on 1st February 2012.

Key Insights

Small increases in skills levels over time are seen

Depending on the skill, the data show that skill levels in 2006 either remained very similar to levels seen in 2002 or are slightly higher. Because the findings are based on two data points (2002 and 2006), subsequent assessment of the same skills is required to confidently state a real change in skill levels has occurred.

Most skills improve with age

Year 8 students performed most skills better than Year 4 students. Year 8 boys did better than Year 4 boys on 10 tasks with similar skill levels seen for three tasks. Year 8 girls outperformed Year 4 girls on eight tasks with similar skill levels seen for five tasks. Large age-related differences were seen for manipulative skills like catching, throwing and kicking.

Boys and girls excel at different skills

Boys outperformed girls on eight skills at Year 4 and seven skills at Year 8. Boys performed better at running, throwing and kicking type skills. Girls outperformed boys on six skills at Year 4 and two skills at Year 8. At Year 4, girls did better than boys on all stability skills. At Year 4 and Year 8, girls did better at skipping and poi swings[2].

While boys and girls did better than each other on different skills, differences favouring boys tended to be larger than those favouring girls. This means, when boys outperformed girls, the gender difference was moderate to large. When girls outperformed boys, the gender difference was small.

Skill levels vary widely among children of the same age and gender

While the average Year 8 student is more skillful than the average Year 4 student, there is substantial overlap in performance between Year 4 and Year 8 students. What this means is when we look at individual scores there are some Year 4 students that outperform most Year 8 students and some Year 8 students that are less skilled than most Year 4 students. Likewise, there is substantial overlap in performance between boys and girls with some girls outperforming some boys on any given task.

This tells us that FMS performance is highly individualised, reducing the ability to make generalisations across genders and age groups.

[2] A poi is a light ball on a string of varying length which is swung or twirled rhythmically.

At-a-Glance Findings

The Skills

Run Students ran from a standing start to a cone placed 20 metres away and back to the start position. Marks were given for form and the time it took to complete the run. Scores range from 0 to 6.

Dodge Students ran in a zigzag pattern from a standing start to a cone placed nine metres away and back again. Marks were given for form and the time it took to complete the task. Scores range from 0 to 6.

Leap Students tried to leap over a mark (1.5m for Year 4 students, 2m for Year 8 students). Marks were given for form. One point was awarded for clearing the mark. Scores range from 0 to 5.

Bridges and arches Students were asked to engage in a number of stretching and bridging floor exercises. Marks were given for form and holding set positions. Scores range from 0 to 18.

Jumps Students were asked to make jumps in various fashions and were scored on their form. Scores range from 0 to 6.

Foot balances Students were asked to balance on one foot and then the other for 10 seconds each. Then they were asked to balance on one foot and bend down and pick up a hoop, straighten up, and hold balance for five seconds. Marks were given on how well each task was performed. Scores range from 0 to 9.

Bottom balances Students were asked to do various stability positions on the floor which involved placing their bottoms, arms, and legs in various positions and holding them there. Marks were given for form and holding positions. Scores range from 0 to 12

Small ball catch Students were asked to catch a small ball thrown to them by the teacher standing six metres away. Marks were given for the number of balls caught and their catching technique. Scores range from 0 to 6.

Distance throw Students threw a ball as far as they could over a cone placed 10 metres from the students. Marks were given for throwing form (not distance). Scores range from 0 to 6.

Beanies Students were asked to throw a bean bag and catch it in a variety of ways including tossing it up from their feet. Marks were given for the number of times they caught the bag and on their form. Scores range from 0 to 17.

Racquet strike This task included two components. First, students bounced a tennis ball and then tried to hit it with a tennis racquet into a target area. Students were given a practice try and then were scored on their next two attempts. Then students were asked to throw the ball up in the air and hit it into a target area. Marks were given for the number of "firm, strong hits" and their technique. Scores range from 0 to 7.

Ball strike Students were asked to roll, throw, and bat a ball with a hockey stick at a target. Marks were given for accuracy and form. Scores range from 0 to 15.

Large ball kick Using a rubber inflated ball, students were asked to dribble and then kick the ball toward a target under various conditions. Marks were given for accuracy and form. Scores range from 0 to 10.

Poi swings This task differed for each age group.

Year 4 students were asked to swing the poi forward at the sides of their bodies. They were then asked to do anything they could do with the poi. Marks were given for the fluency and overall quality of their performance. Scores range from 0 to 7.

Year 8 students were asked to swing the poi forward at the sides of their bodies. Then they were asked to transfer the poi into one hand. They were then asked to do anything they could do with the poi. Marks were given for fluency and overall quality of their performance. Scores range from 0 to 9.

Skipping Students were asked to jump rope both on a short rope that they used themselves and on a long rope that was swung by the administrator and another student. Marks were given on the skill and fluency of the student performance. Scores range from 0 to 11.

Hula hoops Students were asked to throw a small hoop up in the air and catch it. They did this three times with each hand. Then they threw it up with one hand and caught it with the other. Then with a large hoop, they swung the hoop on each arm five times, and then performed a "hula hoop" move with the hoop for ten turns. They were scored on success and form on each task, and then on form overall. Scores range from 0 to 21.

The Results

2006 versus 2002 skill levels

	YEAR 4		YEAR 8	
	Year 4 Boys 2006 vs Year 4 Boys 2002	Year 4 Girls 2006 vs Year 4 Girls 2002	Year 8 Boys 2006 vs Year 8 Boys 2002	Year 8 Girls 2006 vs Year 8 Girls 2002
Locomotive skills				
Run	↑	↔	↔	↔
Dodge	↔	↔	↔	↔
Leap	↑	↑	↔	↔
Stability skills				
Bridges & arches	–	–	–	–
Jumps	–	–	–	–
Foot balances	↔	↔	↔	↔
Bottom Balances	–	–	–	–
Manipulative skills				
Small ball catch	↑	↑	↑	↔
Distance throw	↑	↑	↑	↔
Beanies	–	–	↔	↔
Racquet strike	↔	↔	↑	↔
Ball strike	–	–	–	–
Large ball kick	–	–	–	–
Poi Swings	↑	↔	↔	↔
Skipping ropes	↑	↔	↔	↔
Hula hoops	↔	↑	↑	↔

↑ Increase in skill level (↑small, ↑↑moderate, ↑↑↑large increases) ↔No change over time
– Skill not assessed in 2002, therefore time comparison is not possible

Interpretation example 1:

Running skills increased between 2002 and 2006 for Y4 boys, and remained at a similar level for all other groups.

Skill level by age and gender

	AGE		GENDER	
	Year 4 Boys vs Year 8 Boys	Year 4 Girls vs Year 8 Girls	Year 4 Boys vs Year 4 Girls	Year 8 Boys vs Year 8 Girls
Locomotive skills				
Run	↔	↔	B↑	B↑
Dodge	↑↑	↑↑↑	B↑	B↑
Leap	–	–	B↑	↔
Stability skills				
Bridges & arches	↑	↔	G↑	↔
Jumps	↔	↔	G↑	↔
Foot balances	↑↑	↑	G↑	↔
Bottom Balances	↑	↔	G↑	↔
Manipulative skills				
Small ball catch	↑↑↑	↑↑↑	B↑	B↑
Distance throw	↔	↔	B↑↑↑	B↑↑↑
Beanies	–	–	–	↔
Racquet strike	↑↑	↑↑↑	B↑↑	B↑
Ball strike	↑↑↑	↑↑↑	B↑↑	B↑↑
Large ball kick	↑	↑↑	B↑↑↑	B↑↑
Poi Swings	–	–	G↑	G↑
Skipping ropes	↑↑	↑↑	G↑	G↑
Hula hoops	↑↑↑	↑↑	↔	↔

↑ Year 8 students outperform Year 4 students (↑ small, ↑↑ moderate, ↑↑↑ large difference)
B Boys outperform girls (↑ small, ↑↑ moderate, ↑↑↑ large difference)
G Girls outperform boys (↑ small, ↑↑ moderate, ↑↑↑ large difference)
↔ No difference between groups – No age and/or gender comparisons were possible

Interpretation example 2:

Y4 and Y8 students have similar running skill levels.

Interpretation example 3:

Girls outperform boys at skipping at Y4 and Y8. The difference in skill level is small.

The Assessment

National Education Monitoring Project (NEMP)

This report is based on customised analyses of motor skills (e.g. running, striking a ball) data from the NEMP project. The Ministry of Education (who funded NEMP) provided permission for the re-analysis of the data by the Educational Research Assessment Unit at the University of Otago. Further information about NEMP and the analyses completed for this report is in Appendix A.

The analyses undertaken allowed us to answer the following questions about Year 4 and Year 8 students in New Zealand:

- Have skill levels changed overtime between 2002 and 2006?
- Do skill levels differ between Year 4 and Year 8 students?
- Do skill levels differ between boys and girls?

The FMS tasks

Sixteen fundamental movement skills (FMS) were tested in 2006, with ten of these tasks assessed previously in 2002. A description of each task is provided on pages 4 and 5. The process for developing and choosing the tasks is described in Appendix A.

The Participants

Participants were Year 4 (ages 8-9) and Year 8 (ages 12-13) students. The samples in 2002 and 2006 were randomly chosen and representative of Year 4 and Year 8 students in New Zealand.

Each student was assessed on one-third of the FMS tasks. Depending on the skills tested, the findings are based on a sample of 450 to 480 students for the 2006 assessment and 225 to 240 students for the 2002 assessment.

With the exceptionally high participation rate (98-99%) in NEMP, the samples of students for each task are large enough to give highly reliable estimates of an overall national picture, and for comparisons between Year in school and gender. School and participant selection is described further in Appendix A.

The Analyses

Assessing change using effect sizes

Effect sizes were chosen because they tell us if a change in skill levels over time or a difference in skill level between student groups exist, but more importantly, the strength (or magnitude) of the change/difference.

An **effect size** of:

0.00	=	no change
0.01 to 0.19	=	little change
0.20 to 0.49	=	small change
0.50 to 0.79	=	moderate change
0.80+	=	large change

Box plots

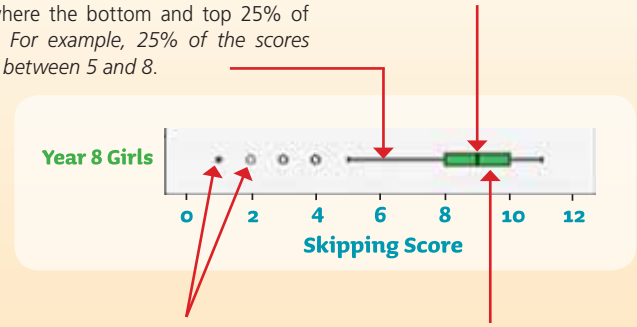
A box plot is a simple way of visually representing a lot of information. Box plots show information about the range of scores, extreme scores, and the spread of scores (or distribution).

Average scores tell a picture of what an *average child's* skill level looks like, while the box plot provides a detailed picture of what skill levels look like across *all children*.

Below is an example of a box plot showing the skipping skill scores for Year 8 girls.

The **whiskers** (or the lines that extend to the left and right of the box) show the **score range**. This is where the central 95% of the scores in the distribution lie. *For example, 95% of scores acheived were between 5 and 11.* Each whisker also tells us where the bottom and top 25% of the scores sit. *For example, 25% of the scores acheived were between 5 and 8.*

The **vertical line** inside the box is the **median score** – also known at the middle score. 50% of the scores are lower and 50% are higher than the median score. *For example, 50% of Year 8 girls achieved a score of 9 or higher.*

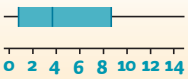


The **single points** beyond the whiskers are extreme scores called outliers. These scores represent the 2.5% of the scores at the low end and 2.5% of the scores at the high end of the scoring scale. If there are no single point values, then the end of each whisker indicates the minimum and maximum scores achieved. If this is the case, the whiskers cover 100% of the scores (rather than 95% of the scores).

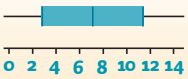
The **horizontal box** is called the **interquartile range** and tells us where the central 50% of the scores in the distribution lie. This means a further 25% of scores lie to the left of the box and 25% lie to the right of the box, these scores are shown by the 'whiskers' and 'single points'. *For example, 50% of Year 8 girls achieved a score between 8 and 10.*

Comparing and interpreting box plots

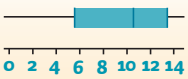
When looking at box plots, we are interested in the **score distribution** and if the scores are **skewed**. Each box plot below shows a different score distribution pattern.



Skewed right
Most scores are at the lower end of the scoring scale



Symmetric
Scores are equally distributed around the median score

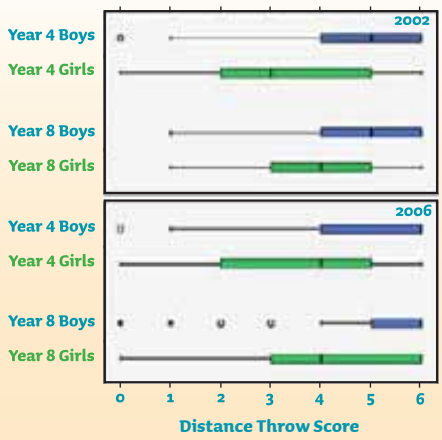


Skewed left
Most scores are at the higher end of the scoring scale

An example of the type of graph used in this report is shown below. The graph has 8 individual box plots - four relate to the 2002 data and four relate to the 2006 data for the skill of distance throw.

When comparing box plots we talk about **positive and negative shifts**:

- A **positive shift** is when at least one box plot component (e.g. score range, score distribution, interquartile range, median) moves to the right in 2006.
- A **negative shift** is used when at least one box plot component moves to the left of the graph.



Interpretation example 1:

In this graph, scores are skewed to the left for most groups. This indicates that, irrespective of age, most children achieved mid-to-high scores.

Interpretation example 2:

Looking at the 2006 data, boys display a more favourable score distribution than girls. They have a narrower range of scores and the score distribution is more skewed to the left.

Interpretation example 3:

We can see a positive shift in the score distribution for Year 8 boys over time. In particular, we see a positive shift in the score range, interquartile range and median score.

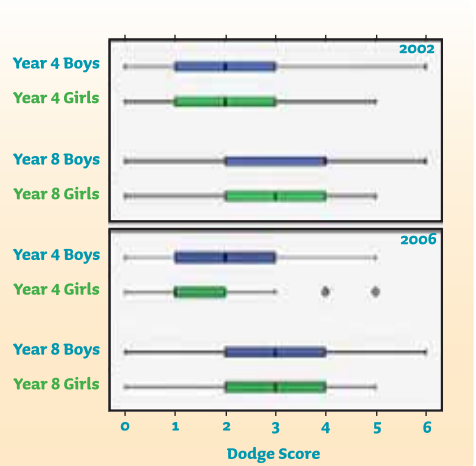
The Results

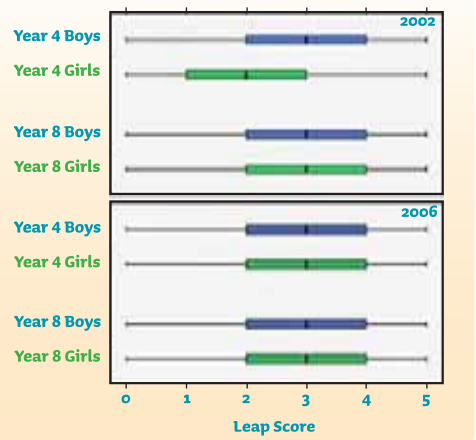
Note 1: Y4 = Year 4 students, Y8 = Year 8 students.
Note 2: All age and gender comparisons are based on the 2006 data.
Note 3: Gender comparisons are made between boys and girls of the same age (e.g. Y4 boys vs Y4 girls).
Note 4: Age comparisons are made between students of the same gender (Y8 boys vs Y4 boys).
Note 5: All effect size (es) results can be found in Appendix B.

Locomotive Skills

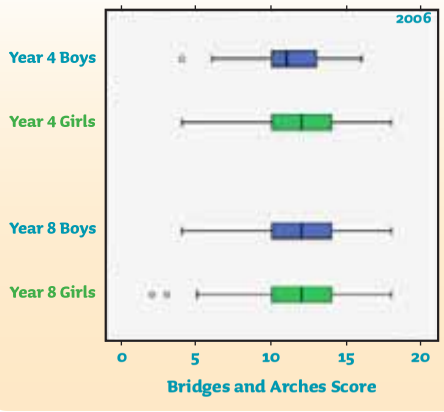
SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
RUN Students ran from a standing start to a cone positioned 20 metres away and back to the start position. Scores range from 0 to 6.	1. Running skills are slightly higher in 2006 than 2002 for Y4 boys. For all other groups, skill levels in 2006 are very similar to levels in 2002. 2. Y4 and Y8 students have similar running skills. 3. Boys are better runners than girls at Y4 and Y8. 4. Irrespective of age, most children achieve mid-to-high scores. 5. A wide range of skill levels is seen, especially among girls. Some girls at Y8 still achieve low scores for running.		**Small increase in skill level for Y4 boys between 2002 and 2006** - this small increase (es: 0.20) is reflected by a positive shift in the range and distribution of scores for Y4 boys in 2006. There was little change in skill level for all other groups. **Y4 and Y8 students have similar skill levels** - this age pattern is seen for boys and girls. **Boys outperform girls** - this gender difference is seen at Y4 (es: 0.46) and Y8 (es: 0.47) and is reflected by a more favourable distribution of scores for boys. **Many children achieve high scores** - all box plots are skewed slightly to the left indicating mid-to-high scores were generally achieved. At least 50 percent of children scored 4 or higher. The maximum score was achieved by some children in each group (except for Y4 girls). **Large variation in skill level** - although high scores are achieved, the range of scores vary widely for most groups (except for Y8 boys), with variability being larger for girls. For Y8 boys, the low variability of scores tells us that their skill levels tend to be more similar than different. The large overlap of scores between groups shows that there are some Y4 students who outperform some Y8 students and some girls who outperform some boys.

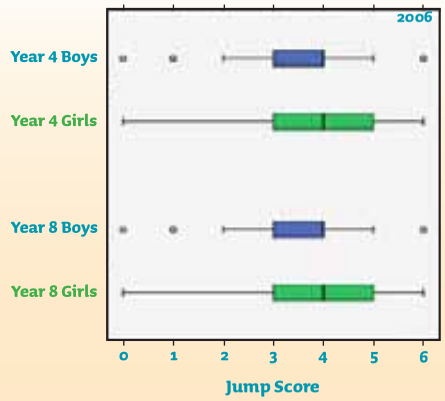
Locomotive Skills

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
DODGE Students ran in a zigzag pattern from a standing start to a cone nine metres away and back again. Scores ranged from 0 to 6.	1. Dodging skills have remained very similar over time. 2. Skill levels improve with age, but there are still Y8 children who get low scores. 3. Boys are more skillful than girls, especially at Y4. 4. A larger increase in skill level occurs for girls (than for boys) between Y4 and Y8. This results in a reduced gender gap at Y8. 5. Few children achieved high scores, especially at Y4.		**No change in skill level between 2002 and 2006** - effect sizes tell us that skill levels in 2006 are similar to levels in 2002 for all groups. **Y8 students outperform Y4 students** - a large difference is seen for girls from Y4 to Y8 (es: 0.96) and a moderate difference is seen for boys (es: 0.68). The larger effect size indicates that the increase with age is greater for girls. This finding is reflected by a positive shift in the distribution of scores and median scores from Y4 to Y8. However, the range of scores achieved is wider at Y8. The wider variation seen at Y8 suggests that while some children improve, others do not. **Boys outperform girls** - this gender difference is seen at Y4 (es: 0.41) and Y8 (es: 0.20). The smaller effect size at Y8 suggests that the gender gap at Y4 narrows by Y8. This finding is highlighted by the range and distribution of scores between genders becoming more similar at Y8. **Few children achieved high scores** - the Y4 box plots are skewed to the right which tells us that most Y4 children achieved scores toward the low end of the scoring scale. At Y8, the box plots are more symmetrical with some children achieving high scores and some achieving low scores, with 50% of children achieving mid-range scores between 2 and 4 (out of 6).

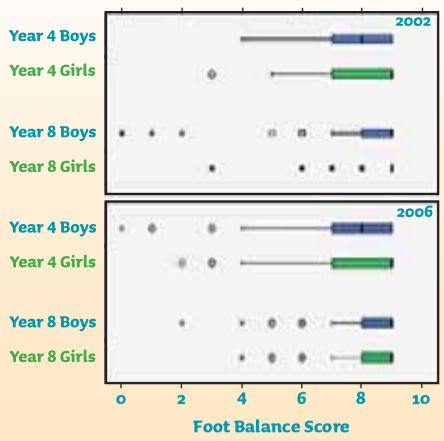
SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
LEAP Students tried to leap over a mark (1.5m for Y4 students, 2m for Y8). Scores range from 0 to 5.	1. Leaping skills are slightly higher in 2006 for Y4 students. For Y8 students, skill levels in 2006 are very similar to levels in 2002. 2. Boys are slightly more skillful than girls at Y4 but this small gender gap narrows by Y8. 3. Skill levels vary widely for all age groups, with low and high scores achieved by children in each group.		**Small increase in skill level for Y4 students between 2002 and 2006** - a small increase in skill level is seen for Y4 girls (es: 0.29) and Y4 boys (es: 0.21). Skill levels of Y8 students have remained very similar over time. **No Y4 and Y8 comparisons** - Y4 and Y8 students did different leap tasks and therefore comparisons are not possible. **Boys outperform girls at Y4 but girls catch up by Y8** - a small gender difference is seen at Y4 (es: 0.26) but not at Y8. The smaller effect size at Y8 suggests that the gender gap at Y4 narrows by Y8. **Large variation in skill level** - a wide range of scores was achieved for all groups spanning the entire score range. Most children achieved mid-to-high scores (50% scored 3 and above), but there are some children who score low.

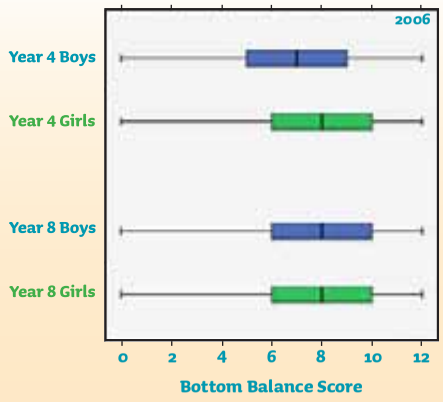
Stability Skills

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
BRIDGES AND ARCHES Students were asked to engage in a number of stretching and bridging floor exercises. Scores range from 0 to 18.	1. Girls are slightly more skillful at bridges and arches than boys but only at Y4. 2. Skill level improves slightly with age for boys. 3. Girls are slightly more skillful than boys, but only at Y4. 4. Large variation in scores achieved with some Y4 and Y8 students achieving high scores.		**No comparison between 2002 and 2006 is possible** - this task was new to the 2006 task list. **Y8 boys outperform Y4 boys** - a small age difference is seen for boys (es: 0.24) but not for girls. **Girls slightly outperform boys** - a small gender difference is seen at Y4 (es: 0.20) but not at Y8. This tells us the gender gap at Y4 decreases by Y8. **Large variation in skill level** - skill levels vary among all groups. A large overlap in scores between groups is also seen. Although girls and Y8 students are typically more skillful, there are some Y4 students who outperform some Y8 students and some boys who outperform some girls.

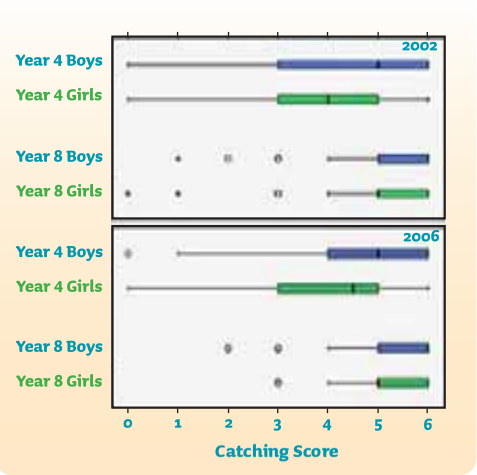
SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
JUMPS Students were asked to make jumps in various fashions. Scores range from 0 to 6.	1. Jumping skills at Y4 are very similar to Y8 skill levels, indicating no change in skills with age. 2. Girls are slightly more skillful than boys, but only at Y4. 3. Skill levels vary widely among girls, with some girls achieving the maximum score but others the minimum.		**No comparison between 2002 and 2006 is possible** - this task was new to the 2006 task list. **Y4 and Y8 students have similar skill levels** - the effect sizes indicate there is little difference in skill levels between Y4 and Y8 students. This is reflected in Y4 boys and Y8 boys displaying very similar score distributions. This similarity is also seen between Y4 girls and Y8 girls. **Girls slightly outperform boys** - a small gender difference is seen at Y4 (es: 0.22) only. The decrease in effect size with age tells us that the small gender gap at Y4 decreases by Y8. **Large variation in skill level for girls** - although girls at Y4 perform this task better than boys, girls display a wider range of scores than boys. This means that among boys, their jumping skills are more similar than different. In contrast, scores vary widely among girls, with the highest and lowest scores achieved.

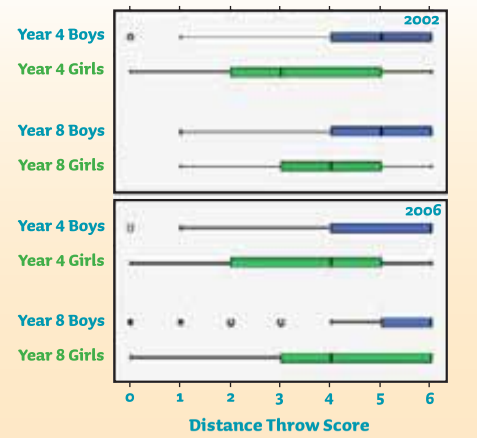
Stability Skills

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
FOOT BALANCES Students were asked to balance on one foot and then the other for 10 seconds each. Then they were asked to balance on one foot and bend down and pick up a hoop, straighten up, and hold balance for five seconds. Scores range from 0 to 9.	1. Skill levels in 2006 are very similar to levels in 2002 for all groups. 2. Skill levels improve with age for boys and girls. 3. Girls are slightly more skillful than boys at Y4 but this small gender gap narrows by Y8. 4. Irrespective of age or gender, many children achieved high scores.		**No change in skill level between 2002 and 2006** - effect sizes tell us that skill levels in 2006 are similar to levels in 2002 for all groups. **Y8 students outperform Y4 students** - this age difference is seen for both genders, but the difference is larger among boys (es: 0.60) than girls (es: 0.40). The positive shift in the range and distribution of scores is a reflection of difference in skill by age. **Girls slightly outperform boys** - girls are slightly more skillful than boys at Y4 (es: 0.30) but not at Y8. The decrease in effect size suggests that the small gender gap seen at Y4 narrows by Y8. **High scores are achieved by many children** - most children achieved high scores, with some children in each group achieving the maximum score. For all groups (except Y4 boys) the median score was the maximum score. This means that 50% of children achieved the maximum score in these groups.

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
BOTTOM BALANCES Students were asked to do various stability positions on the floor which involved placing their bottoms, arms, and legs in various positions and holding them there. Scores range from 0 to 12.	1. Small increase in skill level from Y4 to Y8 is seen for boys. 2. Girls are slightly more skillful than boys at Y4 but not at Y8. This suggests that the gender gap at Y4 narrows by Y8. 3. There is a large range of skill levels across all groups. Most children score highly but there are still some who get low scores.		**No comparison between 2002 and 2006 is possible** - this task was new to the 2006 task list. **Y8 students outperform Y4 students** - this age difference is seen among boys (es: 0.37) but not among girls. The positive shift in the distribution of scores from Y4 to Y8 reflects the small increase seen for boys. **Girls slightly outperform boys** - a small gender difference is seen at Y4 (es: 0.25) but not at Y8. The decrease in effect size suggests that the small gender gap at Y4 disappears by Y8. This gender difference is reflected by a slightly more favourable score distribution and median score for Y4 girls. **Many children score highly** - for most groups (except Y4 boys) the box plots are skewed to the left indicating that high scores are achieved by many children, with the maximum score being achieved by some children in each group. **Large variation in skill level** - although high scores were achieved, skill levels vary widely, with about 25% of children in each group getting a score of 6 or lower. A large overlap in scores between groups is also seen. This means that some Y4 students outperform some Y8 students and some boys outperform some girls.

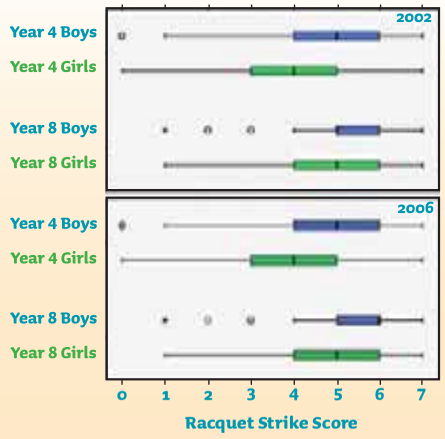
Manipulative Skills

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
SMALL BALL CATCH Students were asked to catch a small ball thrown to them by the teacher from six metres away. Scores range from 0 to 6.	1. Skill levels in 2006 are slightly higher than 2002 for most groups. 2. Skill levels improve with age. 3. Boys outperform girls at Y4 and Y8. This gender gap does not change with age. 4. Most Y8 children achieve high scores on this task. 5. Large variation in skill level at Y4.		**Small increase in skill level for most groups between 2002 and 2006** - a small increase over time is seen for Y4 boys (es: 0.23), Y4 girls (es: 0.24) and Y8 boys (es: 0.26). These findings are reflected in a positive shift in the score distributions and median scores for these groups. There was little change in skill level for Y8 girls. **Y8 students outperform Y4 students** - a large increase from Y4 to Y8 is seen for boys (es: 1.00) and girls (es: 1.02). This age difference is shown by a positive shift in the median score and in the range and distribution of scores from Y4 to Y8. The improved range of scores tells us that most children improve their catching skills with age. **Boys slightly outperform girls** - this gender difference is seen at Y4 (es: 0.31) and Y8 (es: 0.40) and is a reflection of a more favourable distribution of scores among boys. **High scores achieved by many children** - all box plots are skewed to the left (especially at Y8). This tells us many children achieved mid-to-high scores. Over 50% of children scored 4 or higher with the maximum score being achieved by some children in each group. **Large variation in skill level at Y4** - scores vary widely at Y4 but not at Y8. The lower score range for Y8 students tells us that their skills are more similar than different. A large overlap of scores between age and gender is also seen. Although boys and Y8 students are generally more skillful, there are some Y4 students who outperform some Y8 students and some girls who outperform some boys.

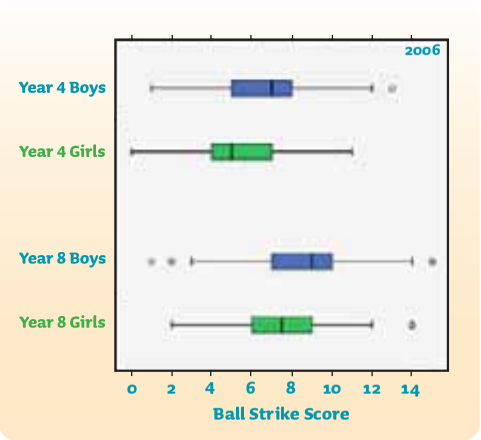
SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
DISTANCE THROW Students threw a ball as far as they could over a cone placed 10 metres from the student. Scores range from 0 to 6. Marks were given for throwing form (not distance).	1. Skill levels in 2006 are slightly higher than 2002 levels for most groups. 2. Skill levels improve with age, but some girls at Y8 still get low scores. 3. Boys outperform girls at Y4 and Y8. 4. Most Y8 children achieve high scores on this task.		**Small increase in skill level for most groups between 2002 and 2006** - this small increase in skill level for Y4 boys (es: 0.34) and girls (es: 0.21) and Y8 boys (es: 0.31) is reflected by a positive shift in score distributions. Little change was seen for Y8 girls. **Y4 and Y8 students have similar skill levels** - effect sizes tell us that Y4 and Y8 students have similar skill levels in terms of throwing form. This age pattern is seen for boys and girls. **Boys outperform girls** - this gender difference is large at Y4 (es: 0.92) and Y8 (es: 0.81) and is highlighted by a more favourable range and distribution of scores for boys. **Many children achieve high scores** - all box plots are skewed to the left, especially for boys. This indicates many boys achieved mid-to-high scores. Across all groups, 50% of children scored 4 or higher, with some children in each group reaching the maximum score. **Large variation in skill level** - while high scores are achieved, skill levels do vary widely among children, with low scores achieved by some children in each group.

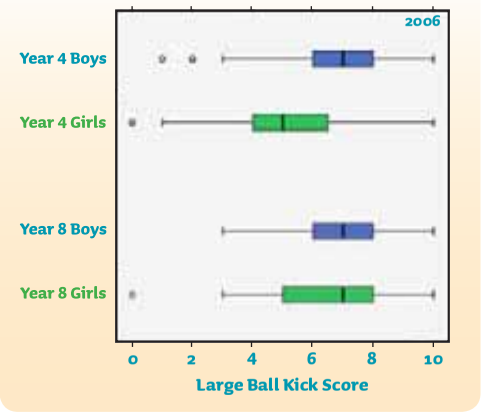
Manipulative Skills

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
BEANIES Students were asked to throw a bean bag and catch it in a variety of fashions including tossing it up from their feet. Scores range from 0 to 17.	1. Skill levels in 2006 are very similar to levels in 2002 for all groups. 2. Boys and girls have similar skill levels for this task.		**No change in skill level between 2002 and 2006** - effect sizes tell us that skill levels in 2006 are similar to levels in 2002 for all groups. **No age comparison possible** - this task was only assessed among Year 8 students. **Boys and girls have similar skill levels** - effect sizes tell us that skill levels of boys and girls are very similar. **Many children achieve high scores** - all box plots are skewed to the left. At least 75 percent of children achieved a score of 10 or higher, with the maximum score being achieved by some children in all groups. **Large variation in skill level** - while high scores are achieved by many children, skill levels vary widely with some children achieving low scores.

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
RACQUET STRIKE Students first bounced a tennis ball and then tried to hit it with a tennis racquet into a target area. Then students were asked to throw the ball up in the air and hit it into a target area. Scores range from 0 to 7.	1. Skill levels of Y8 boys increased slightly between 2002 and 2006. 2. Skill levels improve with age, especially for girls. 3. Boys outperform girls at Y4 and Y8, but this gender gap narrows with age. 4. While large improvements with age are seen for girls, at Y8 there are still some girls who get low scores.		**Small increase in skill level for Y8 boys between 2002 and 2006** - the small increase for Y8 boys (es: 0.31) is reflected by a higher median score in 2006. There was little change in skill levels for all other groups. **Y8 students outperform Y4 students** - a large age difference is seen for girls (es: 0.94) and a moderate difference for boys (es: 0.51). The difference in effect sizes tells us that a greater increase is seen for girls from Y4 to Y8. This increase in skill level is shown by the positive shift in the distribution of scores from Y4 to Y8. A larger shift is seen for boys which suggests most boys but only some girls improve their skills with age. **Boys outperform girls** - the large gender difference at Y4 (es: 0.76) and the moderate difference at Y8 (es: 0.40) are reflected by a more favourable distribution for boys. The smaller effect size at Y8 indicates that the gender gap narrows by Y8. **Many children achieve high scores** - all box plots are skewed to the left, but more so for boys. This indicates mid-to high scores were achieved by many children. A score of 4 or above was achieved by at least 50% of children, with the highest score reached by some children in each group. **Large variation in skill level** - while high scores are achieved, skill levels vary widely among most groups (except for Y8 boys). A large overlap in scores between groups is also seen. Although boys and Y8 students are typically more skillful, there are some Y4 students who outperform some Y8 students and some girls who outperform some boys.

Manipulative Skills

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
BALL STRIKE Students were asked to roll, throw, and bat a ball with a hockey stick at a target. Scores range from 0 to 15.	1. Skill levels improve with age. 2. Boys are more skillful than girls at Y4 and Y8. 3. Few children achieved high scores. 4. Large variation in skill levels.		**No comparison between 2002 and 2006 is possible** - this task was new to the 2006 task list. **Y8 students outperform Y4 students** - this age difference is large for boys (es: 0.84) and girls (es: 0.87). This change is reflected in a positive shift in the distribution of scores and median scores from Y4 to Y8. **Boys outperform girls** - a moderate gender difference is seen at Y4 (es: 0.56) and Y8 (es: 0.50). This gender difference is partly reflected by higher median scores achieved by boys. **Few children achieve high scores** - the Y4 box plots are skewed to the right. This tells us that most Y4 children achieved scores toward the low end of the scoring scale. At Y8, the box plots are more symmetrical, with some children achieving high scores, some achieving low scores and 50% of children achieving mid-range scores between 6 and 10. **Large variation in skill level** - skill levels vary widely among all groups. We also see that scores achieved overlap between groups. So while boys and Y8 students are generally more skillful, there are some Y4 students that outperform some Y8 students and some girls who outperform some boys.

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
LARGE BALL KICK Using a rubber inflated ball, students were asked to dribble and then kick the ball towards a target under various conditions. Scores range from 0 to 10.	1. Skill levels improve with age, especially for girls. 2. Boys are more skillful than girls, but the large gender gap at Y4 narrows by Y8. 3. Large variation in skill levels.		**No comparison between 2002 and 2006 is possible** - this task was new to the 2006 task list. **Y8 students outperform Y4 students** - the large age difference seen for girls (es:0.79) and the small difference seen for boys (es: 0.34) tells us girls achieved a larger increase in skill from Y4 to Y8. This is reflected in the larger change in score distribution and median score for girls between Y4 and Y8. **Boys outperform girls** - the large gender difference at Y4 (es: 0.84) and moderate difference at Y8 (es: 0.47) tells us that the gender gap narrows with age, but a gender difference still exists at Y8. This reduced gender gap is reflected in the median score and score distributions being more similar between genders at Y8 than at Y4. **Large variation in skill level** - skill levels vary widely among all children, especially among Y4 children. There is also large overlap in scores between groups. So while boys and Y8 students are generally more skillful, there are some Y4 students that outperform some Y8 students and some girls who outperform some boys.

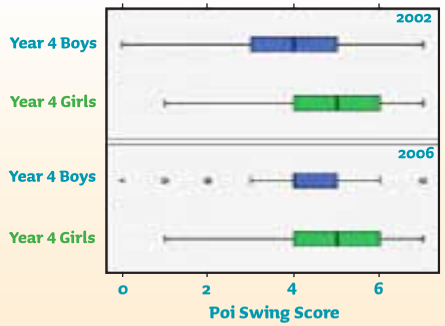
SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS

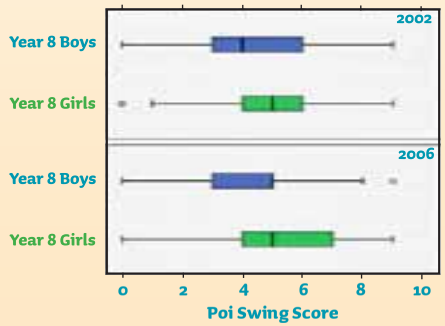
POI SWING

Year 4 students were asked to swing the poi forward at the sides of their bodies. They were then asked to do anything they could do with the poi. Scores range from 0 to 7.

Year 8 students were asked to swing the poi forward at the sides of their bodies. Then they were asked to transfer the poi into one hand. They were then asked to do anything they could do with the poi. Scores range from 0 to 9.

1. Skill levels in 2006 are slightly higher than 2002 levels for Y4 boys.
2. Girls are more skillful than boys.
3. Large variation in skill levels.





Small increase in skill level for Y4 boys between 2002 and 2006 - this small increase in skill level for Y4 boys (es: 0.24) is reflected in a positive shift in the distribution of scores for this group.

No age comparisons possible - Y4 and Y8 students did different poi swing tasks, therefore age comparisons are not possible.

Girls outperform boys - a small-to-moderate skill difference between boys and girls is seen at Y4 (es: 0.44) and at Y8 (es: 0.49). This gender difference is reflected in girls achieving a higher median score and a more favourable score distribution.

Many children achieve high scores - Y4 box plots are skewed to the left indicating that many Y4 children achieved mid-to-high scores; some children achieved the highest score. The Y8 boys' box plot is skewed to the right which indicates many scores achieved were toward the lower end of the scoring scale. For Y8 girls, the score distribution was slightly skewed to the left.

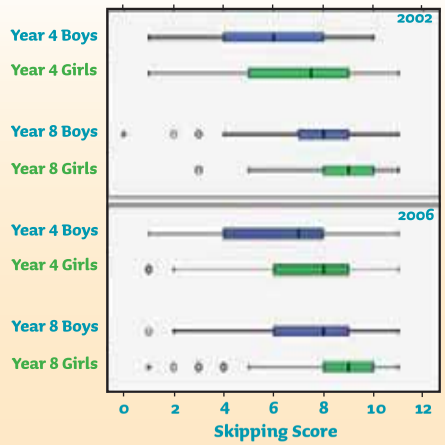
Large variation in skill level - skill levels vary widely among all children. Although girls perform the poi swing better, the overlap in scores between gender groups indicates that there are some boys who outperform some girls.

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS

SKIPPING

Students were asked to jump rope both on a short rope that they used themselves and on a long rope that was swung by the administrator and another student. Scores range from 0 to 11.

1. Skill levels in 2006 are slightly higher than 2002 levels for Y4 boys.
2. Skill levels increase with age.
3. Girls are more skillful than boys.
4. Large variation in skill levels.



Small increase in skill level for Y4 boys between 2002 and 2006 - this small increase in skill level for Y4 boys (es: 0.27) is partly reflected by a higher median score in 2006 and a small positive shift in the distribution of scores. There was little change in skill level for all other groups.

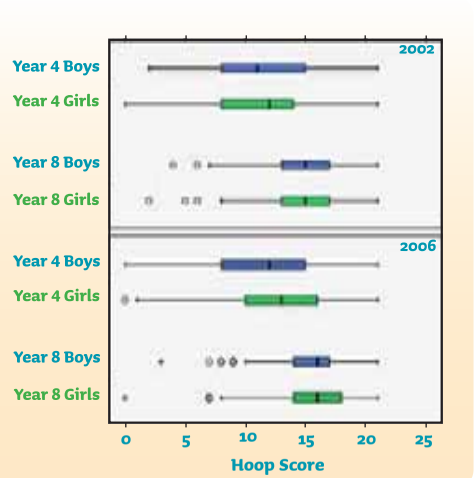
Y8 students outperform Y4 students - a moderate age difference is seen for boys (es: 0.60) and girls (es: 0.58). A positive shift in the range and distribution of scores from Y4 to Y8 suggests that most students improve their skipping skills as they get older.

Girls outperform boys - a small gender difference is seen at Y4 (es: 0.43) and at Y8 (es: 0.45). This difference is reflected in a higher median score and a more favourable range and distribution of scores for girls (especially at Y8).

Many children achieve high scores - with the exception of Y4 boys, box plots are skewed to the left. This tells us that many children achieved mid-to-high scores. Over 50% of children achieved a score of 7 or higher, with some children in each group achieving the highest score.

Large variation in skill level - while some children score highly, skill levels vary widely among most children. There is also a large overlap in scores between groups. So while girls and Y8 students are generally more skillful, there are some Y4 students that outperform some Y8 students and some boys that outperform some girls.

Manipulative Skills

SKILL	KEY FINDINGS	BOX PLOT	DETAILED INTERPRETATION OF EFFECT SIZES AND BOX PLOTS
HULA HOOPS Students were asked to throw a small hoop up in the air and catch it. They did this three times with each hand. Then they threw it up with one hand and caught it with the other. Then with a large hoop, they swung the hoop on each arm five times, and then performed a "hula hoop" move with the hoop for ten turns. Scores range from 0 to 21.	1. Skill levels in 2006 are slightly higher than 2002 levels for Y4 girls and Y8 boys. 2. A Large increase in skill level is seen with age. 3. Boys and girls have similar skill levels.		**Small increase in skill level for Y4 girls and Y8 boys between 2002 and 2006** - the small increase seen for Y4 girls (es: 0.30) and Y8 boys (es: 0.22) is reflected in a small positive shift in the interquartile range for Y4 girls and a positive shift in the range of scores for Y8 boys. **Y8 students outperform Y4 students** - the large age difference seen for boys (es: 0.99) and girls (es: 0.72) is reflected in the positive shift in the median score and score distributions from Y4 to Y8. The larger effect size for boys tells us between Y4 and Y8, improvements are greater for boys than girls. The positive shift in score distribution, combined with the narrowing of the score range from Y4 to Y8, suggests that most children improve with age. **Boys and girls have similar skill levels** - effect sizes tell us that skill levels of boys and girls are very similar at Y4 and at Y8. **Many children achieve high scores** - most box plots are skewed to the left, more so at Y8 than Y4. This tells us that many children achieved mid-to-high scores, with some children in each group achieving the highest score. **Large variation in skill level at Y4** - skill levels vary widely among all children, especially at Y4. Although many children score highly, there are still children who get low scores. The large overlap in scores between groups means that some Y4 students outperform some Y8 students and some girls outperform some boys.

In Summary

This report provides several insights into the fundamental movement skill levels of young children in New Zealand.

Insight 1: Increases in skill level over time are seen

A key finding is that small increases in performance are seen from 2002 to 2006. Although the differences are small, the direction of change is positive and may represent an overall shift in skill level. To determine if a true shift in performance has occurred and that there is real growth over time, it would be necessary to administer the tasks again to see if this increase continues.

Insight 2: Boys and girls excel at different skills

Boys outperformed girls on seven skills at Year 4 and six skills at Year 8. Boys excelled at running, throwing and kicking-based skills. Girls outperformed boys on seven skills at Year 4 but only two skills at Year 8. Girls did better at hoops, skipping and jump rope type of skills.

Differences favouring boys tended to be larger than those favouring girls. This means, when boys outperformed girls, the gender difference was moderate to large. When girls outperformed boys, the gender difference was small.

These findings highlight the skills boys and girls develop at different Year levels and how they excel at different activities. The activities boys and girls are successful at may reflect socialisation into such activities and/or preference toward those activities.

From a measurement standpoint, it suggests that careful consideration should be given to the tasks that are used in any programme assessment or evaluation because the selection of tasks is likely to influence the results found.

Insight 3: Most skills improve with age

For many skills, we see improvements in performance from Year 4 to Year 8. In some instances, we see the bottom of the Year 4 distribution extending much lower than the Year 8 distribution. This tells us that skill levels improve with age for most children. So, children who may seem to be lacking skill at Year 4 have improved by Year 8. This suggests that it takes more time for some children to develop skills – thus what seems lacking at Year 4 has developed by Year 8. For some children, however, improvement doesn't occur, or at least, not to the same extent.

Insight 4: Large variability in skills among children of the same age and gender

Another aspect of the data worth mentioning is the variability in performance throughout. While certain groups outperform other groups, we also see substantial overlap in performance between boys and girls and between Year 4 and Year 8 students. This substantial variation in skill levels among children of the same age and gender shows that children develop skills at different rates.

Appendices

Appendix A: Methodology

About the National Education Monitoring Project (NEMP)

The aim of NEMP was to assess and report on the achievement of New Zealand Year 4 and Year 8 schoolchildren in almost all areas of the school curriculum, including Physical Education. Different subject areas are assessed every four years, with the last assessment of Physical Education occurring in 2006.

As part of the Physical Education module, motor skills and movement concepts (e.g. running, striking a ball) were tested and are referred to as fundamental movement skills (FMS) in this report.

How were the skills tested developed and chosen?

The NEMP's Health and Physical Education Advisory Panel decide what skills will be included for testing. For each new administration, tasks administered previously are reviewed by the panel in terms of how successful the tasks were (e.g. was good information collected, was the task too hard or too difficult) and whether the administration of the task was successful. The panel also reviews the "Framework" for PE and Health areas and discusses what prior tasks (and potentially new tasks) should be included in the next administration. All new tasks developed are reviewed (in terms of merit and quality) by the panel and undergo piloting which provides information about how children are responding to the tasks and looks for difficulties in administration. Modifications to the tasks are made based on the results of the pilot. The panel and NEMP team make final decisions about what tasks to include.

Choosing the participants

First, 120 schools were randomly selected to participate in the assessment, using school decile, region of the country, and school size as factors to ensure that the schools are representative of the nation as a whole. Then 12 students from each school were randomly selected.

For the 2002 sample, 98% of schools contacted agreed to participate, and over 99% of the students selected agreed to participate. For the 2006 sample, 99% of schools agreed to participate, as well as 99% of the students within those schools. Thus, the sample for NEMP is very close to being nationally representative.

Who were the participants?

There are two samples of New Zealand schoolchildren that have been used for these analyses. The first sample came from the 2006 NEMP assessment and the second sample came from the 2002 NEMP assessment. Students who recently arrived into New Zealand and do not speak English, and students for whom disabilities would make participation difficult or uncomfortable for the student were exempted from participation.

In 2006, a total of 1,440 children were selected at Year 4 and at Year 8. Because each participant completed only one-third of all FMS tests, approximately 480 participants were to be tested for each individual task in 2006. The 2002 sample is about half the size of the 2006 sample with approximately 225 students tested for each individual skill. The sample sizes for the different age by gender groups (e.g. Y8 boys, Y4 girls) ranged between 106 and 120 participants in 2002 and between 207 and 262 participants in 2006.

Scoring

The 2002 and 2006 tasks were reanalysed for this report to ensure standardised scoring had been applied to all data.

Effect Sizes

To calculate effect sizes, we work out the difference between the two average scores of interest and then divide this difference by the average standard deviation for the two groups. The standard deviation is an indicator of the spread of scores. This means that effect sizes are influenced by the difference in average scores but also by the distribution of scores around each average score. So, if there is a lot of overlap in the score distribution between say boys and girls, this will reduce the effect size and the strength of the difference. If there is little overlap of scores between groups, the effect size will increase indicating a stronger difference.

Appendix B: Detailed results of effect sizes and average scores

Effect Sizes: Comparison of skill level across years (2002 versus 2006)

	Year 4 Boys 2002 vs 2006	Year 4 Girls 2002 vs 2006	Year 8 Boys 2002 vs 2006	Year 8 Girls 2002 vs 2006
Locomotive skills				
Run	0.20	0.13	0.04	0.10
Dodge	0.07	0.17	0.16	0.06
Leap	0.21	0.29	0.08	0.02
Stability skills				
Bridges & arches	–	–	–	–
Jumps	–	–	–	–
Foot balances	0.12	0.05	0.11	0.08
Bottom balances	–	–	–	–
Manipulative skills				
Small ball catch	0.23	0.24	0.26	0.10
Distance throw	0.34	0.21	0.31	0.00
Beanies	–	–	0.06	0.19
Racquet strike	0.06	0.07	0.31	0.06
Ball strike	–	–	–	–
Large ball kick	–	–	–	–
Poi swings	0.24	0.07	0.05	0.16
Skipping ropes	0.27	0.09	0.02	0.09
Hula hoops	0.15	0.30	0.22	0.13

A dash (-) means the skill was not assessed in 2002, therefore, comparison between 2002 and 2006 is not possible.

Effect sizes tell us if a change has occurred, how big the change is (i.e. the magnitude of change).

Larger effect sizes indicate larger differences.

An **effect size** of

0 .00 = no change;
0.01 to 0.19 = little change;
0.20 to 0.49 = small change;
0.50 to 0.79 = moderate change; and
0.80+ = large change.

Effect Sizes: Comparisons of skill level by age and gender in 2006

	AGE		GENDER	
	Boys Year 4 vs Year 8	**Girls** Year 4 vs Year 8	**Year 4** Boys vs Girls	**Year 8** Boys vs Girls
Locomotive skills				
Run	0.11	0.07	0.46 (B)	0.47 (B)
Dodge	0.68 (Y8)	0.96 (Y8)	0.41 (B)	0.20 (B)
Leap	–	–	0.26 (B)	0.14
Stability skills				
Bridges & arches	0.24 (Y8)	0.05	0.20 (G)	0.00
Jumps	0.03	0.07	0.22 (G)	0.11
Foot balances	0.60 (Y8)	0.40 (Y8)	0.30 (G)	0.13
Bottom balances	0.37 (Y8)	0.08	0.25 (G)	0.02
Manipulative skills				
Small ball catch	1.00 (Y8)	1.02 (Y8)	0.31 (B)	0.40 (B)
Distance throw	0.17	0.17	0.92 (B)	0.81 (B)
Beanies	–	–	–	0.15
Racquet strike	0.51 (Y8)	0.94 (Y8)	0.76 (B)	0.40 (B)
Ball strike	0.84 (Y8)	0.87 (Y8)	0.56 (B)	0.50 (B)
Large ball kick	0.34 (Y8)	0.79 (Y8)	0.84 (B)	0.47 (B)
Poi swings	–	–	0.44 (G)	0.49 (G)
Skipping ropes	0.60 (Y8)	0.58 (Y8)	0.43 (G)	0.45 (G)
Hula hoops	0.99 (Y8)	0.72 (Y8)	0.18	0.02

(Y8) Year 8 students outperform Year 4 students; (B) Boys outperform girls; (G) Girls outperform boys;
A dash (–) means no age and/or gender comparison is possible.

Average scores for each task in 2002 and 2006

		Year 4 Boys	Year 4 Girls	Year 8 Boys	Year 8 Girls
RUN	2002	3.90	3.77	4.19	3.58
Score range = 0-6	2006	4.12	3.61	4.23	3.70
DODGE	2002	2.27	1.86	3.33	2.92
Score range = 0-6	2006	2.17	1.64	3.11	2.84
LEAP	2002	2.86	2.39	3.00	2.95
Score range = 0-5	2006	3.17	2.80	3.12	2.92
LARGE BALL KICK	2002	-	-	-	-
Score range = 0-10	2006	6.76	6.19	7.33	6.59
BALL STRIKE	2002	-	-	-	-
Score range = 0-15	2006	6.61	5.32	8.63	7.39
BEANIES	2002	-	-	12.41	11.21
Score range = 0-17	2006	-	-	12.24	11.78
SKIPPING	2002	5.72	7.17	7.70	8.80
Score range = 0-11	2006	6.36	7.40	7.74	8.65
HOOPS	2002	11.29	11.43	14.97	15.13
Score range = 0-21	2006	11.94	12.76	15.64	15.57
POI	2002	3.82	4.59	4.27	4.98
Score range = 0-7 (Year 4) Score range = 0-9 (Year 8)	2006	4.15	4.69	4.37	5.30
BRIDGES AND ARCHES	2002	-	-	-	-
Score range = 0-18	2006	11.22	11.70	11.82	11.84
JUMPS	2002	-	-	-	-
Score range = 0-6	2006	3.51	3.81	3.56	3.71
FOOT BALANCES	2002	7.71	7.94	8.21	8.58
Score range = 0-9	2006	7.52	8.01	8.37	8.50
BOTTOM BALANCES	2002	-	-	-	-
Score range = 0-12	2006	7.01	7.62	7.88	7.83

Note: A dash (-) means that the task was not assessed.


05
BLUE SUMMER

SPORT
NEW ZEALAND

Ground Floor, 86 Customhouse Quay, Wellington 6011
PO Box 2251, Wellington 6140, New Zealand
Phone: +64 4 472 8058 Fax: +64 4 471 0813

New Zealand Government

www.sportnz.org.nz