The Movement Assessment Battery for Children: A Comparison of 4-Year-Old to 6-Year-Old Children From Hong Kong and the United States

Susanna M. K. Chow, Sheila E. Henderson, Anna L. Barnett

Key Words: child, preschool • culture (sociology)

Objective. There is little information available on the appropriateness of tests developed in the West for children of different ethnicities. The aim of this study was to examine the suitability of the Movement Assessment Battery for Children (Movement ABC) for use with Hong Kong Chinese preschool children.

Method. The performance of 255 Hong Kong Chinese children between the ages of 4 years and 6 years was compared with that of the 493 children of the same age from the United States who took part in the most recent standardization of the Movement ABC.

Results. The test content was found to be suitable for use with Hong Kong Chinese children. However, cross-cultural differences were found on a number of the test items. Chinese children performed significantly better on items contained in the manual dexterity and dynamic balance sections, whereas American children were better at the projection and reception of moving objects.

Conclusion. These findings highlight the need to ensure that norms for all tests are appropriate for the specific cultural groups being assessed.


Some children have exceptional difficulties with tasks requiring motor coordination yet do not have an identifiable neurological disease, physical deformity, or generalized developmental delay. Previously, this condition has been labeled the clumsy child syndrome (Gubbay, 1975), physical awkwardness (Wall, 1982), developmental dyspraxia (Denckla, 1984), perceptuomotor dysfunction (Laszlo, Bairstow, Bartrip, & Rolfe, 1988), and a deficit in attention, motor control, and perception (Hellgren, Gillberg, Bagenholm, & Gillberg, 1994). Recently, however, the term developmental coordination disorder (DCD), first introduced by the American Psychiatric Association (APA) in 1987 (APA, 1987, 1994), has taken precedence over other labels.

Children who fit the diagnosis of DCD have been referred to occupational therapists throughout the West for more than 20 years (Missiuna & Polatajko, 1995), but in Hong Kong and other parts of the Far East, the needs of this particular group are only beginning to be formally acknowledged (e.g., Miyahara et al., 1998; Wright & Sugden, 1996). As a result of this increased awareness, occupational therapists and other professionals are compelled to consider the suitability of the assessments developed in the West for use with children from very different cultures.
The Movement Assessment Battery for Children (Movement ABC; Henderson & Sugden, 1992) is often used to identify children whose motor functioning is impaired, such as children with DCD. The battery contains three components: a teacher’s checklist, an individually administered standardized test, and a set of guidelines for intervention. (For a review of studies using the test, see Barnett & Henderson, 1998). Normative data exist for American and British children. The manual has been translated into Danish, Dutch, Italian, and Swedish; a Japanese translation is in progress; and studies presenting cross-cultural comparisons are now beginning to emerge (e.g., Röblad & Gard, 1998; Smits-Engelsman, Henderson, & Michels, 1998). In this article, our concern is with the applicability of the Movement ABC to the evaluation of Hong Kong Chinese children.

The present study focused on children 4 years to 6 years of age for two reasons. First, the importance of early identification and intervention for children with motor difficulties is now well established. Second, the preschool period seemed likely to be the one in which Chinese children in Hong Kong might differ most from their American counterparts. The preschool child in Hong Kong lives in a rather different physical and social environment from his or her American counterpart. In Hong Kong, most children live in tower blocks in urban areas, and outdoor play is extremely limited. In contrast, in the United States, outdoor play is part of life. In Hong Kong, children are taught to use chopsticks from 2 years of age, and by 4 years of age, many can write 30 Chinese characters in addition to the English alphabet. Writing and reading are taught in preschool, which all children attend from 3 years of age. There are two types of preschool facilities—kindergartens and nurseries—that are administered by different authorities and have slightly different curricula, with the kindergarten being more formal and academically oriented. In contrast, in the United States, not all children attend preschool, and reading and writing skills are not specifically targeted.

Given that Hong Kong Chinese children and American children have such different experiences between 4 years and 6 years of age, we anticipated that the published norms for the Movement ABC and even the nature of the test items might require radical revision. Rather than immediately commit the immense resources required for a full standardization, however, it seemed prudent to conduct a preliminary investigation in which the main focus was the present test items and their suitability. To achieve this objective, we compared the performance of a representative sample of Hong Kong Chinese children, 4 years to 6 years of age, with that of children of the same age from the United States who took part in the American standardization.

**Method**

**Participants**

The total Movement ABC standardization sample included 1,234 children representative of the general population in the United States. For the present study, data for the 493 children between 4 years and 6 years of age were used.

With the sampling technique outlined in the Movement ABC manual (pp. 199–200), a sample of children was selected to represent the general population in Hong Kong in terms of geographical area, age, gender, and parental education. Because the population of Hong Kong is almost entirely Chinese, ethnicity was not included as a selection criterion. For the age range of children included in this study, however, it was necessary to include type of preschool facility as an additional variable.

Starting with geographical area and type of preschool, kindergartens and nurseries from each of the three officially designated areas of Hong Kong (Hong Kong Island, Kowloon, the New Territories) were invited to participate in the study. Sixteen kindergartens and 12 nurseries gave consent. (All preschools refusing did so because of lack of space).

Within each of these 28 preschools, children were randomly selected for the study from class registers with two constraints: (a) that there be an approximately equal number of boys and girls in each of the three age groups—4 years, 5 years, and 6 years—and (b) any child with a clearly diagnosed sensory, physical, or intellectual disability be excluded. In cases where the child selected could not participate (e.g., absent on the day), another child’s name was drawn from the class list. The level of parental education for each child was provided by the school and categorized into three levels: no secondary education, secondary education, and postsecondary education.

A total of 255 children distributed across geographical area and facility took part in the study (see Table 1). Roughly half of the final sample were boys, and half were girls. In terms of geographical distribution, the sample’s proportions closely resembled the population distribution of 22% from Hong Kong Island, 33% from Kowloon, and 45% from the New Territories.

**Table 1**

<table>
<thead>
<tr>
<th>Age (Years)</th>
<th>Hong Kong Island</th>
<th>Kowloon</th>
<th>New Territories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kindergarten</td>
<td>Nurseries</td>
<td>Kindergarten</td>
</tr>
<tr>
<td>4</td>
<td>16</td>
<td>6</td>
<td>18</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>6</td>
<td>19</td>
<td>5</td>
<td>14</td>
</tr>
</tbody>
</table>

*Note. N = 255 for sample; n = 85 for each age group; n = 69 (27.1%) for Hong Kong Island; n = 82 (32.1%) for Kowloon; n = 104 (40.8%) for New Territories.*
New Territories (Hong Kong Census and Statistics Department, 1995). A total of 24.3% of the sample's parents had postsecondary education, 29% completed secondary school, and 46.7% had no secondary education.

**Instrument**

The standardized test component of the Movement ABC contains normative data on children from 4 years to 12 years of age. It is divided into four age bands, each designed to be suitable for a specific age group of children: 4 to 6 years, 7 to 8 years, 9 to 10 years, and 11 or more years. Each age band of the test contains eight items grouped under three headings. The first group of items assesses manual dexterity; the second assesses ball skill; and the third assesses static and dynamic balance. The characteristics of the items in the 4 to 6 years age band are outlined in Table 2.

**Procedure**

Two occupational therapy trainees in their final year of a 3-year training course and one psychologist were trained by the first author to use the test. They then administered the Movement ABC, following instructions provided in the manual. For example, on each item, children were first shown the task and then given a specified number of practice attempts before the formal test trial (see Table 2). In cases where children were given more than one test trial, the best score was adopted as the indicator of the child's competence. Each child was individually tested in his or her own school. Depending on the age of the children, the test duration ranged from 20 min to 35 min.

**Scoring and Data Analysis**

Performance on the test can be scored in several ways. Raw scores, such as the number of seconds taken to complete a task or the number of catches made, are always noted. These raw scores may then be converted into scaled scores to ascertain where the child's performance lies in relation to the standardization sample. In this study, we focused on the raw scores. Because two of the items in the 4 to 6 years age band—posting coins and balancing on one leg—involve testing both the preferred and nonpreferred limb, a total of 10 raw scores are obtained from the eight test items. For those items that yielded interval data, scores were analyzed with parametric analyses of variance (ANOVAs). For the one item—jumping over cord—that yields ordinal data, Mann Whitney U tests were used. In view of the large number of comparisons being made, the level of significance adopted was .01.

**Results**

**The Hong Kong Sample**

Table 3 shows the children's mean scores and standard deviations for each item as a function of area and type of preschool. The results from three-way ANOVAs in which area, type of facility, and parental education were entered as between-subject variables are summarized in Table 4. These analyses revealed no effect of area or parental education for any item, max $F = 2.93$. A significant effect of type of preschool facility was found for only one item, threading beads, $F(1, 241) = 6.85$, $p = .009$. On this item, there was a significant interaction between geographical area and type of facility, $F(2, 241) = 5.45$, $p = .005$. Post hoc tests using Tukey's test revealed that the children in kindergartens on Hong Kong Island performed more slowly than all other groups (minimum difference between means = 15.70, minimum $t = 11.23$).

**Comparison of the Hong Kong Chinese Children and American Children**

Table 5 presents the means and standard deviations of the children's scores on each test item. Table 6 summarizes the results of the three-way ANOVA performed on these data for which country, age, and gender were entered as between-subject variables.

As Table 5 shows, the Hong Kong Chinese children performed better than their American counterparts on all of the items requiring manual dexterity. This difference reached significance for posting coins with the preferred hand, $F(1, 735) = 17.36$, $p < .0001$, and drawing trail, $F(1, 733) = 50.64$, $p < .0001$. The performance of the Chinese children was also better on all three balance items. On the line-walking task, the difference in the number of correctly executed steps was significant, $F(1, 736) = 14.69$, $p < .0001$. For the item jumping over cord, Chinese children in all three age groups were significantly better than American children (Mann Whitney corrected z values = 10.12–11.72, all $p < .001$).

In contrast, the performance of the American children was better on the tasks involving the projection and reception of a moving object, with the difference on the catching bean bag item reaching our set level of significance, $F(1, 444) = 28.71$, $p < .0001$.

There was a main effect of age on all items listed in Table 6, min $F = 23.19$, all $p < .0001$. Gender effects were obtained on four items, with the girls better at threading beads, $F(1, 736) = 15.14$, $p < .001$; drawing trail, $F(1, 733) = 9.25$, $p = .002$; and balancing on both legs $F(1, 736) = 8.35$, $p = .004$, for preferred leg and $F(1, 736) = 12.35$, $p < .001$, for nonpreferred leg]. Boys were better at rolling a ball, $F(1, 734) = 24.75$, $p < .0001$.

For the item jumping over cord, there was no significant difference in performance between children 5 years and 6 years of age1 (Mann Whitney corrected z value = 1.13, $p = .26$), and there were no significant gender effects at any age (Mann Whitney corrected z values = .70–1.50, all $p > .01$).

1The scoring criteria of 4-year-old children was different from that of 5-year-olds and 6-year-olds; hence, only the age difference between 5-year-olds and 6-year-olds was examined.
There were two significant interactions: A “country by age” effect in drawing trail, $F(2, 733) = 6.90$, $p = .001$, was produced by the fact that the difference between the Chinese and American children was greatest for the youngest children. Post hoc analyses using Tukey’s test revealed that the mean difference between the Chinese and American children was 1.68 ($w = .79$) at 4 years of age, 1.01 ($w = .84$) at 5 years of age, and .41 ($w = .85$) at 6 years of age. A “country by gender” effect was obtained for one-leg balance–nonpreferred leg, $F(1, 736) = 8.44$, $p = .004$, with the performance of the Chinese girls being significantly better than the American girls, whose performance was similar to the boys from both countries. Post hoc analyses with Tukey’s test showed that the minimum difference between

### Table 2

**Age Band One Items From the Movement Assessment Battery for Children**

<table>
<thead>
<tr>
<th>Domain</th>
<th>Item</th>
<th>Description</th>
<th>Measures</th>
<th>Practice Session</th>
<th>Number of Possible Test Trials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manual dexterity</td>
<td>Posting coins</td>
<td>Posting 12 coins into a money box with the preferred hand and then the other hand.</td>
<td>Time taken in seconds for preferred hand, other hand</td>
<td>6 coins for each hand</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Threading beads</td>
<td>Threading beads onto a string (6 beads for 4-year-olds and 12 for 5-year-olds and 6-year-olds).</td>
<td>Time taken in seconds</td>
<td>3 beads</td>
<td>2</td>
</tr>
<tr>
<td>Ball skill</td>
<td>Drawing trail</td>
<td>Tracing with a pen between two curved lines of 4 mm apart without going over the boundary lines.</td>
<td>Number of times the boundaries were crossed</td>
<td>Half of the trail</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Catching bean bag</td>
<td>Catching a bean bag with both hands thrown by the tester from a distance of 2 m. (Trapping the bean bag against the body is not allowed for children 5 and 6 years of age.)</td>
<td>Number of successful catches</td>
<td>5 attempts</td>
<td>10 attempts</td>
</tr>
<tr>
<td></td>
<td>Rolling ball</td>
<td>Rolling a tennis ball through a goal of 40 cm in width from a distance of 2 m.</td>
<td>Number of successful goals</td>
<td>5 attempts</td>
<td>10 attempts</td>
</tr>
<tr>
<td>Static and dynamic balance</td>
<td>One-leg balance</td>
<td>Standing on one leg for as long as possible to a maximum of 20 sec with the preferred leg and then with the other leg.</td>
<td>Duration in seconds (to maximum of 20 sec) on both preferred leg and other leg</td>
<td>10 sec</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Jumping over cord</td>
<td>Jumping over a cord of knee height (5-year-old and 6-year-old children must land on both feet to pass).</td>
<td>Whether passed on first, second, or third trial</td>
<td>1 jump</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Walking heels raised</td>
<td>Walking along a 4.5-m line with heels raised. Time taken in seconds for preferred hand, other hand</td>
<td>Number of correct steps to a maximum of 15</td>
<td>5 steps</td>
<td>2</td>
</tr>
</tbody>
</table>

*According to the test manual, the maximum number of test trials were administered in cases where children did not pass in earlier trial(s). The best of the trials was taken as the test score.

There were two significant interactions: A “country by age” effect in drawing trail, $F(2, 733) = 6.90$, $p = .001$, was produced by the fact that the difference between the Chinese and American children was greatest for the youngest children. Post hoc analyses using Tukey’s test revealed that the mean difference between the Chinese and American children was 1.68 ($w = .79$) at 4 years of age, 1.01 ($w = .84$) at 5 years of age, and .41 ($w = .85$) at 6 years of age. A “country by gender” effect was obtained for one-leg balance–nonpreferred leg, $F(1, 736) = 8.44$, $p = .004$, with the performance of the Chinese girls being significantly better than the American girls, whose performance was similar to the boys from both countries. Post hoc analyses with Tukey’s test showed that the minimum difference between

### Table 3

**Mean Scores for Hong Kong Sample by Geographical Area and Type of Preschool Facility**

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Hong Kong Island</th>
<th>Kowloon</th>
<th>New Territories</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Kindergarten M (SD)</td>
<td>Nursery M (SD)</td>
<td>Kindergarten M (SD)</td>
</tr>
<tr>
<td>Posting coins–preferred hand</td>
<td>18.64 (3.40)</td>
<td>17.89 (2.33)</td>
<td>17.94 (2.73)</td>
</tr>
<tr>
<td>Posting coins–other hand</td>
<td>21.62 (4.66)</td>
<td>20.26 (2.54)</td>
<td>21.59 (4.13)</td>
</tr>
<tr>
<td>Threading beads*</td>
<td>67.12 (27.96)</td>
<td>47.95 (10.74)</td>
<td>50.73 (13.25)</td>
</tr>
<tr>
<td>Drawing trail</td>
<td>0.56 (0.93)</td>
<td>0.63 (1.12)</td>
<td>0.80 (1.35)</td>
</tr>
<tr>
<td>Catching bean bag</td>
<td>6.53 (2.79)</td>
<td>7.62 (1.80)</td>
<td>7.58 (2.36)</td>
</tr>
<tr>
<td>Rolling ball into goal*</td>
<td>6.38 (2.25)</td>
<td>6.05 (2.12)</td>
<td>6.00 (2.28)</td>
</tr>
<tr>
<td>One-leg balance–preferred leg</td>
<td>13.26 (6.99)</td>
<td>13.68 (6.37)</td>
<td>16.12 (5.56)</td>
</tr>
<tr>
<td>One-leg balance–other leg</td>
<td>11.94 (7.09)</td>
<td>15.26 (6.37)</td>
<td>14.94 (6.37)</td>
</tr>
<tr>
<td>Jumping over cord*</td>
<td>0.53 (1.02)</td>
<td>0.15 (0.38)</td>
<td>0.74 (1.09)</td>
</tr>
<tr>
<td>Walking heels raised</td>
<td>13.42 (3.02)</td>
<td>14.32 (1.45)</td>
<td>13.14 (3.52)</td>
</tr>
</tbody>
</table>

*According to the test manual, the maximum number of test trials were administered in cases where children did not pass in earlier trial(s). The best of the trials was taken as the test score.

*Because 4-year-old children thread 6 instead of 12 beads, the scores for this age group were multiplied by 2 for analysis. Only 5-year-olds and 6-year-olds are compared because the scoring criteria are less stringent for 4-year-olds.
the mean for the Chinese girls and all other groups was 2.96 (minimum $w = 1.99$). None of the differences between other means for this item were significant.

**Discussion**

The study reported in this article forms part of an ongoing project designed to evaluate the suitability of the Movement ABC for use with Hong Kong Chinese children. Because the early identification of children with movement difficulties is important, the project began with an evaluation of the part of the test designed for use with 4-year-olds to 6-year-olds. In purely practical terms, we found the test satisfactory in that Chinese children appeared to enjoy participating, and none of the items proved difficult to administer.

Successive standardization and restandardizations of the Movement ABC found no significant difference among American, Canadian, and British children (Henderson & Sugden, 1992; Stott, Moyes, & Henderson, 1972, 1984). More recent studies report minor differences in performance between American children and children from other European countries, such as Holland and Sweden, but none suggest that the current norms require radical revision (e.g., Rösblad & Gard, 1998; Smits-Engelsman et al., 1998). In contrast, the study by Miyahara et al., (1998) suggested that Japanese children perform quite differently from their American counterparts when using the nonpreferred hand. Additionally, an interaction existed between country and age on the drawing trail item such that the difference was significantly better on the two tasks that involved the preferred hand but did not differ from their American counterparts when using the nonpreferred hand. Although Wright and her collaborators had children of different ethnic origins in their Singapore studies (Wright & Sugden, 1996; Wright, Sugden, Ng, & Tan, 1994), data on the Chinese children in the sample has not been separately reported.

In this article, we have reported data on a representative sample of Hong Kong Chinese children between 4 years and 6 years of age. The children were selected from all three officially designated areas of Hong Kong in proportions that closely matched the population distribution. No systematic differences in performance attributable to geographic area were found. The type of preschool attended by the children was also used as one of our selection criteria. Oppen (1993) suggested that the curriculum in nurseries and kindergartens in Hong Kong differed quite substantially in that kindergartens were more academically oriented. However, a more recent statement from the Social Welfare Department’s (1996) *Guide to Entrance to Pre-Schools* noted an increasing emphasis on academic skills in nursery classes as well. In our study, the type of preschool attended had no overall effect on the children’s performance on the Movement ABC. In addition, level of parental education was generally unrelated to level of performance. This finding is similar to that of Su, Lu, and Chen (1987), who found parental education levels did not affect motor skills in their study of 420 1-year-old Chinese children in Taiwan. Although we are confident, therefore, that our data are representative of Chinese children in Hong Kong, the question of its generalizability to Chinese children in mainland China, the United States, or other countries remains open.

The current Movement ABC manual provides separate age norms for each item in the test as well as for the composite scores. Similar age effects were present in the data on Chinese children, with clear progression in performance between 4 years and 6 years of age on most items. On the manual dexterity tasks, we found that Chinese children were significantly better on the two tasks that involved the preferred hand but did not differ from their American counterparts when using the nonpreferred hand. Additionally, an interaction existed between country and age on the drawing trail item such that the difference between Chinese and American children was larger at

![Table 4](image)

**Table 4**

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Area</th>
<th>Facility</th>
<th>Parental Education</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posting coins–preferred hand</td>
<td>2.17</td>
<td>0.07</td>
<td>1.85</td>
</tr>
<tr>
<td>Posting coins–other hand</td>
<td>0.10</td>
<td>0.01</td>
<td>0.25</td>
</tr>
<tr>
<td>Threading beads</td>
<td>2.03</td>
<td>6.85*</td>
<td>2.28</td>
</tr>
<tr>
<td>Drawing trail</td>
<td>1.05</td>
<td>2.35</td>
<td>0.75</td>
</tr>
<tr>
<td>Catching bean bag</td>
<td>0.19</td>
<td>2.78</td>
<td>1.64</td>
</tr>
<tr>
<td>Rolling ball into goal</td>
<td>2.93</td>
<td>0.65</td>
<td>0.88</td>
</tr>
<tr>
<td>One-leg balance-preferred leg</td>
<td>2.59</td>
<td>0.84</td>
<td>0.16</td>
</tr>
<tr>
<td>One-leg balance–other leg</td>
<td>0.52</td>
<td>0.51</td>
<td>0.33</td>
</tr>
<tr>
<td>Walking heels raised</td>
<td>0.70</td>
<td>3.66</td>
<td>0.65</td>
</tr>
</tbody>
</table>

*aBecause 4-year-old children thread 6 instead of 12 beads, the scores for this age group were multiplied by 2 for analysis. bOnly 5-year-olds and 6-year-olds are compared because the scoring criteria are less stringent for 4-year-olds.*

![Table 5](image)

**Table 5**

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Hong Kong</th>
<th>American</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posting coins–preferred hand</td>
<td>17.43 (2.71)</td>
<td>17.86 (2.92)</td>
</tr>
<tr>
<td>Posting coins–other hand</td>
<td>20.37 (3.97)</td>
<td>20.57 (3.89)</td>
</tr>
<tr>
<td>Threading beads</td>
<td>48.67 (13.25)</td>
<td>53.17 (17.98)</td>
</tr>
<tr>
<td>Drawing trail</td>
<td>0.32 (0.73)</td>
<td>0.49 (0.98)</td>
</tr>
<tr>
<td>Catching bean bag</td>
<td>6.86 (2.53)</td>
<td>6.89 (2.49)</td>
</tr>
<tr>
<td>Rolling ball into goal</td>
<td>5.98 (1.93)</td>
<td>6.36 (1.97)</td>
</tr>
<tr>
<td>One-leg balance-preferred leg</td>
<td>15.46 (6.14)</td>
<td>14.49 (6.69)</td>
</tr>
<tr>
<td>One-leg balance–other leg</td>
<td>15.30 (6.10)</td>
<td>13.77 (6.74)</td>
</tr>
<tr>
<td>Jumping over cord</td>
<td>0.30 (0.72)</td>
<td>0.38 (0.86)</td>
</tr>
<tr>
<td>Walking heels raised</td>
<td>13.91 (2.57)</td>
<td>13.88 (2.55)</td>
</tr>
</tbody>
</table>

In this article, we have reported data on a representative sample of Hong Kong Chinese children between 4 years and 6 years of age. The children were selected from all three officially designated areas of Hong Kong in proportions that closely matched the population distribution. No systematic differences in performance attributable to geographic area were found. The type of preschool attended by the children was also used as one of our selection criteria. Oppen (1993) suggested that the curriculum in nurseries and kindergartens in Hong Kong differed quite substantially in that kindergartens were more academically oriented. However, a more recent statement from the Social Welfare Department’s (1996) *Guide to Entrance to Pre-Schools* noted an increasing emphasis on academic skills in nursery classes as well. In our study, the type of preschool attended had no overall effect on the children’s performance on the Movement ABC. In addition, level of parental education was generally unrelated to level of performance. This finding is similar to that of Su, Lu, and Chen (1987), who found parental education levels did not affect motor skills in their study of 420 1-year-old Chinese children in Taiwan. Although we are confident, therefore, that our data are representative of Chinese children in Hong Kong, the question of its generalizability to Chinese children in mainland China, the United States, or other countries remains open.

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younger ages. One possible explanation of the preferred hand superiority of the Chinese children may be that they learn to use a writing implement at 3 years of age and are coached on the use of chopsticks, an extremely dexterous task, from as early as 2 years of age. This training must generalize to other tasks requiring the dominant hand. Conversely, our failure to find a difference for the nonpreferred hand suggests that any practice effect that exists for Chinese children does not transfer to the other hand.

American children were better than Chinese children on both tasks involving the projection and reception of moving objects (balls, bean bags). This finding might be attributed to different experiences in the preschool period or to the fact that American children are introduced to ball games much earlier than Chinese children.

The finding that Chinese children performed better on two of the dynamic balance items—jumping over cord and walking heels raised—than American children was unexpected. As noted earlier, opportunities for gross motor play in Hong Kong are very limited, and Chinese society does not value proficiency in gross motor skills nearly as much as fine motor skills. In fact, games requiring gross motor skills are often seen as a low priority by parents and teachers in Hong Kong (Chow, Kwan, Tsang, & Chan, 1995; Opper, 1994), whereas parental aspiration for achievement in academic work, such as mathematics, is high (Chan, 1996; Chen & Stevenson, 1995). Our explanation for this outcome is pure speculation. The majority of families in Hong Kong use public transportation. Jumping on and off boats and buses may lead to better development of locomotor skills than participation in gross motor play!

In this study, girls were better than boys on all items except those involving the projection and reception of moving objects. In a meta-analysis of 64 studies using a variety of tasks, Thomas and French (1985) found a small but significant and consistent advantage for girls in fine motor skills, a finding replicated by Broadhead and Bruininks (1982) in a study of more than 700 children. The fact that Chinese boys were better than the girls on both ball skill tasks is also consistent with studies in other cultures (Aponte, French, & Sherrill, 1990; Broadhead & Bruininks, 1982; Thomas & French, 1985). It is interesting to note, however, that Karapetras and Vlachos (1992) only found gender differences in this area of performance between 6.5 years and 9.5 years of age in a study of participants ranging in age from 5.5 years to 20.5 years. Gender differences found in the present study involved even younger children and may be associated with the fact that the gender role socialization process is accelerated as a function of earlier formal education. The influence of parental, teacher, and societal expectation on gender differences has been emphasized by both Munroe and Munroe (1975) and Thomas and French (1985). One of the main purposes of the Movement ABC is the identification of children with coordination difficulties, including those with DCD. To achieve this purpose, raw scores on the items are rescaled according to test norms, and children are assigned a score of 0 through 5 on each, with 0 indicating good performance and 5 indicating poor performance. These scores are then summed to produce a total, and a child is judged to have a definite movement difficulty if his or her total test score falls below the 5th percentile for that age group and to be at risk if the score falls between the 5th and 15th percentile. All scores above the 15th percentile are considered to be in the normal range. In this study, we also compared the proportion of children falling into each of the scaled score categories on individual items as well as on the total score. Because these analyses simply mirrored those obtained by the parametric tests reported previously, we have not reported them here. To illustrate, any item that produced a significant difference between Chinese children and American children showed a shift in the proportions in the predicted direction. Where Chinese children were better on average, fewer obtained lower scaled scores (i.e., failed the item); where American children were better, the converse was true. Consequently, these results simply confirmed that there was nothing unusual about any of the distributions of scores on the test tasks and highlighted the items on which scoring adjustments would have to be made to make the instrument an effective tool for use in Hong Kong.

**Conclusion**

For occupational therapists working with children of different ethnic origins in countries far removed from the countries in which a test was developed, it is important to examine the suitability of any instrument for use in that context. In this study, the Movement ABC has been found

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### Table 6

**Analyses of Variance on Test Items for the Hong Kong and American Samples**

<table>
<thead>
<tr>
<th>Test Item</th>
<th>Country (C)</th>
<th>Age (A)</th>
<th>Gender (G)</th>
<th>C x A</th>
<th>C x G</th>
<th>A x G</th>
<th>C x A x G</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posting coins–preferred hand</td>
<td>17.36*</td>
<td>37.73**</td>
<td>5.44</td>
<td>0.09</td>
<td>0.07</td>
<td>0.92</td>
<td>0.60</td>
</tr>
<tr>
<td>Posting coins–other hand</td>
<td>5.95</td>
<td>38.74**</td>
<td>0.35</td>
<td>0.22</td>
<td>0.02</td>
<td>0.98</td>
<td>1.18</td>
</tr>
<tr>
<td>Threading beads</td>
<td>0.20</td>
<td>72.32**</td>
<td>15.14**</td>
<td>3.14</td>
<td>2.85</td>
<td>0.25</td>
<td>0.20</td>
</tr>
<tr>
<td>Drawing trail</td>
<td>50.64**</td>
<td>55.81**</td>
<td>9.25*</td>
<td>6.90**</td>
<td>0.55</td>
<td>2.17</td>
<td>0.12</td>
</tr>
<tr>
<td>Catching bean bag</td>
<td>28.71**</td>
<td>38.47**</td>
<td>1.82</td>
<td>0.01</td>
<td>0.79</td>
<td>0.05</td>
<td>0.37</td>
</tr>
<tr>
<td>Rolling ball into goal</td>
<td>1.72</td>
<td>34.55**</td>
<td>24.75**</td>
<td>0.47</td>
<td>0.01</td>
<td>0.05</td>
<td>0.01</td>
</tr>
<tr>
<td>One-leg balance–preferred leg</td>
<td>3.95</td>
<td>87.85**</td>
<td>8.35*</td>
<td>0.31</td>
<td>1.37</td>
<td>1.23</td>
<td>1.32</td>
</tr>
<tr>
<td>One-leg balance–other leg</td>
<td>3.74</td>
<td>86.78**</td>
<td>12.35**</td>
<td>0.18</td>
<td>8.44*</td>
<td>2.06</td>
<td>1.03</td>
</tr>
<tr>
<td>Walking heels raised</td>
<td>14.69**</td>
<td>23.19**</td>
<td>1.72</td>
<td>1.67</td>
<td>1.32</td>
<td>0.52</td>
<td>0.01</td>
</tr>
</tbody>
</table>

* p < .01. ** p < .001.
to be attractive to Hong Kong Chinese children and easy to
administer. However, cross-cultural differences were found
on some items, highlighting the need to establish specific
group norms that can serve as a valid guide for classifying
Chinese children with motor impairment. Using the
norms for the Movement ABC set in the United States and
United Kingdom as a gauge for identifying children with
motor impairment in Chinese preschools must be caut-
tioned against.

With a quarter of the world's population being
Chinese, this culture encompasses many subgroups, rang-
ing from persons in underdeveloped rural provinces in
China to highly urbanized cities, such as Hong Kong. Even
in second or third generation Chinese living overseas, the
Chinese culture and values are often preserved (Dion &
Dion, 1996) and, thus, still influence the development of
the children. In this article, only Hong Kong Chinese
children were studied. As the development of motor skills is
influenced by environmental factors and societal attitudes,
there is also a need to study the relevance of Western norms
for other subgroups. ▲

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