Identification of Children With Motor Coordination Problems

Annlaug Flem Maeland
University of Trondheim, Norway

This study focuses on identification of children with motor coordination problems and investigates whether the incidence of children with such problems in a normal school setting in Norway is comparable to that found in other countries using the same tests and criteria. The study also examines whether there would be any agreement between two motor tests, the Test of Motor Proficiency (TMP) and the Test of Motor Impairment (TOMI), and teachers' judgment in identifying clumsiness among 360 children 10 years of age. The results showed that while the three different assessment methods identified about the same number of children with such problems (5–5.6%), each measure identified a somewhat different set of children. The lack of agreement demonstrates the difficulty in assessing subtle motor coordination problems or clumsiness.

The mastery of many school subjects and everyday activities is dependent on the acquisition of skilled movement. Drawing, copying, writing, running, jumping, throwing, catching, and kicking are but a few of the basic skills required. In the typical school setting, however, there are some children who find it exceptionally difficult to acquire the motor skills expected of them. These children have received only limited attention in special education, despite the fact that perceptual-motor impairments and general coordination deficits are 2 of the 10 most frequently found psychological and behavioral symptoms in learning-disabled children (Hallahan & Kauffman, 1986). However, there is much confusion in the terminology used to describe these children. Terms such as developmental apraxia, perceptual-motor impairment, motor coordination problems, and movement problems are used along with terms such as clumsiness and physical awkwardness (Gubbay, 1975; Wall, Reid, & Paton, 1990).

Keogh (1982) proposes that children who experience problems in acquiring skilled movements have a movement learning disability in the same sense that some children are identified as having learning disabilities in other areas such as reading, spelling, or arithmetic. For these children, the inclusion of remedial movement may be just as valid as remedial reading, writing, or arithmetic (Arm-
Consequently, it is important that teachers have an understanding of motor skill development in children.

Although there is no clear agreement on a definition of clumsiness, there has been considerable agreement that these children have no evidence of central nervous system disorders (Gubay, 1975; Henderson & Hall, 1982; Wall, 1982). Most researchers (Wall et al., 1990) define the clumsy child as cognitively competent, whereas Henderson and Hall (1982) and Gubay (1975) do not exclude children with below average intelligence unless there is clear evidence of organic impairment. It is also evident that clumsiness is related to culturally normative demands in the child’s environment. Thus, Wall (1982) states that “physical awkwardness refers to children without known neuromuscular problems who fail to perform culturally-normative motor skills with acceptable proficiency” (p. 245). This definition has been adopted in the present study, including the notion that children with below average intelligence should not be excluded unless there is clear evidence of organic impairment.

However, children with motor coordination problems, or clumsy children, do not form a homogeneous group. There are variations both in the severity and range of motor problems. There are children who are severely affected and children who are less affected. Some children have difficulty with almost every motor activity while others seem to have only specific problems such as in manipulative skills. There is also variation in the development of motor problems over time. Furthermore, clumsiness may be due to emotional factors or lack of experience, not only to intrinsic motor disability.

This heterogeneity has implications for assessment. Keogh (1982) states that motor performances can be measured in different ways and from different perspectives, and that “there is very little agreement within and across studies in the identification of clumsy children” (p. 247). Thus the question arises as to whether it is possible to construct a single assessment instrument that can cover the wide range of motor skills. Besides, over the last few years there has been a debate about the utility of using general concepts such as motor ability or IQ. Davis (1984) suggests that movement tasks ought to be assessed independently, assuming skill specificity. Rather than a composite score, a profile of the individual’s performance should be given to detect strengths and weaknesses in the motor area. In the same way, Stott, Henderson, and Moyes (1986) also point out that “we no longer assume motor ability as a fixed unitary capacity, or even that it can be broken up into a number of component abilities with which children are endowed in varying degrees” (p. 206). The identification of clumsy children is therefore not without problems and might require different measurement approaches.

Nevertheless, given these shortcomings of motor tests, we are in need of standardized motor tests because standardized procedures permit replication and comparison between and within individuals. Furthermore, the scores on a screening test can be the point of departure from which one determines how to proceed in testing/diagnosing the motor problems of the child.

A wide variety of tests and methods of assessment have been developed to measure motor skill performances in children. There have been a number of reviews of the instruments (Davis, 1984; Henderson, 1986, 1987; Laszlo & Bairstow, 1985). Some of the tests are only normative screening tests directed toward identifying children who experience difficulties in the motor domain.
These norm-referenced tests rely primarily on product scores and focus on what the child can and cannot do, and performance is judged against chronological age. Another group of tests are the criterion-referenced tests which study how children perform a task, and performance is judged against an established criterion of a pattern of moving. Because of the detailed study and diagnosis of movement performances, these tests can lead to recommendations for remediation.

Classroom teachers have also helped to identify children with motor coordination problems. Several investigations have focused on whether there is any agreement among classroom teachers in identifying clumsiness. Gubbay (1975) asked teachers to complete a 7-item questionnaire that included questions on sporting ability and general clumsiness of all the children in the study. The teachers in Søvik and Mæland’s (1986) study were also asked to identify the clumsy children. Keogh, Sugden, Reynard, and Calkins (1979) compared three assessment procedures: a teacher questionnaire, observational ratings by physical education specialists, and a motor test. These studies reported no substantial agreement on the identification of clumsiness. On the other hand, Henderson and Hall (1982) found a close relationship between three measures of motor coordination problems: teacher’s rating, a motor test, and a neurodevelopmental examination.

So far, studies examining the agreement between two motor tests in identifying clumsiness are rare. The purpose of the present study therefore was to investigate whether clumsiness would be identified with any consistency by means of two standardized motor tests. Given the lack of agreement on the identification of clumsiness by independent persons and a motor test, teachers’ opinions were also sought. It was also of interest to examine whether the incidence of children with motor coordination problems in a typical school setting in Norway is comparable to that found in other countries when using the same tests and criteria.

The two motor tests chosen were the Test of Motor Proficiency (TMP) (Gubbay, 1975) and the Test of Motor Impairment (TOMI) (Stott, Moyes, & Henderson, 1984). The TMP was chosen because it is a screening test that allows for rapid classification of children. Besides, this test has been used in Norway (Søvik & Mæland, 1986). The TOMI was chosen because the test items cover a wide range of motor performance traits involving everyday skills, and it was developed to identify children with subtle motor impairments. No data have been published using TOMI to identify children with motor problems in Norway.

Both tests are standardized and easy to administer and score, and thorough descriptions of the development of test norms are available. Concerning validity, the manual of the TOMI (Stott et al., 1984) refers to several empirical studies that report an agreement between performances on the TOMI and teachers’ assessment (Henderson & Hall, 1982; Lam, 1982). Gubbay (1975) reports that the validity of the TMP was ratified by agreement between the test results and the opinion of parents, teachers, and children in the pilot study. Comparison of a group of clumsy children and a control group showed significant differences between the groups, that is, both schoolteachers and parents considered the clumsy children to be more clumsy and much below average in sporting ability. Compared to the control group, clumsy children also rated themselves to be much below average in sporting ability.

The manual of the TOMI reports that the reliability of the total scores
showed a test-retest coefficient of 0.71. There was also a close correspondence between the mean scores of the British and the Canadian samples used for standardization. The reliability of the TMP is not given by Gubbay (1975).

Method

Subjects and Assessment Methods

Eight schools were randomly chosen among the public schools in Trondheim, Norway. Children were mainstreamed into the schools. The schools did not differ with regard to socioeconomic groups, as they all covered a representative socioeconomic range. Seventeen school classes (10-year-old children) were selected from the eight schools for the study. The total sample consisted of 360 students: 183 boys and 177 girls. Three assessment methods were used in the study—two standardized tests and teachers’ judgment.

1. Test of Motor Proficiency (TMP). The TMP was developed by Gubbay (1975) to identify mild motor impairment or clumsiness in children; it can be administered to a child in less than 5 minutes. The test consists of eight subtests that are classified into three broad categories: facial and lingual praxis, trunk and leg praxis, and manual praxis. The eight subtests are as follows: (a) whistle through pouted lips, (b) make five successive skips (three attempts after demonstration), (c) roll ball with dominant foot in spiral around six matchboxes at 30-cm intervals (three attempts, no touching), (d) throw ball up, clap hands up to four times, and catch with both hands or dominant hand (three attempts), (e) tie single shoelace with double bow, (f) thread 10 beads, (g) pierce 20 holes in graph paper, and (h) place six plastic shapes into appropriate slots (posting box).

The Test of Motor Proficiency is administered in the same way to all children regardless of age, and each item is scored as a pass or fail according to the criteria given by Gubbay (1975, p. 116). When Gubbay had the test standardized, the clumsy children were selected on the following basis: 8-year-olds, 6 or more failures; 9-year-olds, 5 or more failures; 10-year-olds, 4 or more failures; 11-year-olds, 3 or more failures; 12-year-olds, 2 or more failures.

2. Test of Motor Impairment—Henderson Revision (TOMI). The Henderson revision of the Stott et al. (1984) test, first published in 1972, was used. The stated aim of the test is to identify and measure impairment of motor function in children 5 to 12 years of age. The focus is to measure the extent to which a child falls below the level of age peers, not to rank children on their motor ability. Thus the average child is not distinguished from the highly skilled one. The test consists of four sets of items, each appropriate for different age levels: 5–6 years of age, 7–8 years, 9–10 years, and 11 years and older. The two ages within each age level have separate normative data. Eight categories of motor functioning are assessed: (a) manual dexterity 1 (speed and sureness of movement of each hand), (b) manual dexterity 2 (coordination of both hands for performance of a single operation), (c) manual dexterity 3 (eye-hand coordination using the preferred hand), (d) static balance (control and balance of the body while immobile), (e) ball skills 1 (catching), (f) ball skills 2 (throwing), (g) dynamic balance 1 (control of the body in rapid movement), and (h) dynamic balance 2 (control and balance in slow movement).

In the present study age band 3 for ages 9 and 10 was used. The items were
as follows: peg transfer, nuts on bolt, flower trail, two-hand catch, throwing bean bag, one-board balance, hop in squares, and ball balance. For most of the items, two or three trials are allowed if the child fails to achieve the pass criterion.

Each task is given a 0 (pass), 1 (partial failure), or 2 (failure). A score of 1 indicates that the child’s performance falls below the lowest 15%, while a score of 2 indicates a definite problem. These scores are summed to obtain a composite score. The higher the child scores, the more impaired he or she is. A total score of 6 or more indicates a definite motor problem. Subtotal scores for manual dexterity, balance, and ball skills are also given. Thus, norm-based scores, both subtotal and total, are used as measures of the child’s capabilities of the eight categories of motor function at the time of testing. The TOM1 also provides a qualitative assessment of the child’s motor abilities. The tester is given three checklists to help focus on the nature of a child’s failure of motor control or on behavioral sources of poor performance. Although these checklists were used in the present study, only the norm-based scores will be reported.

3. Teachers’ Judgment (TJ). Teachers involved in the study were asked to identify any child in the classroom who appeared to have motor coordination difficulties for his/her age. To help them identify the clumsy children, the teachers were given a checklist of 13 items developed by the author. The checklist consisted of items such as the following: The child has problems cutting with scissors, tying shoelaces, drawing precisely on paper, holding and maintaining balance, hopping and skipping properly, throwing and catching a ball, imitating movements, or has speech difficulties, or bumps easily into and collides with objects and other children. Thus the checklist reflected the test items found in many motor tests. The teachers were requested to report only on children they assessed as clumsy.

Procedure and Data Collection

Administration and scoring for the two motor tests were done according to the prescription given in the test manuals. The children were tested individually by the same test administrator. All schools provided a convenient room for testing. The children in one classroom were tested before the testing of a new class began. The teachers’ checklists were given out to the classroom teachers to help them identify the clumsy children, then the children were tested by the TMP, and finally the TOM1 was administered.

The TMP is a rapid screening test that can be administered to a child in less than 5 minutes, whereas even a well-coordinated child would need 20 to 30 minutes to complete the TOM1. It would thus be too time consuming to test all the children with the TOMI. Because of this, the TMP was administered to all the children in the sample. The TOMI was only administered to all children in five classes: 55 boys and 44 girls. For the rest of the sample the procedure was as follows: The TMP was administered individually to all the children in a classroom. The TOMI was then administered to the children identified by the TMP as clumsy or so judged by the teachers. Moreover, if the test administrator observed a child having motor problems in spite of passing the test criteria of the TMP, the TOMI was given to that child.

To be sure that no child with motor problems would be overlooked, the TOMI was also administered to all children the teachers suspected of having slight motor problems, in addition to those they judged as clumsy. Children with learning disabilities were also tested. As a result, the screening test (TMP) was
administered to all 360 children in the sample. The TOMI was administered to 223 children, including the small sample of 99 in the five classes.

**Results**

First we will give the results for the TJ and TMP. Next, the TOMI results for the small sample and the total sample will be presented. Because this test has not been used in Norway before, the frequency of clumsiness will be compared to the normative samples in Britain and Canada. Afterward we will compare the results of the TOMI and TJ, the TOMI and TMP, and the TMP and TJ. Finally, all three assessment methods will be compared.

**Screening Methods**

*Teachers' Judgment (TJ).* With the help of a checklist, the teachers selected 20 children (5.6%) with motor problems. In this group there were 16 boys and 4 girls.

*Test of Motor Proficiency (TMP).* Table 1 presents the results of the TMP. According to the criteria established by the TMP, 11 children (7 boys, 4 girls) were identified as clumsy. The figures represent 3.1% of total sample. In his investigation, Gubbay had included the oldest borderline cases in his group of clumsy children, thus the percentage of such children increased from 4 to 6. For comparable reasons, the same procedure was followed in the present study and the oldest borderline children were included, 1 girl and 6 boys. The final sample of children with motor problems thus consisted of 13 boys and 5 girls, that is, 5% of the total sample.

*Test of Motor Impairment (TOMI).* Within the small sample of 99 children, 4 boys and 1 girl obtained a score of 6 or more on the TOMI and thus were identified as having motor problems. This result is in line with the expected outcome, as a score of 6+ was chosen to identify approximately 5% of a nondisabled population. Of the 223 children tested (total sample), 17 children (11 boys, 6 girls) obtained a score of 6 or more on the TOMI, indicating a definite motor problem. Among the children tested, 2 girls and 1 boy had to be excluded from this group because it turned out that one child had glaucoma and the other

**Table 1**

<table>
<thead>
<tr>
<th></th>
<th>Boys</th>
<th></th>
<th>Girls</th>
<th></th>
<th>Both genders</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td>Total sample</td>
<td>183</td>
<td>100.0</td>
<td>177</td>
<td>100.0</td>
<td>360</td>
<td>100.0</td>
</tr>
<tr>
<td>Motor problems</td>
<td>7</td>
<td>3.8</td>
<td>4</td>
<td>2.3</td>
<td>11</td>
<td>3.1</td>
</tr>
<tr>
<td>Motor problems*</td>
<td>13</td>
<td>7.1</td>
<td>5</td>
<td>2.8</td>
<td>18</td>
<td>5.0</td>
</tr>
</tbody>
</table>

*With borderline cases.
two had previously been involved in car accidents. Therefore, 14 children (4 girls and 10 boys, or 3.9% of the total sample) were identified as having motor problems. Each of these children had a score of 6 or more on the TOMI.

The TOMI manual does not indicate whether a child of 9 years and 11 months is a 9- or a 10-year-old. Therefore, all children 9 years and 11 months of age were scored according to the normative data for 10-year-olds. Thus 3 boys obtained a score of 6 or more. These children were also included in the sample. Eight children (1 girl, 7 boys) had obtained a score of 5.5. Two of the boys would be 11 years within a few months and thus were included in the sample. That is to say, if these two groups of "borderline" children were added to the definite group of 14 clumsy children, a total of 19 children (4 girls, 15 boys) would be identified as having motor coordination problems.

Table 2 shows the percentages of Norwegian 10-year-olds identified as having motor problems within the total sample, compared to the Norwegian small sample and the TOMI norms for the British and Canadian samples. The results show a striking resemblance between the Norwegian sample without borderline children (3.9%) and the Canadian sample (4.0%) for both genders. If the borderline children are included, the Norwegian (5.3%) and the British samples (5.6%) are comparable. In the British sample there was no significant difference between boys (5.9%) and girls (5.4%), but in the Norwegian sample there was a significant difference in the motor performances of boys (8.2%) and girls (2.3%) identified as clumsy (p<.05). The Norwegian small sample is also similar to the Norwegian total sample with borderline cases, with respect to both genders. However, comparison of this type is somewhat problematic because the British and Canadian samples consisted of children from each of the four age bands (5–12 years).

Comparison of the TOMI, TJ, and TMP

TOMI and TJ. Ten children defined by the TOMI as having motor problems were also identified as such by the teachers. This suggests that teachers were able to identify 52.6% of the children in accord with the TOMI test criterion.

Table 2

Percentages of 10-Year-Olds Defined With Motor Problems as Assessed by the Test of Motor Impairment (TOMI)

<table>
<thead>
<tr>
<th></th>
<th>Boys (%)</th>
<th>Girls (%)</th>
<th>Both genders (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>British sample</td>
<td>5.9</td>
<td>5.4</td>
<td>5.6</td>
</tr>
<tr>
<td>Canadian sample</td>
<td>5.2</td>
<td>2.9</td>
<td>4.0</td>
</tr>
<tr>
<td>Norwegian small sample</td>
<td>7.3</td>
<td>2.3</td>
<td>5.1</td>
</tr>
<tr>
<td>Norwegian total sample</td>
<td>5.5</td>
<td>2.3</td>
<td>3.9</td>
</tr>
<tr>
<td>Norwegian total sample*</td>
<td>8.2</td>
<td>2.3</td>
<td>5.3</td>
</tr>
</tbody>
</table>

*With borderline cases.
Thus, better agreement was obtained between the TJ and the TOMI than between the TJ and the TMP.

**TOMI and TMP.** Ten children identified by the TOMI were also identified by the TMP; that is, the TMP was able to identify 52.6% of the children in accord with the criteria used by the TOMI.

**TMP and TJ.** Each procedure identified a somewhat different group as having motor problems. Seven children screened as clumsy by the TMP were also reported as such by the teachers. Thus the teachers identified only 38.9% of the children with motor problems according to the test criterion by the TMP.

**Additional Comparisons.** Table 3 shows the number of children identified by the three assessment procedures as cases with motor problems. In order to further check the relationships between the procedures, a $2 \times 2$ contingency table was constructed for TJ and TMP, TJ and TOMI, and TMP and TOMI, as illustrated in Figure 1. The four cells of the figures contained the number and proportions of students classified as clumsy and nonclumsy by the three pairs of tests. The proportion of agreement was equal to the sum of the proportions in the main diagonal, or cells a and d, and was calculated for each pair of tests. The pair of TJ and TMP showed an agreement of .32; for the TJ and TOMI the agreement was .45; and for the TOMI and TMP it was .51. As suggested by Riggen, Ulrich, and Ozmun (1990), an arbitrary level of 80% agreement was set up to support adequate agreement between two tests. Therefore none of the pairs showed adequate agreement.

Thus, even if the TJ, TMP, and TOMI identified about the same number of children with motor problems, each procedure identified a somewhat different set of children with these problems. Only 5 children were identified by all three assessment procedures. Eight were identified by the teachers (TJ) only, 6 by the TMP only, and 4 by the TOMI only. Better agreement was obtained by the TOMI and the two other measures than between any of the others.

**Table 3**

<table>
<thead>
<tr>
<th>Children Identified With Motor Problems by the Assessment Procedures (TOMI, TMP, TJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clumsy on all three assessment procedures:</td>
</tr>
<tr>
<td>TOMI, TMP, &amp; TJ</td>
</tr>
<tr>
<td>Clumsy on two assessment procedures:</td>
</tr>
<tr>
<td>TOMI &amp; TMP</td>
</tr>
<tr>
<td>TOMI &amp; TJ</td>
</tr>
<tr>
<td>TMP &amp; TJ</td>
</tr>
<tr>
<td>Clumsy on one assessment procedure:</td>
</tr>
<tr>
<td>TOMI</td>
</tr>
<tr>
<td>TMP</td>
</tr>
<tr>
<td>TJ</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>
Figure 1 — The agreement of clumsy/non-clumsy children by TJ and TMP, TJ and TOMI, and TOMI and TMP. Data in cells are actual numbers of children; data in brackets are proportion of children in that cell.
Discussion

For the present study we intended to examine whether the incidence of motor problems in a typical school setting in Norway is comparable to what is found in other countries when using the same tests and criteria. We also wanted to investigate whether there would be agreement among three different assessment methods in identifying children with motor coordination problems.

As there is a continuum of motor ability in any sample of children, it is difficult to determine the arbitrary point in a given motor scale below which a child might be regarded as having definite motor problems. On the basis of our three measures, each of them identified an incidence of about 5–6% of children with motor impairment in a typical school setting. This is consistent with other studies estimating the prevalence of children with motor problems (Brenner, Gillman, Zangwill, & Farrell, 1967; Gubbay, 1975; Henderson & Hall, 1982). Keogh et al. (1979) also state that the incidence of clumsiness is likely to be 5% or more. By using the same test and test criteria applied by Gubbay in Australia, the frequency of clumsiness in our Norwegian sample (5%) was found to be about 1% lower than in Australia. This difference may be due to measurement error. In an earlier Norwegian study using TMP, the frequency of third graders identified as clumsy was found to be around 5.7%, about the same percentage as for Gubbay (Søvik & Maeland, 1986).

Applying criteria similar to those of the Test of Motor Impairment (TOMI), the frequency of clumsiness in the Norwegian total sample with borderline cases was 5.3%. In the present study not all of the children in the total sample were tested by the TOMI. Therefore some may have been overlooked who otherwise would have been identified by this test as clumsy. Since the TOMI was administered after the TMP, there may also have been an order effect in identifying the clumsy children by the TOMI. However, there was close correspondence between the percentages of boys and girls identified as clumsy in the small sample, which consisted of all the children in five classes, and the total sample including the borderline cases. Thus the prevalence of children with motor impairment in a typical school setting in Norway is comparable to that found in other countries when using the same tests and criteria.

According to the two motor tests, a majority of those defined as clumsy were boys. The teachers also reported more boys to be clumsy than girls. This is in agreement with Henderson and Hall (1982) and Keogh et al. (1979), but different from Brenner et al. (1967) and Gubbay (1975). Gubbay (1975) notes that more boys than girls have been reported by others as clumsy, but his study identified the same number of boys and girls as clumsy. Stott et al. (1984) also report that in a British sample the TOMI identified the same proportion of boys and girls as having motor impairments, but in the Canadian sample the proportion of boys and girls was similar to the Norwegian results. An earlier Norwegian investigation (Søvik & Maeland, 1986) using the TMP also identified more boys than girls as clumsy.

Even though different investigations seem contradictory when estimating the proportion of boys and girls as clumsy, most of the studies show that more boys than girls are identified as such. Likewise, in almost all studies of developmental disorders, including other types of learning disabilities, it appears that the majority are boys. Gubbay (1975) also states that the equal-sex incidence of clumsy
children in his investigation might be misleading because the clumsiest children in the entire population probably had been excluded from most ordinary schools. This may also help explain the small gender difference among children with motor problems in the British sample (Stott et al., 1984). However, this is not the case in Norway, where children with special needs are integrated in ordinary schools. The finding that most of the borderline children identified as clumsy by both the TOM1 and the TMP were boys indicates that more boys than girls will score in the lowest range.

A somewhat different set of children were identified as clumsy by each of the three types of measures. This result is in agreement with most studies (Gubbay, 1975; Keogh et al., 1979; Sugden & Wann, 1987; Whiting, Clark, & Morris, 1969) but different from Henderson and Hall (1982). The teachers in Gubbay's investigation were able to discover about half of the children identified as clumsy by a screening test. This was also the case in the present study. Teachers were able to identify 52.6% of the students who were also identified by the TOM1, but only 38.9% of the children identified by the TMP.

The difference in teachers recognizing clumsy students seemed to be a function of their training and the criteria for identification. Some of the teachers would not reveal a single case of clumsiness whereas others would report several cases in their classroom. When many teachers do not pay attention to clumsy students, this may be due to lack of time and opportunity to observe children in motion. Most of the teachers in this study did not teach their pupils in physical education, and when children reach 10 years of age most of their schoolwork is academic and they are not involved in a great deal of motor activity. Perhaps the reason why Henderson and Hall (1982) found a remarkably high agreement between teachers' judgment, a neurodevelopmental examination, and Stott's Test of Motor Impairment is due to the fact that the teachers had received systematic training for a year to observe clumsiness in children. The children were 5 to 8 years old; this age range may have been an important factor in detecting clumsiness in children, since learning in grammar school involves a considerable amount of motor activity compared to learning in older children.

Because the TMP and the TOM1 were developed to identify nondisabled children with motor problems, we might expect that the two tests would identify the same children. Yet only 10 children (52.6%) identified by the TOM1 were also identified by the TMP. This raises the question of whether it is possible to construct a single screening instrument that operationalizes and measures a complex capacity such as motor ability and includes manipulative, writing, self-help, ball, balancing, and locomotor skills (Gallahue, 1982; Keogh & Sugden, 1985). The two motor tests consisted of different items and may have been too limited in scope to make comparisons across tests. Both Whiting et al. (1969) and Keogh et al. (1979) state that it can be useful to employ different measurements in identifying children with motor problems. Thus, from this study we can conclude that each assessment procedure can be helpful in identifying children with motor problems not identified by the other test procedure.

The study therefore confirms the heterogeneity of children who are described as "clumsy" and the necessity of providing a profile of the child's motor performance rather than a composite score only. In view of the conflicting results of the three assessment methods, the study also supports the future directions established by Wall et al. (1990), who call for agreement on a definition of
clumsiness and for the development and refinement of checklists and rating scales to identify children with motor coordination problems.

An important question is, which of the three measures used in the present study seemed the most valid? The results showed stronger agreement between the TOMI and the two other measures than between any of the others. The 8 children that only the teachers had identified as clumsy obtained relatively low scores on the two motor tests and probably had less if any motor problems at all. Data also indicated that most of the clumsy children identified by the TMP, but not by the TOMI, were borderline by the TOMI and thus were identified as mildly impaired according to the TOMI. The 3 children with severe motor problems according to the TMP were all identified by the TOMI. However, this was not the case with the clumsy children identified by the TOMI but not by the TMP. The TMP did not always detect a child who scored high on the TOMI.

The fact that the TOMI also allowed for two or three trials on most items if the child failed to achieve the pass criterion suggests that this test is more reliable and better suited for identifying children with motor problems than the TMP. Hence, TOMI appears to be the most appropriate test for identifying a child with motor problems. The TOMI also offers a better profile of the individual child’s motor performances. However, it might be too time-consuming to serve as a screening test. For screening purposes a test such as the TMP, together with observation by a trained observer, would be more suitable, and the TOMI could then be administered to specify the child’s motor problems. By using additional checklists, the TOMI also provides an opportunity to observe systematically the specific motor difficulties and to consider whether it is failure of motor control or behavioral sources that might be responsible for poor performance. Thus the TOMI combines the advantages of a normative standardized test and a clinical diagnostic instrument.

References


