CHAPTER 5
DISCUSSION

The intention of the study was to determine if the widely used Beery-Buktenica Developmental Test of visual-motor integration with Supplemental Developmental Tests of Visual Perception and Motor Coordination (4th Edition, Revised)\(^4\) are culture free and can be used reliably to test visual perception in children in the 7 year 0 month to 7 year 3 months age range from diverse environmental, educational and linguistic backgrounds, as claimed by the author of the test.

The fifth edition of the VMI test was published in 2004 and could not be used for the purpose of this study since the candidate did the data collection for her study in 2003. In the fifth edition, now called the Beery VMI, the VMI test, the STMC and the STVP have 30 items instead of 27 items as in the fourth edition\(^4\). Three items were added to the start of each test to allow for the assessment of younger users\(^4\). The fifth edition includes standardized norms from 2 years up to 18 years and 11 months where the fourth edition only includes standardized norms from 3 years up to 17 years and 11 months\(^4\). The Beery VMI also includes 600 developmental stepping stones from birth through to age six and teaching methods to address problems identified on the three tests\(^4\). The changes made to the fifth edition do not impact on the results obtained in this study.

The study was designed to use the VMI test and two supplemental tests to evaluate the visual-motor integration, visual perception and motor coordination of a normally distributed sample of children within the prescribed age range, representative of a population of the Eastern Cape. The test results of the 79 children within the study sample were then analysed to determine the performance of the participants compared to the norms established for children in the same age range during the standardization process of the test. The test results of the study sample indicated a departure from the expectation on all three of the tests.
The results for the VMI test clustered around average and below average scores, with no
participants achieving scores in the high or very high categories. Similarly results for the
Supplemental Developmental Test of Visual Perception indicated a general poor performance
with as many as 27% of the participants clustering in the very low category.

The results for the Supplemental Developmental Test of Motor Coordination were interesting
in that 100% of the children obtained results in the average category. Since visual-motor
integration develops by practicing visual and motor responses and then integrating the two,
the concern exists that the scores of the South African children might be unrealistically high
on the STMC when using the American norms and this might result in children missing out
on therapeutic intervention in this area. The 100% cluster could be due to the assessment not
being appropriate for this particular population group, or it could indicate that this group has
better motor development than the American sample. Research on population groups similar
to the group used for this study only identified improved gross motor coordination and not
improved fine motor coordination, which is needed to perform the STMC.\(^{(23,31,47)}\)

Literature suggests that most assessments used for motor proficiency were developed in
North America, Australasia or Europe and were not always completely culture-free\(^{(27)}\). When
looking at the assessments used to determine motor proficiency in South Africa, research
done by Pretorius and Naude investigated the impact of Pêpa (carrying the baby on the
mother’s back) on the development of visual integration pathways and identified problems
with fine motor coordination in a sample of Tswana children aged between five and a half
and seven years\(^{(48)}\). The instrument used in this research was the SEGO, a school readiness
assessment developed in South Africa, which made the identification of the significantly
poorer performance in fine motor skill development possible which is contradictory to the
results obtained on the STMC. The 100% cluster in the average category of the STMC could
therefore be due to the assessment not being appropriate for the particular population group,
resulting in a false positive.

In an attempt to explain the lower than expected test results of the study sample on the STVP
and STMC the data was then further analysed to determine if any one of the following
variables, different socio-economic status, gender and population groupings within the study sample could explain this.

The study sample was selected so that these variables were equally distributed within the study sample. In the African sample the distribution was 51% male and 49% female with 52% male and 48% female in the total sample. The composite index derived by Riordan, specifically designed for a South African population\(^{(31)}\) was used and the socio-economic status distribution turned out to be fairly equal for the African group, being the largest group. The study was limited to the Eastern Cape area of South Africa and further limited to the Uitenhage area of the Eastern Cape. The Uitenhage area is representative of the Eastern Cape, but the Eastern Cape is not necessarily representative of the rest of South Africa, because of the complexity of our population. The small percentage of White children and Coloured children and the exclusion of Indian children might be different to the population percentages of South Africa as a whole. It was appropriate in the context of the study to select percentages according to the way the different population groups were represented in the Eastern Cape. Since the African group represented 87% and the White and Coloured groups 6% and 7% respectively, the exclusion the two smaller groups from the sample was considered. In the permission letter from the Department of Education it was stipulated that the research sample should be representative of the various population groups. \((Appendix \ I)\) This limited the exclusion of the two smaller population groups i.e. White children and Coloured children and for the purpose of the study these two groups were included and the statistics were interpreted in conjunction with the results obtained from the African children. Since the White and Coloured population groups were so small, the candidate is of opinion that it was not within the scope of her study to significantly compare the different population groups to each other. The candidate did however report on the results of these comparisons. No statistical significant difference was found on the VMI test or on the two supplemental tests to this regard. If the difference in performance of population groups were to be investigated in future studies, the population groups need to be equally distributed rather than proportionate to the population composition and the study should be designed to specifically achieve this.
In a recent South African study by Dunn, Loxton and Naidoo, a multi-ethnic pre-school sample was used and performances compared between the VMI test and a locally standardized Copying test\(^{28}\). They identified statistical significant differences in test performance according to population groups and socio-economic status, highlighting once again the importance of further study in this area.

According to Buktenica, the VMI test is sensitive in predicting achievement in low socio-economic groups\(^{49}\). Beery identified statistically significant differences between the scores of children from families earning under $12,500 per annum (net) in 1981 and those earning over that amount\(^{50}\). Since the division according to socio-economic status for this study was done by the selection of schools according to the size of the houses in the areas, as well as by using the Riordan composite index\(^{31}\) specifically designed for a South African population, the division of the sample according to socio-economic status was deemed to be accurate. Therefore the results indicating no significant difference between the socio-economic groups on the VMI test are to be considered reliable as this result was found for the total sample and when the African sample was analysed separately from the total sample.

Differences between participants of different socioeconomic groups were found for the Supplemental Developmental Tests of Visual Perception and Motor Coordination. A statistical significant difference was found on the STVP, when comparing the high and low socio-economic groups of the total sample but not when the African sample was considered separately. The comparison of the total sample could be considered more reliable, as there was a more equal distribution between the three socio-economic groups. (Table 4.3 p.34)

A statistical significant difference was found on the STMC when comparing the high socio-economic group to the low as well as the middle socio-economic status group for both the total sample and African sample. Socio-economic status thus has an influence on motor coordination performance. Kulp when considering the clinical value of the Beery visual-motor integration supplemental tests concluded that even children who perform within normal limits on the VMI test may show deficits on the STVP or STMC\(^{51}\). This is a concern since the supplemental tests are only intended to be performed if problems are
identified on the VMI test\(^4\). Further research, to determine if the variance in performance found between the VMI test and the two supplemental tests in the different socio-economic groups is due to this factor or a difficulty with the skills themselves, is therefore needed.

The results of this study confirm allegations by Beery that the "preponderance of studies have found no significant gender differences."\(^4\) (p.122) No statistical significant differences were found between male and female performance on any of the three tests. It is thus recommended that there is no need to control gender when doing further studies to gather normative data for the VMI test and the two supplemental tests.

When the performance of 79 South African participants was compared with the performance of the USA children used by Beery to collect normative data for the VMI test and two supplemental tests, a statistical significant difference was identified. The South African participants performed better than the USA participants on the STMC, and this could result in false negatives where children with problems could be missed when using this test on a South African population.

The statistical significant difference found on the VMI test and STVP could result in a false positive, where children could be identified as having a problem where there might not be one. These differences were also confirmed by the t-test comparison of the sample. New South African norms were compiled by using the method described under Point 3.7 on page 28. Only standard scores are provided since these can be converted to NCE’s, T-scores, scaled scores or percentile ranks by using the table in Beery’s manual on page 176\(^4\). The new norms for the VMI test and two supplemental tests are in Appendix K.

Since the poor performance on the VMI test and the two supplemental tests indicate a score \(\geq 1\) sd below the mean for study population norms,\(^4\) the clinical implication that occupational therapy for these children would be recommended, is of concern as these scores reflect a false negative or positive.
To highlight the clinical implications when using the new South African norms, *(Appendix K)* three examples will be briefly illustrated:

**Example 1: VMI test results:**

A child in the age group 7 years 0 months to 7 years 1 month with a raw score of 13 will not require occupational therapy for Visual Motor Integration when using the new South African visual-motor integration scores. This skill would be considered within normal limits with a standard deviation score of +0.3 as opposed to a standard deviation score of -1 according to the Beery manual (Table 5.1.)

<table>
<thead>
<tr>
<th>Raw score</th>
<th>VMI scores – Beery Manual</th>
<th>New South African VMI scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SS</td>
<td>Scaled score</td>
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<tr>
<td>12</td>
<td>82</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
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<td>7</td>
</tr>
<tr>
<td>14</td>
<td>92</td>
<td>8</td>
</tr>
</tbody>
</table>

**Example 2: STVP results:**

A child in the age group 7 years 0 months to 7 years 3 month with a raw score of 10 will not be identified as having difficulties in the area of visual perception according to the STVP when using the new South African Visual scores. This skill would be considered within normal limits with a standard deviation score of -0.7 as opposed to a standard deviation score of -2.3 according to Beery’s norms. (Table 5.2.)
Table 5.2 STVP Results: 7yr 0mo – 7yr 3mo

<table>
<thead>
<tr>
<th>Raw score</th>
<th>STVP scores Beery Manual</th>
<th>New South African STVP scores</th>
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</thead>
<tbody>
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<td>4</td>
</tr>
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<td>10</td>
<td>65</td>
<td>3</td>
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</tbody>
</table>

Example 3: STMC results:
A child in the age group 7 years 0 months to 7 years 3 month with a raw score of 14 will be identified as having difficulties in the area of motor coordination according to the STMC when using the new South African visual-motor integration scores. This skill would be considered to be outside of the normal limits with a standard deviation score of -1.3 whereas standard deviations score of -0.7 according to the Beery manual would be considered as acceptable and within the normal limit. (Table 5.3)

Table 5.3 STMC Results: 7yr 0mo – 7yr 3mo

<table>
<thead>
<tr>
<th>Raw score</th>
<th>STMC scores Beery Manual</th>
<th>New South African STMC scores</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SS</td>
<td>Scaled score</td>
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<tr>
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</tbody>
</table>

Summary
The South African participants performed better than the USA participants on the STMC and this could result in false negatives where children with problems could be missed when using this test on a South African population.
The statistical significant difference found on the VMI test and STVP could result in a false positive where children could be identified as having a problem where there might not be one.

No statistical significant difference was found between the performances of the three population groups investigated in this study; however the small representation of the White and Coloured groups could make this particular comparison unreliable.

The VMI test and STVP proved no significant difference between the performance of the low, middle and high socio-economic groups, while this variable had an influence on the performance of participants on the STMC and should be further researched.

The study confirmed allegations by Beery that no significant differences were found between male and female performance and this variable could be excluded in further studies\(^4\).