Evaluating Normative Data for the Visual-Motor Speed and Precision Test for Children

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Key Words: visual-motor integration • fine motor

Objective: *This study investigated the reliability of the commonly accepted normative data for the Visual-Motor Speed and Precision Test (VMSPT). Additionally, it was the authors' intent to modify these norms based on their research findings. This would include re-evaluating initial normative data, gender comparisons, and precision evaluation as well as changing age groups, if necessary, and adding standard deviations for the normative data.*

Method: *A sample of 675 typical students from two school districts was used for this study. Each child completed the Visual-Motor Speed and Precision Test. The sample included 333 males and 341 females ranging in age from 46 months to 188 months.*

Results: *The research was able to reproduce similar results as those reported from the original test. The age related means and standard deviations obtained conformed to the original data for each age group. There was no significant difference between males and females when comparing the groups based on the number of correct entries.*

Conclusion: *A deficiency in visual input, motor output and/or visual motor integration can produce scores that are outside the first standard deviation for an individuals age group. This would indicate the need for further developmental testing.*

The ability to coordinate visual information processing skills with motor skills defines visual motor integration. Visual fine motor coordination is necessary to perform a broad range of tasks such as drawing, writing and tool manipulation. Visual fine motor integration is an essential aspect of the early learning process. Demands on a child's visual fine motor skills are intensified when structured learning begins. Many kindergarten classes as well as preschool curriculum focus on developing these skills in expectation of increased copying demands. Successful achievement in a structured learning environment requires good copying skills (Cornhill and Smith, 1996).

Method

Subjects

A convenience sample consisting of 675 typical elementary and middle school students from two school districts was used for this study. Of the 675 students, 14 students' results were not incorporated into normative data because of improper test completion.

Of the 661 students with acceptable test completions the study included 326 males and 334 females. The 661 students were broken into 4 month age groups starting at 3 years 8 months up to 16 years. Group size ranged from 1 member (3 groups) to 37 members (see Table 1).

Table 1
VMSPT Age Groups, Means and Standard Deviations

age groups	n	Means	SD
44-47	1	0.000	N/A
48-51	1	8.000	N/A
52-55	2	10.500	10.607
56-59	7	17.143	15.291
60-63	17	20.588	15.464
64-67	25	28.240	16.213
68-71	22	35.818	15.827
72-75	17	39.706	17.048
76-79	19	50.474	21.900
80-83	27	55.148	18.730
84-87	28	57.857	19.291
88-91	37	70.081	19.956
92-95	35	70.429	15.973
96-99	35	78.029	17.578
100-103	13	78.846	18.321
104-107	34	75.853	13.791
108-111	24	84.917	21.387
112-115	25	93.760	18.620
116-119	30	98.333	21.360
120-123	21	96.381	17.987
124-127	27	99.259	22.005
128-131	31	97.161	17.922
132-135	15	106.867	14.436
136-139	4	83.250	40.161
140-143	9	114.556	12.739
144-147	11	100.727	35.889
148-151	18	123.778	21.433
152-155	14	116.786	24.275
156-159	15	137.667	28.706
160-163	15	134.200	26.948
164-167	26	131.615	35.095
168-171	19	134.421	28.187
172-175	20	140.800	21.927
176-179	7	104.857	36.219
180-183	5	138.000	10.536
184-187	3	135.333	11.015
188-191	1	137.000	N/A

Note. VMSPT=Visual Motor Speed and Precision Test

Instruments

The subjects were tested in classroom groups by the first author using the Visual-Motor Speed and Precision Test (VMSPT) originating from the Detroit Test of Learning Aptitudes First Edition (DTLA-I) (Baker and Leland, 1935).

The test was administered while each subject was seated at a table using either a pencil or a pen. For those students that did not have appropriate length pencils acceptable writing tools were dispensed.

Procedures

All but the pre-school subjects were tested in groups of 20 to 35 students. The 27 pre-school subjects were tested individually to optimize understanding of test requirements. Hammill, Pearson, & Voress (1996) compared individual test results to group test results while developing the Visual Motor Integration test. Their results indicated that there was no significant difference in test scores between the individuals and equivalent age groups. Each subject was given two minutes to complete as many entries as possible on the test form. Additionally, time was allowed for instructions and practice. The original test included 3 minute testing for age groups from 7 years 9 months and above. In this study, only 2 minutes were used for test administration.

The instructions were read verbatim from the backside of the original VMSPT recording sheet. (See page 2 of enclosure 1). Additional instructions included not to skip any rows or circles and not to make erasures or corrections.

Each subject was allowed the opportunity to practice on 12 sample circles decreasing in size. (See page 1 of enclosure 1). All practice samples were evaluated and remedial instruction given to ensure understanding.

In some instances classroom teachers assisted the original author but the same basic instructions and test methods were followed for all subjects.

The recording sheets were graded by both authors and an assistant and were peer-reviewed for consistency of grading. The following grading criteria was used: two lines that cross at any point with no line surpassing the outside edge of the circle.

Test results included initials, gender, age in months, number attempted and number correct.

Data Analysis

Statistical analysis included *t* tests to compare original age groups for number of items correct verses age and gender verses age and number of items correct. Standard deviations and means were determined for each age group where possible. A Precision Ratio was developed using means for number of items completed in each age group divided by the mean number of items correct for each age group. This was also evaluated on an individual basis.

Results

A Comparison of male performance vs. female performance based on number of correct entries was done. The authors used a two-sample t-test assuming equal variances (see chart 1). The *p* value for the test was 0.000665 (2 tailed). This revealed no significant difference between male and female subjects when comparing the groups based on number of correct entries. The 4 month age grouping revealed significant changes between all but one group. Although the original test groups were three months our findings did not suggest a significant statistical difference until a four-month grouping was implemented.

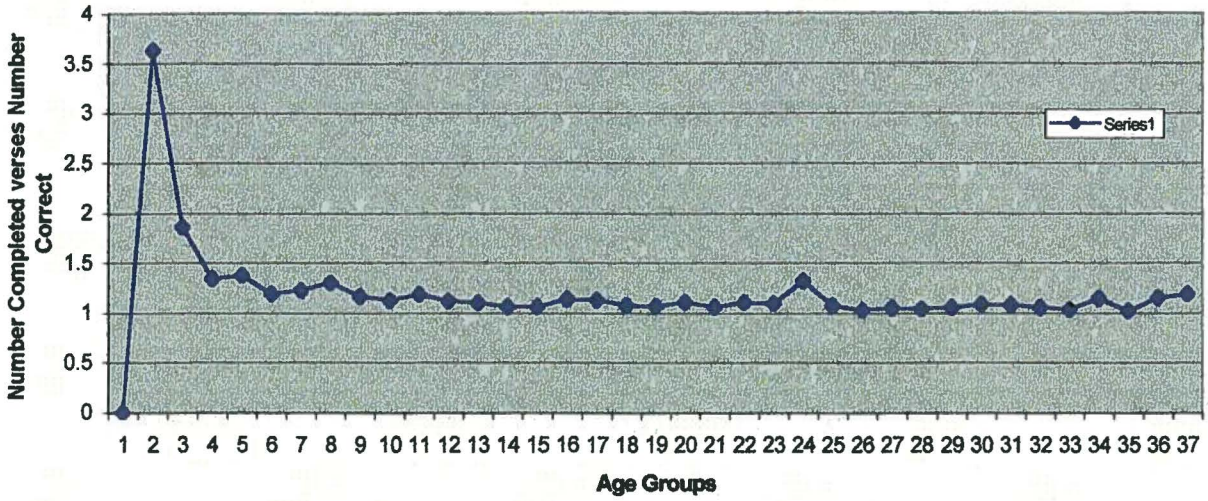
Table 2
***t* Test for Gender Comparison**

t Test: Two-Sample Assuming Equal Variances

	Variable 1	Variable 2
Mean	89.88024	79.54601
Variance	1404.568	1610.759
Observations	334	326
Pooled Variance	1506.41	
Hypothesized Mean Difference	0	
Df	658	
t Stat	3.419924	
P(T<=t) one-tail	0.000333	
t Critical one-tail	1.647172	
P(T<=t) two-tail	0.000665	
t Critical two-tail	1.963576	

There was a definite pattern when comparing number of completed entries to the number of correct entries. The number of completed entries compared to the number of correct entries has been evaluated and a significant age related pattern has been identified. A comparison of number of items correct verses number of items completed for age groups is demonstrated in Graph 1. This graph reveals an age-related pattern with few deviations. It is the opinion of the authors that this pattern may be useful as a clinical diagnostic tool. Any individual with a deviation of .2 would indicate a statistically significant deficiency in fine motor accuracy. The ratio has an optimum score of one; the age groups approach this asymptote after the age of 64 months (group 6). The mean ratio for age group above 64-67 months was 1.11. This pattern is a representation of the specific developmental milestones for an average child to draw certain geometric shapes as discussed by Beery (1982).

Graph 1
Age Group Precision Ratio



Discussion

The authors completed an extensive literature search for a test that met the parameters of visual fine motor testing. Their search revealed numerous tests that fell under the heading of Visual motor integration. This suggests that either the VMSPT is a screening Visual Motor Integration (VMI) test or it is the only test specifically designed for visual fine motor speed and precision. Baker and Leland (1935) originally designed the VMSPT as one of 19 separate tests used in an individual intelligence scale. The original normative data was obtained using 50 individuals per age group. The age groups were initially year groups then broken down into age groups of 3 months each (Anastasi, 1938). There is no information on the actual size of each 3-month age group. The lack of original data was the catalyst for this study.

Visual motor integration can be broken down into three components. The visual aspect of visual motor integration is necessary to distinguish the task at hand. The motor aspect is necessary to manipulate the writing tool and the integrative aspect is necessary to coordinate the visual input and motor output to reach a desired end result.

A comparison of male verses female subjects based on the number of items correct provided a p value of 0.000665. This was not statistically significant when compared to the group sizes of 334 females and 326 males.

A comparison of number of items correct verses number of items completed revealed a statistically significant age related pattern. When grafted against each other the number of items completed verses the number of items correct yielded a curve with the high-end (least precise) being at the youngest age groups and quickly approached an asymptote (most precise) approaching 1 at the 64 months and older age groups. The age group at which the curve flattened was at 64-67 months (see Graph 1).

Implications for Practice

The Visual Fine Motor Speed and Precision Test has the ability, with the new normative data to be an excellent screening test for identifying individuals that have delays in some aspect of the visual motor integration system. The test is of a simple and straightforward design allowing for use by laypersons and professionals alike. It has a relatively short learning time and has a 2 minute maximum test time making it an efficient and effective tool. The test has a simple grading system that is printed along with the instructions on the reverse of the recording sheet, which reduces storage space in the office and classroom.

Limitations

The primary limitation of our data is the large variation of group size. The small groups produced data that may not accurately represent their population age group. These groups also had large standard deviations, which could mask possible delays in individuals within these age groups. The repetitive nature of this test may also have an adverse effect on those individuals with non-visual motor disorders such as attention deficit disorder. The data collection method did not evaluate individual student's vision. This study assumed each individual either passed each school's visual screening or wore appropriate spectacle correction.

Conclusion

The authors believe that students successfully falling into their age related norms have the potential to be delayed several months. This masking effect is a result of the standard deviations encompassing several age groups. The delays are not considered clinically significant until they fall outside of the first standard deviation. These individuals would require a more detailed evaluation of the three aspects of visual motor integration as discussed earlier. A deficiency in any one of these aspects, as well as other contributing factors (e.g., attention deficit, fatigue, cognitive ability, distractibility) can produce such delays. ♦

References

Anastasi A (1938). The 1938 Mental Measurements Yearbook; Oscar Krisen Buros, Editor. 1058. Highland Park NJ: The Gryphon Press,.

Baker HJ & Leland B (1935). Detroit Tests of Learning Aptitude. Bloomington, IL: Public School Publishing Co

Beery KE (1982). The developmental test of visual motor integration. Cleveland, Modern Curriculum Press.

Cornhill H & Case-Smith J (1996). The factors that relate to good and poor handwriting. American Journal of Occupational Therapy. 50(9)732-739.

Hammill DD, Pearson NA, & Voress JK (1996). Test of Visual-Motor Integration (TVMI). Austin, TX: Pro-Ed.

COLLEGE OF OPTOMETRY
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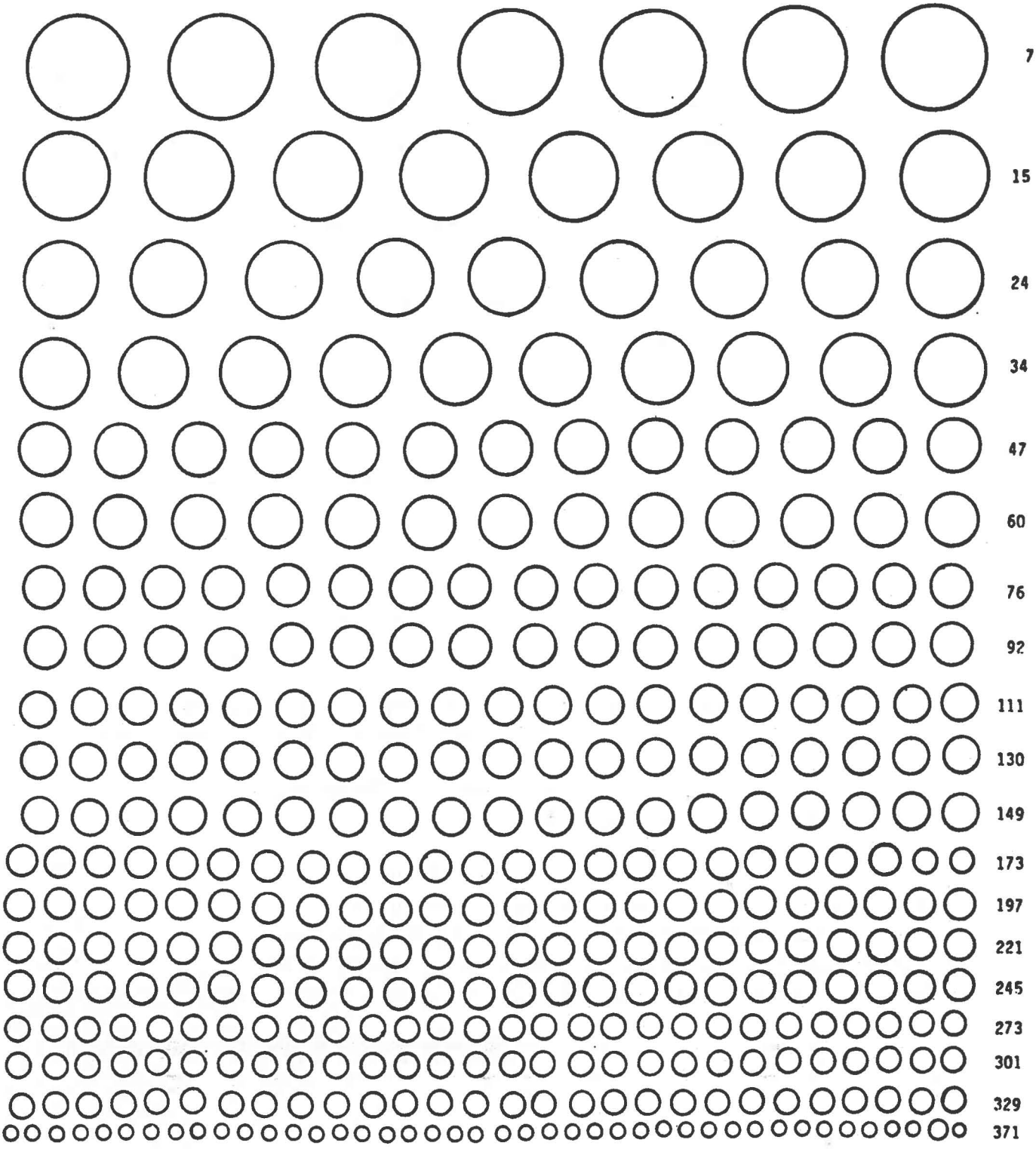
FINE VISUAL-MOTOR SPEED & PRECISION

Score_____
☐ Right or ☐ Left

Patient Name _____ Date_____



VISUAL-MOTOR SPEED AND PRECISION

INSTRUCTIONS: "Here is a page with lots of circles on it. I want you to make a mark like this 'X' in each circle; be careful to keep your mark inside of the circle. You are to do as many as you can one right after the other. Do you understand? Show me in this row how you do it."

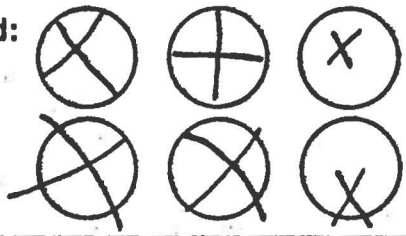
"When I tell you to start, you do as many rows as you can and keep going until I say 'stop'. Ready - Start."

SCORE: Two minutes - through fifth grade
Three minutes - sixth and seventh grades and above

CREDIT: One (1) point for each cross placed within the circle.
This is the precision score.
The total of all crosses either within or outside the circle represents the speed score.

EXAMPLES:
Credit for precision and speed:

Credit for speed only



Motor Age	Motor Speed and Precision		Motor Age	Motor Speed and Precision		Motor Age	Motor Speed and Precision	
	2'	3'		2'	3'		2'	3'
4-0			8-0	83-85	111-115	12-0	132-135	180-184
4-3			8-3	86-88	116-120	12-3	136-139	185-189
4-6	to 25		8-6	89-91	121-125	12-6	140-143	190-194
4-9	26-30		8-9	92-94	126-130	12-9	144-147	195-199
5-0	31-35		9-0	95-97	131-135	13-0	148-151	200-203
5-3	36-40		9-3	98-100	136-139	13-3	152-155	204-207
5-6	41-45		9-6	101-103	140-143	13-6	156-159	208-210
5-9	46-50		9-9	104-106	144-147	13-9	160-163	211-213
6-0	51-55		10-0	107-109	148-151	14-0	164 up	214-216
6-3	56-60		10-3	110-112	152-155	14-3		217-219
6-6	61-64		10-6	113-115	156-159	14-6		220-222
6-9	65-68		10-9	116-118	160-163	14-9		223-224
7-0	69-72		11-0	119-121	164-167	15-0		225-226
7-3	73-75		11-3	122-124	168-171	15-3		227-228
7-6	76-79		11-6	125-127	172-175	15-6		229-230
7-9	80-82	to 110	11-9	128-131	176-179	15-9		231-232
						16-0		233-234
						16-3		235 up

VISUAL-MOTOR SPEED AND PRECISION

INSTRUCTIONS: "Here is a page with rows of circles on it. I want you to make a mark like this "X" in each circle; be careful to keep your mark completely inside the circle. You are to do as many circles as you can one right after the other. Do not skip any circles or rows of circles. Do you understand? Show me in this row how you do it."

"When I tell you to start do as many rows as you can and keep going until I tell you to stop. Do not make any corrections or go back and erase mistakes. Are there any questions? Ready start!"

GRADING:

Correct: One (1) point is given when two lines cross at any point within the circle with no line surpassing the outside edge of the circle.

Complete: One point is given for all attempts.

PRECISION RATIO: Number Completed/Number Correct

Age Groups	Means	SD	Precision Ratio
44-47	0	N/A	N/A
48-51	8	N/A	3.6250
52-55	10.5	10.6066	1.8571
56-59	17.1429	15.2908	1.3417
60-63	20.5882	15.4639	1.3800
64-67	28.24	16.2129	1.1926
68-71	35.8182	15.8269	1.2284
72-75	39.7059	17.0478	1.3037
76-79	50.4737	21.8997	1.1606
80-83	55.1481	18.7303	1.1195
84-87	57.8571	19.2906	1.1864
88-91	70.0811	19.9560	1.1130
92-95	70.4286	15.9729	1.1043
96-99	78.0286	17.5775	1.0604
100-103	78.8462	18.3205	1.0585
104-107	75.8529	13.7909	1.1334
108-111	84.9167	21.3865	1.1276
112-115	93.76	18.6196	1.0759

Age Groups	Means	SD	Precision Ratio
116-119	98.3333	21.3595	1.0637
120-123	96.381	17.9874	1.1087
124-127	99.2593	22.0045	1.0631
128-131	97.1613	17.9222	1.1062
132-135	106.867	14.4364	1.0967
136-139	83.25	40.1611	1.3213
140-143	114.556	12.7388	1.0718
144-147	100.727	35.8890	1.0280
148-151	123.778	21.4327	1.0467
152-155	116.786	24.2746	1.0385
156-159	137.667	28.7055	1.0533
160-163	134.2	26.9476	1.0859
164-167	131.615	35.0954	1.0804
168-171	134.421	28.1865	1.0552
172-175	140.8	21.9272	1.0341
176-179	104.857	36.2189	1.1431
180-183	138	10.5357	1.0159
184-187	135.333	11.0151	1.1502
188-191	137	N/A	1.1898