CHAPTER 4

DATA ANALYSIS

This research aims to examine the validity and reliability of the Thai version of the DTVP-2 and to determine the normative values of the DTVP-2 in Thai children. There were three main stages involved in this research. The first phase was to translate the DTVP-2 from the English version to a Thai version and to run a test trial of the Thai version of the DTVP-2. The second phase was to examine of the validity and reliability of the DTVP-2 (Thai version). The third phase was to determine the normative values of the DTVP-2 in Thai Children. The presentation of the analysis has been classified into these three main stages as shown in the following details:

4.1 Phase one: Results of translation of the DTVP-2 from the English version to a Thai version and test-trial of the DTVP-2 (Thai version)

The results of the research in phase one were derived from these two main courses of action. The results from the translation of the DTVP-2 are presented in the details below:

4.1.1 Results from the translation of the DTVP-2

For translation of the DTVP-2 from the English version to a Thai version, the researcher applied the forward-backward translation method which resulted in the following essential points:

1) **Result of the forward translation process** which was from the English language to the Thai language. In this stage, we could get the DTVP-2 in the first Thai edition.

2) **Result of the back translation process** which was from the first version of the DTVP-2 in Thai to be translated back to English by the translator, a native speaker who is able to read and write both Thai and English, who has no knowledge of the DTVP and has

never used the DTVP-2 before. Obviously, in this stage, the DTVP-2 was in the English version.

3) **Result of finding differences and making corrections**. In this process, any differentiation between the DTVP-2 in English (which is the original version), and the English version back translated from the Thai version of the DTVP-2 was checked. At this stage, there was a mutual understanding between the researcher and the advisor to compare the differences and the corrections so as to distinguish the points found in each case. All sub-tests from 1 – 8 were checked, and it was generally concluded that the points on visual perception in both versions contained the same details; however, both the researcher and the advisors detected some points which required correction. The differences and points for correction found in the original DTVP-2 and the back translated DTVP-2 are shown in Table 4.1
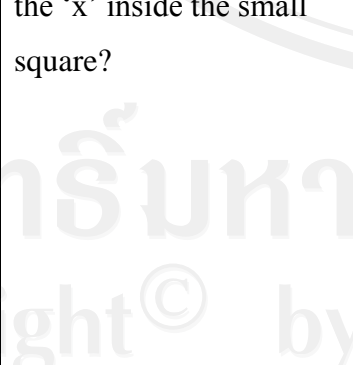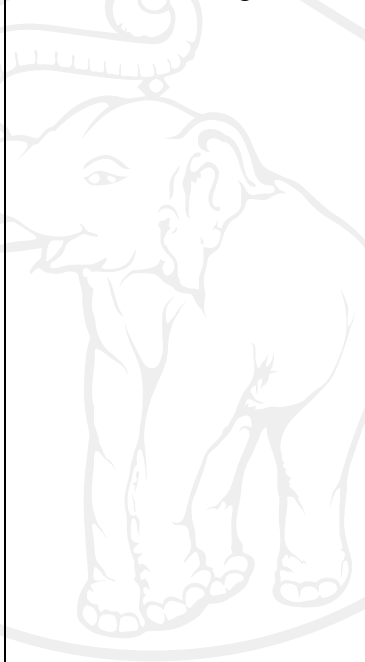
Table 4.1   Results of differentiation and points for correction found in the
original DTVP-2 and back translated DTVP-2

DTVP-2 Original version	DTVP-2 Back translation version	Detecting differences and corrections
Subtest 3: Copying		
Scoring The quality of this drawing suggests that the child has missed the "Gestalt" (i.e. the basic idea) of the stimulus, and therefore is given a score of 0.	**Scoring** This qualified picture shows that the child missed the "Gestalt" (e.g., basic thinking) of the stimulus, and as a consequence, the child got 0 points.	From the comparison of the versions, it was detected that the details in the back translation version provided a different meaning from the original version. It happened in the correction of back translation. The original version needed to be translated as "Drawing of this quality shows that…", but the back translation version gives the meaning that the "Drawing which has been qualified shows that…". Therefore, the researcher corrected it to be "This quality of drawing shows that…".

Table 4.1   Results of differentiation and correction points found in the original
DTVP-2 and back translated DTVP-2 (cont.)

DTVP-2 Original version	DTVP-2 Back translation version	Detecting differences and corrections
Subtest 4: Figure – ground		
Instructions I want you to show me which of these shapes down here is a part of the picture at the top of the page (point and gesture appropriately). Complete both examples with the child before you administer the rest of the items.	**Instructions** I want you to tell me which pictures are parts of the same picture on the top of the paper (point at the picture). Complete both examples prior to the start of the test.	From the comparison, translated details were detected from the original version, such as "point and gesture at appropriately" and the process of completing both examples together with the children. Before starting the test, the back translation version was used to translate "point at the picture" and examine both examples before starting the process of the test. The researcher corrected it to "point and gesture at appropriately" and performed a sample together with the children before starting the test.

Table 4.1   Results of differentiation and correction points found in the original DTVP-2 and back translated DTVP-2 (cont.)

DTVP-2 Original version	DTVP-2 Back translation version	Detecting differences and corrections
Subtest 7: Visual- motor speed		
Instructions I want to see how fast you can make different marks inside these shapes.	**Instructions** I need to see how fast you can draw these sign forms.	From the comparison, it was detected that details of the back translation version had a different meaning than in the original version. It was caused by the researcher missing the word 'different'. Therefore, the researcher corrected it to be "I would like to see how fast you are able to make different signs in these pictures."
See the two lines drawn inside the big circle and the 'x' inside the small square?	Did you see the two lines that are drawn in the big circle and the 'x' in the small rectangle?	From the comparison, it was detected that details in the back translated version had a different meaning from the original version. This was due to the error of the researcher who translated the word "square" as "rectangle." Therefore, the researcher corrected it as "Look at the two lines that are drawn in the big circle and the cross inside the small square."

4.1.2 Results of test-trial of the DTVP-2 (Thai version)

The researcher applied the Thai version of the DTVP-2 to 5 children with normal development for a trial to find any errors which might occur, and to make sure that the language usage is understandable before using this test to collect data. Since the results of the test-trial showed some errors, the researcher corrected the errors and presented them in Table 4.2

Table 4.2 Summary of errors detected from the test-trial of the Thai version of the DTVP-2 and the corresponding corrective actions

Errors detected from the test-trial of the Thai version of the DTVP-2	Corrections
1. Font type and spacing of words Based on taking the test for the test-trial, the researcher detected errors in the font type and the spacing between words in every topic of the test.	The researcher corrected the errors by changing the instructions, by using words in bold type that can be more easily seen while doing the test, and by organizing the space between the words to be read more easily.

Table 4.2 Summary of errors detected from the test-trial of the Thai version of the DTVP-2 and the corresponding corrective actions (cont.)

Errors detected from the test-trial of the Thai version of the DTVP-2	Corrections
2. Instructions to be used on the test On every sub-test, it was found that the instructions given to the children were often misunderstood, particularly in terms of a pronoun used to refer to children. For this translation, the researcher translated "you" into "ter" (in Thai language); however, "ter" in Thai is a pronoun which is used for friends "chan – ter" (me – you), and is widely used for adults. For children, the pronoun used in Thai is mostly "Nu" or a nick-name. For Example : Eye and hand co-ordinations 1) Instructions: "Look at this mouse; you are going to draw a line from the mouse to this cheese over here (point to the cheese). Be very careful when you draw your line; try to stay in the center of the gray path. Once you start your line, do not lift your pencil from the paper until you get to the end. Go"	The researcher corrected this and consulted the advisor before making the amendments. 1) Space for the pronoun used to refer to children was given. However, it would depend on the actual test situation. If the children had familiarity with the person administering the test, either "you" or the nick-name could be used to refer to them. Instructions: "… going to draw a line from the mouse to this cheese over here (point to the cheese). Be very careful when … draw your line; try to stay in the center of the gray path. Once … start your line; do not lift your pencil from the paper until … get to the end. Go"

4.2   Phase 2: Examination of the validity and reliability of the Thai version of the DTVP-2

The research results of phase 2 contain two main processes which were 1) examining the validity of the DTVP-2 and 2) examining the reliability of the DTVP-2. Details of each process are as follows:

4.2.1   Results of examining the validity of the Thai version of the DTVP-2

The researcher presented the Thai version of the DTVP-2 to three experts to allow them to examine the content validity. After revisions by the three experts, the results from the DTVP-2 sub-tests 1, 4, 5, 6, and 8 (Subtest 1: Eye-hand coordination; Subtest 4: Figure-ground; Subtest 5: Spatial relations; Subtest 6: Visual closure; and Subtest 8: Form constancy) showed a correlation index of 0.6, and sub-tests 2, 3, and 7 (Subtest 2: Position in space; Subtest 3: Copying; and Subtest 7:Visual-motor Speed) had a correlation index of 1. The Index of Conjugate (IOC) has standardized criteria that every question needs to have an Index of Conjugate of 0.50 or above (Ruedjaroon, 2011). Experts gave some advice to correct these, and the researcher made the corrections. The results of the Index of Conjugate (IOC) are shown in Table 4.3.

Table 4.3 Index of Conjugate (IOC) of DTVP-2 subtests among the 3 reviewers

DTVP-2 Subtests	Agreed	Disagreed	Not sure	IOC	Comments
Subtest 1. Eye-hand coordination	2	-	1	0.60	Recommendation: Eye-hand coordination in the Thai language
Subtest 2. Position in space	3	-	-	1.00	-
Subtest 3. Copying	3	-	-	1.00	-
Subtest 4. Figure-ground	2	-	1	0.60	Recommendation: Figure-ground in the Thai language
Subtest 5. Spatial relations	2	-	1	0.60	Recommendations : Spatial relations in the Thai language, and correct wording of "upper part" as "upper box" and "lower part" as "lower box"
Subtest 6. Visual closure	2	-	1	0.60	Recommendation: Visual closure in the Thai language
Subtest 7. Visual-motor speed	3	-	-	1.00	-
Subtest 8. Form constancy	2	-	1	0.60	Recommendation: Form constancy in the Thai language.
Total	-	-	-	0.75	-

Therefore, the results of examining the validity of the DTVP-2 show that the content validity is equivalent.

4.2.2 Results of examining the reliability of the DTVP-2

The researcher brought the DTVP-2 with approved content validity, which had passed the test-trial and had already been amended to test the reliability through test-retest with a sample group of 70 children. The details are shown in Table 4.4

Table 4.4 Characteristics of the sample

Characteristics of the sample	Number (n)	Percentage (%)
Gender		
Boys	35	50
Girls	35	50
Age (Years)		
4-0 – 4-11	10	14.28
5-0 – 5-11	10	14.28
6-0 – 6-11	10	14.28
7-0 – 7-11	10	14.28
8-0 – 8-11	10	14.28
9-0 – 9-11	10	14.28
10-0 – 10-11	10	14.28
Handedness		
Right-handed	66	94.29
Left-handed	4	5.71

The sample group was comprised of children aged 4 years to 10 years and 11 months. Each age group was made up of 10 children (14.28%); 35 children were divided equally according to gender and age matching (50%); 66 children were right-handed (94.29%), and 4 were children left-handed (5.71%).

The results of examining the reliability of the DTVP-2 by test-retest using the Pearson product-moment correlation method are shown in Table 4.5

Table 4.5 Correlation coefficients for test-retest reliability

Correlation coefficients for test-retest reliability (n=70)	r
Subtest 1. Eye-hand coordination	0.96*
Subtest 2. Position in space	0.85*
Subtest 3. Copying	0.91*
Subtest 4. Figure-ground	0.81*
Subtest 5. Spatial relations	0.82*
Subtest 6. Visual closure	0.86*
Subtest 7. Visual-motor speed	0.93*
Subtest 8. Form constancy	0.92*
Motor reduced visual perception	0.89*
Visual motor integration	0.92*
General visual perception	0.89*

* $P < 0.01$

In examining the reliability of the DTVP-2 by using test-retest reliability had high reliability (r=0.89) for the entire DTVP-2 and (r=0.81-0.96) for each subtest (Table 4.5).

For the evaluation of the expected agreement, the classification of Pearson product-moment correlation was used: 0.00-0.20 = very low; 0.21-0.40 = low; 0.41-0.70 = moderate; 0.71-1.00 = high (Srisuk, 2009).

Based on the reliability examine, it is indicated that the DTVP-2 had high reliability. It is suitable for use in screening for visual perception problems among Thai children.

4.3 Phase 3. Determination of the normative values of the DTVP-2 in Thai Children

To process the results of phase 3, the research has been divided into 6 main areas: 1) descriptive statistics about the general information of the sample group in terms of age, gender, handedness and geographical area. 2) developing standardized raw scores and percentiles by specific age ranges of 6 months for ages 4 years – 7 years, 11 months; and 1 year age ranges for ages 8 years – 10 years, 11 months. 3) converting sums of standard scores to quotients for composites. 4) converting raw scores to age equivalents for subtests. 5) a guideline for interpreting Standard Scores. 6) a guideline for interpreting composite quotients. Details of each topic are as follows:

4.3.1 Descriptive statistic results

These results include general information on characteristics of the sample in age, gender, handedness, residence and geographical area.The samples' characteristics by age are shown in Table 4.6, the samples' characteristics by gender, handedness and residence are shown in Table 4.7, and the samples' characteristics by geographical area are shown in Table 4.8.

Table 4.6 The samples' characteristics by age

Age (Years)	Number	Minimum (Month)	Maximum (Month)	Mean	SD
4-0 – 4-11	160	49	59	55.19	2.55
5-0 – 5-11	160	60	71	66.86	2.97
6-0 – 6-11	160	69	84	77.56	3.55
7-0 – 7-11	160	83	96	90.03	3.72
8-0 – 8-11	160	97	108	102.31	3.53
9-0 – 9-11	160	109	120	113.54	3.68
10-0 – 10-11	160	121	132	126.90	3.39
	1120	49	132	88.74	3.34

In terms of age, the participants have a mean age of 88.74 months, a standard deviation of 3.34, a maximum age of 132 months, and a minimum age of 49 months.

Table 4.7   The samples' characteristics by gender, handedness and residence

The sample's characteristics					
Gender		**Handedness**		**Residence**	
Boys	**Girls**	**Left-handed**	**Right-handed**	**Urban**	**Rural**
n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
519 (46.3)	601 (53.7)	192 (17.14)	928 (82.86)	867 (77.41)	253 (22.59)

In terms of the participants' gender, handedness and residence, there were 519 boys (46.3%) and 601 girls (53.7%). Between the two groups there were 192 left-handed (17.14%) and 928 right-handed (82.86%) participants, and 867 living in an Urban area (77.41%) and 253 living in a rural area (2.59%).

Table 4.8   The samples' characteristics by geographical area

Geographical areas (Provinces)	Bangkok		Northern (Chiang Mai)		Northeastern (Nakorn Ratchasima)		Southern (Songkhla)		Central (Samutprakarn)		Total
Age (Years)	Boys (n) %	Girls (n) %	Boys (n) %	Girls (n) %	Boys (n) %	Girls (n) %	Boys (n) %	Girls (n) %	Boys (n) %	Girls (n) %	
4-0 – 4-11	19 59.4%	13 40.6%	16 50.0%	16 50.0%	14 43.8%	18 56.3%	17 53.1%	15 46.9%	15 46.9%	17 53.1%	160
5-0 – 5-11	15 46.9%	17 53.1%	18 56.3%	14 43.8%	13 40.6%	19 59.4%	19 59.4%	13 40.6%	13 40.6%	19 59.4%	160
6-0 – 6-11	16 50.0%	16 50.0%	15 46.9%	17 53.1%	9 28.1%	23 71.9%	16 50.0%	16 50.0%	16 50.0%	16 50.0%	160
7-0 – 7-11	16 50.0%	16 50.0%	12 37.5%	20 62.5%	10 31.3%	22 68.8%	17 53.1%	15 46.9%	17 53.1%	15 46.9%	160
8-0 – 8-11	14 43.8%	18 56.3%	14 43.8%	18 56.3%	11 34.4%	21 34.4%	13 40.6%	19 59.4%	15 46.9%	17 53.1%	160
9-0 – 9-11	14 43.8%	18 56.3%	14 43.8%	18 56.3%	11 34.4%	21 65.6%	13 40.6%	19 59.4%	15 46.9%	17 53.1%	160
10-0 – 10-11	18 56.3%	14 43.8%	19 59.4%	13 40.6%	16 50.0%	16 50.0%	15 46.9%	17 53.1%	14 43.8%	18 56.3%	160
Total (n)	112 50.0%	112 50.0%	108 48.21%	116 51.78%	84 37.50%	140 62.50%	110 49.11%	114 50.89%	105 46.88%	119 53.12%	1,120
	224		224		224		224		224		

With regards to geographical areas, the participants live in one of five regions of Thailand: Bangkok, Chiang Mai (Northern) Province, Nakorn Ratchasima (Northeastern) Province, Songkhla (Southern) Province and Samutprakarn (Central). There were 224 children from each region, and both gender categories of participants from each province have an analogous distribution.

4.3.2   Results of developing normative values

These results were taken from the raw data to establish standard scores and percentiles. Before running all of the data, testing for normality by using SPSS program found that the dataset was normally distributed in every age range, except the dataset for the age range 4-5 years old. However, at this age range a transformation

was used which is applied to data that is not normally distributed so that the new, transformed data is normally distributed by taking the log of the data. (Howell, 2007). The standard age range of the original DTVP-2 as shown in Tables 4.9 – 4.19.
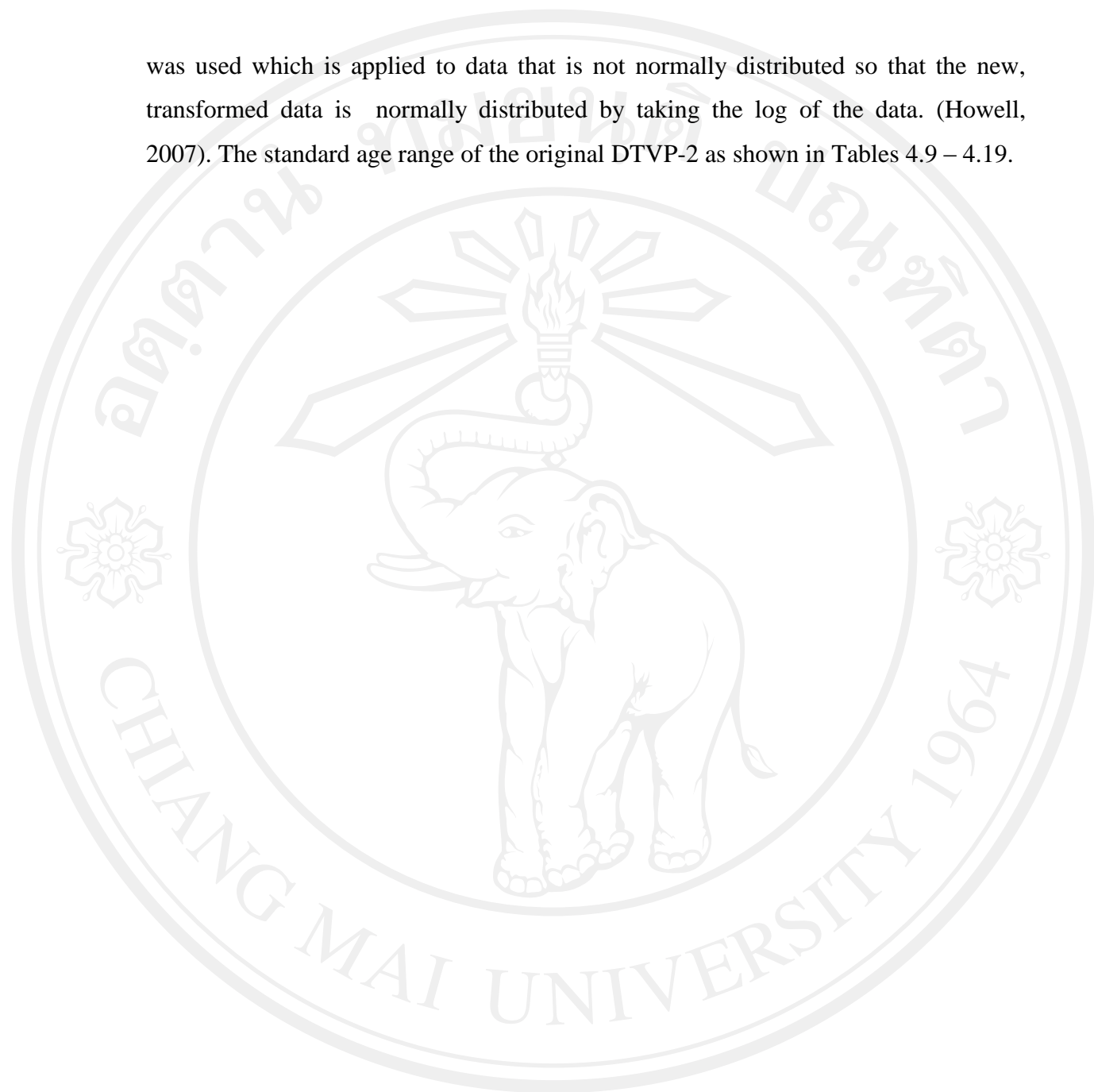
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Table 4.9 Standard Scores and Percentiles for Ages 4-0 through 4-5

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
									1
<1									2
1									3
2	0	0	0	0-4	0				4
5	1-68	1-3	1-4		1-4				5
9	69-80	4	5-8	5	5-6		0		6
16	81-97	5	9-10		7-8		1	0	7
25	98-119		11-		9-11	0-1	2-4	1-2	8
37	120-135	6	13	6-7	12-	2		3-4	9
50	136-143	7	14-	8	15	3	5-6	5-6	10
63	144-150	8-9	17-		16-	4-5	7	7-10	11
75	151-158	10-	19-	9	20-	6-7	8-10		12
84	159-164	12-	22-	10	26-	8	11-15	11-13	13
91		15-	33	11-	38-	9	16-18	14-15	14
95	165-171	20	34-	14-		10	19-27		15
98	172-181		39	16-	43	11-16	28-56	16-19	16
99									17
>99									18
									19
									20

When testing the children aged 4-0 through 4-5, the raw scores of their subtests were shown in different ranges, respectively: from 0 to 181 for EH; from 0-20 for PS, from 0-39 for CO; from 4-17 for FG; and from 0-43 for SR. On the other hand, the raw score for VC ranged from 1-16; VMS's raw score ranged from 0-56 and FC's raw score ranged from 0-19.

Table 4.10   Standard Scores and Percentiles for Ages 4-6 through 4-11

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
	0								1
<1	1-9								2
1	10								3
2	11-63	0	0	0					4
5	64-81	1-3	1-4	1-2	0		0		5
9	82-84	4	5-6	3-5	1-8	0-1	1-2	0	6
16	85-95	5	7			2	3-4		7
25	96-110	6	8-12	6	9-12		5-6	1	8
37	111-131	7	13	7	13-15	3	7	3	9
50	132-142	8-9	14-15		16-18	4	8	4-6	10
63	143-150	10-11	16-17	8	19-20	5	9-11	7-8	11
75	151-157	12-13	18-20	9	21-31	6-7	12-14	9-10	12
84	158-164	14	21-30	10	32-35	8-10	15-19	11	13
91	165-169	15-18	31-34	11	36-41	11	20-28	12	14
95	170-176	19-20	35-37	12-	42		29-40	13-14	15
98	171-180	21	38-40	14-	43	12-14	41-44	15-16	16
99	181-183			16		15	45-54	17-18	17
>99	>183			>16		>15	55	>18	18
							>55		19
									20

For children aged 4-6 through 4-11, the raw scores of their subtests were shown in different ranges, respectively: from 0-184 for EH; from 0-21 for PS; from 0-40 for CO; from 0-17 for FG; and from 0-43 for SR. In addition, the raw scores for the VC subtest ranged from 0-16; the raw scores for the VMS subtest ranged from 0-56; and the FC subtest's raw scores ranged from 0-19.

Table 4.11   Standard Scores and Percentiles for Ages 5-0 through 5-5

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
									1
<1									2
1	0-60		0-11	0-3					3
2	61				0-5				4
5	62-89	0-3	12	4	6	0-1	0	0	5
9	90-107	4	13	5	7-8	2	1	1-2	6
16	108-123	5-7	14-15		9-14		2-5	3-4	7
25	124-127	8	16-19	6-7	15-21	3	6	5-8	8
37	128-140	9-10	20-22	8	22-26	4	7-8	9	9
50	141-152		23		27-31	5	9-12	10	10
63	153-155	11-14	24-25	9	32-34	6	13-15		11
75	154-163	15	26-29	10	35-36	7-8	16	11	12
84	164-173	16	30	11	37-38		17-18	12	13
91	174-178	17-21	31-33	12	39-41	9-11	19-21	13	14
95	179-181	22	34-35	13-14	42	12	22-23	14-15	15
98			36-38		43	13-17	24-25		16
99		23	39			18	26	16	17
>99									18
									19
									20

For children aged 5-0 through 5-5, the raw scores of their subtests were shown in different ranges, respectively: from 60-181 for EH; from 3-23 for PS; from 11-39 for CO; from 3-14 for FG; and from 0-43 for SR. Moreover, the VC subtest's raw scores ranged from 1-18; the VMS subtest's raw scores ranged from 0-26 and the FC subtest's raw scores ranged from 0-16.

Table 4.12   Standard Scores and Percentiles for Ages 5-6 through 5-11

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
	0-38			0	0-2	0			1
<1	39-42								2
1		0-1	0-11						3
2	43-83	2		1-2	3-4	1	0		4
5	84-103	3-5	12-13	3-5	5-10		1	0	5
9	104-111	6	14-15	6	11-16	2	2-5	1-2	9
16	112-130	7	16-18		17-20	3	6-7	3-4	16
25	131-142	8	19-20	7	21-22		8-11	5	8
37	143-151	9-11	21-23	8	23-28	4	12-14	6-7	9
50	152-155	12-13	24	9	29-30	5	15	8-9	10
63	156-163	14-15	25-27	10	31-33	6	16		11
75	164-172	16	28-31	11	34-38	7	17	10	12
84	173	17-20	32-33		39-42	8-9	18-22	11	13
91	174-176	21	34-36	12	43	10-11	23-31	12-13	14
95	177-178	22	37	13		12	32	14-15	15
98			38	14		13-17	33-38	16-17	16
99	179-185	23		15			39-40		17
>99	186		39						18
									19
									20

For children aged 5-6 through 5-11, the raw scores of their subtests were shown in different ranges, respectively: from 38-186 for EH; from 1-23 for PS; from 11-39 for CO; from 0-15 for FG; and from 2-43 for SR. In addition, the VC subtest's raw scores ranged from 0-17; the VMS subtest's raw scores ranged from 0-40 and the FC subtest's raw scores ranged from 0-17.

Table 4.13   Standard Scores and Percentiles for Ages 6-0 through 6-5

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
									1
<1									2
1	0-108	0-5	0	0-1			0		3
2	109-117		1-8	2-4	0-10	0-1	1-2		4
5	118-128	6-7	9-17		11-16	2	3-6		5
9	129-138	8	18-21	5-7	17-18		7	0	6
16	139-148	9-11	22		19-26	3	8-11	1-4	7
25	149-150	12-13	23-24	8	27-28		12-14	5	8
37	151-158	14	25-28	9	29-33	4	15	6-7	9
50	159-162	15	29-32		34-35	5	16-17	8-9	10
63	163-165	16-17	33	10	36-38	6	18-20	10	11
75	166-171		34-36	11-12	39-41	7-8	21-23	11	12
84	172	18-20	37		42	9	24-28	12	133
91	173-177	21	38	13-15	43	10-11	29-31	13-14	14
95	178	22	39	16-17		12-15	32-34	15-17	15
98	179	23-24	40	18		16	>34	18	16
99	>179					>16			17
>99									18
									19
									20

For children aged 6-0 through 6-5, the raw scores of their subtests were shown in different ranges, respectively: from 108-180 for EH; from 5-24 for PS; from 0-40 for CO; from 1-18 for FG; and from 10-43 for SR. The VC subtest's raw scores ranged from 1-18; the VMS subtest's raw scores ranged from 0-35 and the FC subtest's raw scores ranged from 0-18.

Table 4.14   Standard Scores and Percentiles for Ages 6-6 through 6-11

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
									1
<1									2
1	0	0-4	0-11				0-6		3
2	1-68	5	12-13	0-6	0-14	0-1	7	0	4
5	69-125	6	14-19		15-20		8-9	1-3	5
9	126-127	7-12	20-25		21-26	2	10		6
16	128-138	13	26-29	7	27-29	3	11-12	4	7
25	139-157	14	30	8	30-32	4	13-15	5	8
37	158-163	15	31	9	33-37		16-17	6-7	9
50	164-165	16-17	32-34	10	38	5	18-21	8-9	10
63	166-170		35-36	11	39-40	6-8	22-23	10	11
75	171-172		37	12-13	41	9	24-25	11	12
84	173-176	18-20	38	14-15	42-43	10	26	12	13
91	177		39	16		11-12	27-30	13	14
95	178	21-22		17		13	31-32	14	15
98	179-184	23	40	18		14-19	33-36	15-18	16
99							>36	>18	17
>99									18
									19
									20

For children aged 6-6 through 6-11, the raw scores of their subtests showed different ranges, respectively: from 0-184 for EH; from 4-23 for PS; from 11-40 for CO; from 6-18 for FG; and from 14-43 for SR. In addition, the VC subtest's raw scores ranged from 1-19; the VMS subtest's raw scores ranged from 6-40 and the FC subtest's raw scores ranged from 0-20.

Table 4.15 Standard Scores and Percentiles for Ages 7-0 through 7-5

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
					0-4				1
<1					5-9				2
1	0-116	0-6	0-13	0-6	10-13	0-1	0-6		3
2	117	7	14-15		14-17		7		4
5	118-138	8	16-26		18-19	2	8-10	0	5
9	139-144	9-13	27	7	20-31		11-13	1-3	6
16	145-153	14	28-29		32-35	3	14-16	4	7
25	154-159		30-31	8	36-38	4	17-19	5	8
37	160-164	15	32	9	39	5	20-21	6-8	9
50	165-167	16-19	33-34	10-11	40	6	22-23	9	10
63	168-169	20	35-37	12	41	7	24-25		11
75	170-173	21	38	13-15	42	8-10	26-28	10	12
84	174-179	22-23	39		43	11-13	29-32	11-13	13
91	180-184		40	16-17		14-16	33	14-16	14
95		24				17-18	34-35	17	15
98		>24		18		>18	36-50	>17	16
99							>50		17
>99									18
									19
									20

For children aged 7-0 through 7-5, the raw scores of their subtests indicated different ranges, respectively: from 116-184 for EH; from 6-25 for PS; from 13-40 for CO; from 6-18 for FG; from 17-43 for SR; from 1-19 for VC; from 6-62 for VMS and from 0-18 for FC.

Table 4.16   Standard Scores and Percentiles for Ages 7-6 through 7-11

| Percentiles | Subtests | | | | | | | | Std. scores |
	EH	PS	CO	FG	SR	VC	VMS	FC	
									1
<1									2
1			0			0-1		0	3
2	0-86	0-5	1-12	0-6	0-13	2	0-6	1-2	4
5	87-113	6-8	13-18		14-16	3	7		5
9	114-146	9-13	19-27		17-26		8-11		6
16	147-151	14	28-31	7	27-33	4	12-14	3-4	7
25	152-161	15	32-33	8	34-38		15-19	5	8
37	162-165	16-17	34-35	9	39-40	5	20-21	6-8	9
50	166-170	18-19	36	10	41	6	22-25	9	10
63	171-172	20-21	37-38	11-12	42-43	7	26-29	10	11
75	173-175		39	13		8-9	30	11	12
84	176-179		40	14-15		10-13	31-34	12-13	13
91	180-181	22		16		14	35-37	14-15	14
95	182-183	23		17		15-16	38-41	16-17	15
98	184	>23		>17		17	42-47	>17	16
99						>17	>47		17
>99									18
									19
									20

For children aged 7-6 through 7-11, the raw scores of their subtests indicated different ranges, respectively: from 86-184 for EH; from 5-24 for PS; from 0-40 for CO; from 6-18 for FG; from 13-43 for SR; from 1-19 for VC; from 6-63 for VMS and from 0-19 for FC.

Table 4.17   Standard Scores and Percentiles for Ages 8-0 through 8-11

| Percentiles | Subtests | | | | | | | | Std. scores |
	EH	PS	CO	FG	SR	VC	VMS	FC	
	0-136	0-9	0-10		0-24		0-10		1
<1	137		11-14		25				2
1	138	10							3
2	139-144	11	15-17	0-6	26-27	0-2	11	0	4
5	145-150		18-27		28-31		12-13	1	5
9	151-157	12-14	28-29	7	32	3	14		6
16	158-163	15	30-33	8	33-37	4	15-17	2-4	7
25	164-167	16	34-35	9	38	5	18-20	5	8
37	168-171	17	36-37	10-11	39-40	6-7	21-25	6-8	9
50	172-174	18-20	38	12	41-42	8-9	26-27	9	10
63	175-176	21	39	13-14	43	10-12	28-31	10-11	11
75	177-180	22	40			13-15	32	12	12
84	181-183			15		16	33-36	13-14	13
91		23		16		17	37-40	15-17	14
95		24		17		18	41	18	15
98	184	25		18		19	42-44	19	16
99						20-23	45-55	>19	17
>99	185					24-25	56-57		18
	>185					>25	>57		19
									20

For children aged 8-0 through 8-11, the raw scores of their subtests indicated different ranges, respectively: from 136-186 for EH; from 9-25 for PS; from 10-40 for CO; from 6-18 for FG; from 24-43 for SR; from 2-30 for VC; from 10-63 for VMS and from 0-20 for FC.

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Table 4.18   Standard Scores and Percentiles for Ages 9-0 through 9-11

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
	0-139	0-7	0	0-6	0-33		0-10		1
<1	140-141	8-10	1-8				11-14		2
1	142	11	9			0-2		0	3
2	143-147		10-15	7	34	3	15-18	1-2	4
5	148-153	12-14	11-30		35-37		19-21	3	5
9	154-157	15	31-32	8	38	4	22-23	4	6
16	158-161		33	9	39	5-6		5	7
25	162-164	16-17	34-36	10-11	40-41	7	24-25	6-8	8
37	165-169	18-20		12	42	8-11	26-28	9-10	9
50	170-171		37-38	13	43	12-14	29-30	11	10
63	172-175	21-22	39	14		15-16	31	12	11
75	176-180	23	40	15		17	32-34	13-14	12
84	181-182			16		18	35-39	15-16	13
91	183-184	24					40-43	17-18	14
95		25		17		19	44-46		15
98				18		20	47-54	19	16
99							55	>19	17
>99									18
									19
									20

For children aged 9-0 through 9-11, the raw scores of their subtests indicated different ranges, respectively: from 139-184 for EH; from 7-25 for PS; from 0-40 for CO; from 6-18 for FG; from 33-43 for SR; from 2-20 for VC; from 10-55 for VMS and from 0-20 for FC.

Table 4.19 Standard Scores and Percentiles for Ages 10-0 through 10-11

Percentiles	Subtests								Std. scores
	EH	PS	CO	FG	SR	VC	VMS	FC	
	0-151	0-11			0-35		0-14	0	1
<1	152	12			36-37				2
1			0-28	0-6			15		3
2	153-155	13-14	29		38-39	0-4	16	1-2	4
5	156-161	15	30-33	7-8			17-19	3-4	5
9	162-164	16	34-35	9	40	5	20-22		6
16	165-167	17	36-37		41	6-7	23-26		7
25	168-171	18-21		10-12	42	8-10	27-30	5-9	8
37	172-173		38	13-14	43	11-14	31-33	10-11	9
50	174-175	22	39	15		15-16	34-35	12	10
63	176-178	23	40	16		17	36-38	13-15	11
75	179-181			17		18	39-40	16	12
84	182-183	24		18			41-43	17-18	13
91	184	25				19	44-45	19	14
95							46-47		15
98						20	48-60	20	16
99	185					21	61-62		17
>99	186					22	63		18
	187					>22			19
									20

For children aged 10-0 through 10-11, the raw scores of their subtests indicated different ranges, respectively: from 151-187 for EH; from 11-25 for PS; from 28-40 for CO; from 6-18 for FG; from 35-43 for SR; from 4-25 for VC; from 14-63 for VMS and from 0-20 for FC.

These results converted the sums of standard scores into quotients for composites, converting raw scores to age equivalents for subtests, the conversion of the sums of standard scores to quotients for composites is shown in Table 4.20, the conversion of the raw scores to age equivalents for subtests is shown in Table 4.21.

Table 4.20   Converting sums of standard scores to quotients for composites

Quotient	Sum of 8 subtests	Sum of 4 subtests	Percentile rank	Quotient	Sum of 8 subtests	Sum of 4 subtests	Percentile rank
153	130	64	>99	101			53
152	129		>99	100	80	40	50
151	128		>99	99	79		47
150	127		>99	98			45
149	126		>99	97	78	39	42
148	125		>99	96	77	38	39
147	124		>99	95	76		37
146	123		>99	94			35
145	122		>99	93	75	37	32
144	121	63	>99	92	74		30
143	120	60-62	>99	91	73	36	27
142	119	59	>99	90			25
141	118		>99	89	72	35	23
140	117		>99	88	71		21
139	116	58	99	87	70	34	19
138	115	57	99	86			18
137	114		99	85	69	33	16
136	113		99	84	68		15
135	112		99	83	67	32	14
134	111	56	98	82			13
133	110		98	81	66		12
132	109		98	80	65	31	10
131	108	55	97	79	64	30	9
130	107		97	78	63		8
129	106	54	96	77	62	29	7
128	105	53	95	76	61		6
127	104	52	95	75	60	28	5
126	103	51	94	74	59	27	4
125	102		93	73	58		3
124	101		92	72	57	26	3
123	100	50	92	71	56	25	2
122	99		91	70	55	24	2
121	98	49	90	69	54	23	1
120	97-96		89	68	52-53		1
119	95	48	87	67	51	22	1
118	94		86	66	50		<1
117	93	47	84	65	49	20-21	<1
116		46	82	64	48		<1
115	91-92		81	63	47		<1
114	90		79	62	46	19	<1
113		45	78	61	45	18	<1
112			77	60	44		<1
111	88-89	44	75	59	43		<1
110	87		73	58	42		<1
109	86	43	70	57	41		<1
108			68	56	40		<1
107	85	42	65	55	39		<1
106	84		63	54	38		<1
105	83		61	53	37		<1
104		41	59	52	36		<1
103			58	51	35		<1
102	82-81		55				

Table 4.21   Converting raw scores to age equivalents for subtests

Age Equiv.	EH	PS	CO	FG	SR	VC	VMS	FC	Age Equiv.
<4-0	<142	<7	<14	<7	<15	<3	<7	<5	<4-0
4-0 - 4-5	142	7	14	7	15	3	7	5	4-0 - 4-5
4-6 - 4-11	145	9	15	8	18	4	8	6	4-6 - 4-11
5-0 - 5-5	152	13	23	9	28	5	12	9	5-0 - 5-5
5-6 - 5-11	155	14	24	9	30	5	15	9	5-6 - 5-11
6-0 - 6-5	162	15	32	10	36	5	17	9	6-0 - 6-5
6-6 – 6-11	165	17	34	10	39	5	21	9	6-6 – 6-11
7-0 – 7-5	167	18	35	11	41	6	23	9	7-0 – 7-5
7-6 – 7-11	170	19	36	11	41	6	25	9	7-6 – 7-11
8-0 - 8-11	172	20	38	12	42	9	27	10	8-0 - 8-11
9-0 - 9-11	173	21	39	13	43	14	30	11	9-0 - 9-11
10-0 - 10-11	175	22	40	15	43	16	35	12	10-0 - 10-11
>10-11	>175	>22	>40	>15	>43	>16	>35	>12	>10-11

4.3.3 The translation results of the Thai version of the DTVP-2

The guidelines for interpreting standard scores are shown in Table 4.22, and the guidelines for interpreting composite quotients are shown in Table 4.23.

Table 4.22   The guidelines for interpreting standard scores

Standard scores	Descriptive ratings	Percentage included (%)
17-20	Very Superior	1.73
15-16	Superior	4.38
13-14	Above Average	15.51
8-12	Average	56.78
6-7	Below Average	15.51
4-5	Poor	4.38
1-3	Very Poor	1.73

The standard scores have been classified into 7 levels based on a normal distribution with mean of 10 and standard deviation of 3 (Hammill, Pearson & Voress, 1999) as follows: 17-20 = very superior; 15-16 = superior; 13-14 = above average; 8-12 = average; 6-7 = below average; 4-5= poor; 1-3 = very poor.

For example, if a student got standard scores of 13 on eye hand coordination subtest and copying subtest, that means that their scores would be above average. In the same way, if a student obtained standard scores of 6 for spatial relation and 17 for visual closure, an examiner could conclude that their spatial relation would be below average whereas their visual closure would be very superior.

Table 4.23   Guidelines for interpreting composite quotients

Quotients	Descriptive ratings	Percentage included (%)
> 130	Very Superior	1.73
121-130	Superior	4.38
111-120	Above Average	15.51
90-110	Average	56.78
80-89	Below Average	15.51
70-79	Poor	4.38
< 70	Very Poor	1.73

Composite quotients have value in terms of diagnosing general visual perceptual abilities and identifying specific strengths and weaknesses. Quotients are derived by the sum of 8 subtests standard scores and converted to a quotient by applying a standard scores having a mean of 100 and standard deviation of 15 (Hammill, Pearson & Voress, 1999). This study is interpreted into the 7 levels as follows: > 130 = very superior; 121-130 = superior; 111-120 = above average; 90-110 = average; 80-89 = below average; 70-79= poor; <70 =very poor.