CHAPTER 5

DISCUSSION AND CONCLUSION

The contents of this chapter were divided into 3 main parts: 1) the forward-backward translation of the DTVP-2, 2) the examination of the validity and reliability of the DTVP-2 (Thai version), and 3) the determination of the normative values of the DTVP-2 in Thai children. The applications, limitations and recommendations of this research study was also presented.

5.1 Discussion and summary of the translation of the DTVP-2

The translation of the DTVP-2 for this research applied a process called forward-backward translation which was provided by the World Health Organization (WHO). This method included forward translation, review by an expert panel, back translation, pre-testing and a cognitive interview (World Health Organization, 2011). Therefore, this translation can be used to interpret the DTVP-2 (Thai version), and it is able to perform consistently as a conceptual and cultural equivalent. However, this translation detected 3 points of error (Table 4.1), which needed to be corrected as following:

The first error was detected on subtest 3 (Copying): the details in the back translation version provided a different meaning from in the original version. The original version needed to be translated as “Drawing this quality shows that…”, but the back translation version gave the meaning of “Drawing which has been qualified shows that…”.

The second error was detected on subtest 4 (Figure – ground): in the original version, as the instruction of “point and gesture at appropriately” was given to describe the process of completing both examples together with the children. Before starting the test, the back translation version was used to translate the phrase “point at the picture” and to examine both examples before starting the process of the test.

The third error was detected on subtest 7 (Visual-motor speed): the details of the back translation version had a different meaning from in the original version. This discrepancy was caused by the researcher omitting 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.", and the details in the back translated version had a different meaning from in the original version. This was due to an error made by the researcher who translated the word "square". Therefore, the researcher corrected it to be "Look at the two lines that are drawn in the big circle and the cross inside the small square."

Nevertheless, the errors in this translation were not caused by cultural bias, but through the translation process. For reasons that may be explained as follows:

1. The DTVP-2 is a test that requires very little spoken language; it is able to be administered to children who do not use English (Hammill, Pearson, & Voress, 1993). Therefore, this translation does not involve many terms and concepts which are sensitive to translation issues or to particular aspects of different cultures.
2. In this translation from the original English version to a Thai version, the translator was a researcher and occupational therapist who had familiarity with the technical terms of occupational therapy and experience with interventions in children. Kavacs (1992) said that experts who are involved in the translation process will have an influence on the results of translation. For example, a person who studies or works with children will be able to choose the correct wording and sentences to use when processing the details of translation related to children. For Geisinger (1994) and Hambleton (2001) (cited in Widenfelt et al, 2005), those who do the translation need to have not only the qualifications to understand and translate both languages, but also knowledge of the tools and cultures of both countries. For these reasons, the results of translating the original version to a Thai version were free from any complications. Therefore this translation maintains similarity or equivalence to the content of the original version.

After the aforementioned errors had been corrected, the DTVP-2 (Thai version) was used to conduct a test-trial with five children in order to look for possible errors that could occur during the administration of the test. For example, the use of instructions, the choice of words which are clear to the examinee while administering the test, and any other problems or obstacles which may arise during the test administration. These issues are being improved and corrected. After the test-trial was given to five children, there were 2 errors found as described below:

1. Font style and spacing between words. Based on the test-trial, the researcher detected errors while arranging the font style and spacing between words in every topic of the test. There were errors in the font style arrangement in spacing before printing and in emphasizing the sentence structure of the instructions. However, all of these were edited by changing the instructions. Words were written in bold text in order to make perception and visualization easier throughout the test, and the spacing between words was carefully arranged to make reading effortless.

2. Type of instructions. During the testing of the instructions for every subtest, it was found that the children repeatedly misunderstood the pronouns used. In translating the test, the researcher converted the pronoun "You" into "Ter" in Thai; however, when taking this Thai word in context, "Ter" is a pronoun which is widely used among friends, and "Chan – Ter" (I – You) is mostly used among adults. For children, the Thai pronoun which is widely used is "Noo" or a nick-name. For example, the instructions in subtest 1 (Eye-hand coordination): "Look at the mouse. You are going to draw a line from the mouse to the butter (Point to the butter); be careful when you start to draw. Try to draw that line in the center of the gray tab. When you start drawing, don't pick up the pencil from the paper until you have finished drawing. Start". Once the children completed the test, the simulation must be quickly continued, saying: "Do you see the car? You are going to draw a line from the car to the garage; remember that the line drawn should be in the center of the gray tab and don't pick up the pencil". The amendments underlined the blank spaces for the pronoun referring to the children.

Which word would be used was dependent on the context of each situation when evaluating the children. If they were familiar with the word, they would be called “Noo” in Thai or by their nick-names.

Based on the results of the test-trial of the DTVP-2 (Thai version), there were few barriers in testing the children. Accordingly, the children (n=5) understood the instructions, and they were able to complete the entire test. In addition, they were able to control the time of the test, a length of 35 – 45 minutes per child was utilized. The reasons for this may be explained as follows:

1. The Thai version of the DTVP-2 was translated by the researcher, and the errors were corrected together by the researcher and the thesis advisors. Such corrections were governed by the theory of visual perception and by the underlying guidelines used in developing the DTVP-2.
2. The researcher being a responsible party to administer the test-trial of the DTVP-2 was an occupational therapist who has experiences in utilizing and administering the DTVP-2 to children, and achieved qualifying training on the subject of the study. With experiences, knowledge and full understanding of using the test of administer, there was less difficulty for the scoring and interpreting the test (Hammill, Pearson & Voress, 1993).

5.2 Discussion and summary of the examination of the validity and reliability of the DTVP-2

The DTVP-2 (Thai version), which passed the test-trial and corrections from the researcher and thesis advisors, was submitted for approval by three experts to examine the content validity and to be administered to 70 children to examine the reliability.

The results of the examination of the validity of the DTVP-2

The content validity was examined by three expert occupational therapists with clinical knowledge and experience using the DTVP-2. Examining the content validity is a necessary and significant measure in order to validate the psychometric properties. These psychometric properties are important to ensure that the test content

represents the objectives of the test (Munkhetvit, 2009). The results of the examination of the content validity of the DTVP-2 showed the Index of Conjugate (IOC) as follows: The IOC has standardized criteria in which every question an Index of Conjugate at 0.50 or above (Ruedjaroon, 2011). However, it was found in this research that the content validity of subtests 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) had an Index of Conjugate at 0.6, and the content validity of subtests 2, 3, and 7 (subtest 2: Position in space, subtest 3: Copying, and subtest 7: Visual-motor speed) had an Index of Conjugate at 1.0 . After considering the expert opinions on subtests 1, 4, 5, 6 and 8, there were some recommendations for choosing terms in the Thai language that were different from the researcher's translation (Table 4.3).

To summarize the results obtained from the Thai language choices, there might be different opinions given by the experts in the area of word selection. For example, in Eye–hand coordination, the researcher translated this term as "coordination between eye and hand", while the experts recommended "relations between eye and hand"; in Visual closure, the researcher used "ability to imagine the whole feature once some parts have been visualized", however the experts recommended "ability to translate an incomplete picture of results, etc". These differences arise from selecting the use of different wording that has no different meaning, therefore results were not lead to mis-understanding the meaning of those wordings. (Hsiu-Lin, Yueh-Chen & Kun Chin, 2012). However, the researcher made amendments in accordance with the experts' advice with the mutual consideration of the thesis advisors.

In this study, the results provided by the experts as examine of the content validity showed that the Index of Conjugate (IOC) of every subtest had a score of 0.50 or above; therefore, the DTVP-2 contains content validity, which covers the 8 subtests.

The results of the examination of the reliability of the DTVP-2

Srisuk (2010) describes reliability as a test that gives correct results. When a re-test is administered, or however often the test is administered, if the test is reliable the results remain the same or similar to the first time the test was taken. Test reliability is a necessity that every test must have. If a test has no consistency, that tool is not able to be utilized for evaluation (Munkhetvit, 2009). The results of the examination of the reliability of the DTVP-2 through the test–retest method demonstrate that the DTVP-2 contains a high measure of reliability, in which the total correlation was 0.89, ranging from 0.81 – 0.96 for the subtest calculations. Based on the analysis, it was concluded that the Thai version of the DTVP-2, which had undergone a qualified translation procedure, obtained results in its evaluation which demonstrated high reliability.

The explanation of the results are as follows:

1. The original DTVP-2 that brought the study to this point has been developed and considered to be a standardized test. A study was conducted to measure the validity and the reliability which resulted in widely acceptable levels (Burtner et al, 1997).
2. Moreover, the process of translating the DTVP-2 into Thai applied the forward-backward translation guidelines developed by WHO in order to maintain conceptual and cultural equivalence.
3. This researcher concerned in cross-cultural biases as followings:
    3.1. *Construction bias.* This bias can be avoided in the translation processes.
    3.2. *Method bias.* This bias can be avoided by strictly maintaining the rules of the testing process such as organizing the test location, establishing a silent environment, ensuring enough lighting and ventilation, creating a private and comfortable space, organizing a testing process with an examiner to examinee ratio of 1:1, arranging a good environment for children, and perceiving the children's interest and providing a break when they become anxious or less attentive by cheering them up without distracting them from the test. A chronological evaluation of each subtest has been provided in accordance with the recommendations for the test.

3.3. *Item bias.* This bias could be the result of various causes, for example, use of words that have different meanings, evaluation methods, score records, incorrect translation, and misunderstanding the details of the test, e.g. evaluation methods, recording methods.

The examination of the reliability of the DTVP-2 can be concluded to have evidence that showing high reliability (Srisuk, 2009) and be able to use for screening visual perception problems in Thai children.

5.3 Discussion and summary of normative values of the DTVP-2 in Thai children

The results of the normative values of the DTVP-2 in Thai children from the sample of 1,120 children were discussed into 2 main issues as follows:

1. Raw scores of 8 subtests of the DTVP-2 results a positive correlation between age and scores of children. This means that as the children increase in age, their scores on the test increase resulting in higher scores. This can be explained by the Principle of Human Development, that the test scores express maturation and learning, which lead children to develop their abilities according to their age (Ruedthakananon, 2007).

The ability of visual perception develops together with other abilities from the time of birth. Visual development progresses according to maturity and the ways that a child learns. Normally, visual perception will progress faster in the age range from 3 – 6 years old until 11 years old (Clutten, 2009). Besides, Schneck (2005) also states that visual perception appears from birth, and it will not fully develop to maturity until the adolescent stage.

Therefore, visual development is considered to be an individual form of development. Maturity or full development in visual perception depends on visual experience from the environment and education. Accordingly, the rate of development differs from one child to another. Visual development starts when infants are just one week old. For example, children express their ability to perceive in terms of differentiating objects which have different figures and complex forms. Children are

able to differentiate between a circle, triangle and square from an early age. It is shown that children have the visual discrimination ability to be able to draw a circle when they are 3 years old, a square when they are 4 years old, a triangle when they are 5 years old, and a diamond shape when they are 6 years old. These capabilities demonstrate that the children are developing visual motor integration (Clutten, 2009), and once children reach the age of development, they are able to perfectly develop their perceptual abilities; e.g., 3 – 5 years old for Figure-ground, 7 – 9 years old for Form constancy (Williams, 1983).

2. Raw scores of Thai children for each age range showed similar score intervals with US children on the 8 subtests of the DTVP-2: subtest 1.) Eye–hand coordination- EH; 2.) Position in space- PS; 3.) Copying- CO; 4.) Figure–ground- FG; 5.) Spatial relations- SR; 6.) Visual closure- VC; 7.) Visual–motor speed- VMS; and 8.) Form constancy- FC) (Hammill, Pearson & Voress, 1993).

When considering the details of the DTVP-2 that are classified into visual motor perception: subtests 1, 3, 5, and 7 and non-visual motor perception: subtests 2, 4, 6 and 8, the researcher noted that in this test, both motor related and non-motor related perception are globally standardized. This includes the use of pencils, the response booklet, and picture books with straight lines or basic shaded objects which characterized the test. Every child has familiarity with horizontal lines, vertical lines, triangles, squares, geometric figures and varieties of dots, etc. These patterns allow children to understand more easily, and all of the children who completed the test are enrolled in school. Since school is believed to be an information center, the children get used to seeing a variety of pictures such as those used in the test. Moreover, visual perception is one of the global developments according to the official Development Policy. Children from every nation and race undergo the same developments, even when we consider that aspects of these developments arise through studying (Clulten, 2005).

In addition, when considering factors related to studying, it can be seen that Thai children have learning opportunities brought about by globalization, which has offered learning opportunities to all homes; for example, the media that children are exposed to, such as books, television and study materials (Panich, 2012).

Therefore, Thai children may have opportunities to perceive a variety of pictures, so they will already be familiar with the types of pictures used in the test. Additionally, none of the subtests except Visual-motor speed use time limits to restrict the test. This allows children to complete the test without rushing (Hammill, Pearson & Voress, 1993). These are the causes of the score intervals of each subtest, except on Visual-motor speed, in the age ranges 4-0 through 4-5 and 4-6 through 4-11, which showed that Thai children had higher scores than US children. In the age range 4-0 through 4-5, Thai children had a score interval from 0 –> 56, while US children had a score interval from 0 -> 18 (Table 4.9). In the age range 4-6 through 4-11, Thai children had a score interval from 0 -> 55, while US children had a score interval from 0 -> 22 (Table 4.10). In the age ranges 8-0 through 8-11, 9-0 through 9-11 and 10-0 through 10-11, there were indications that Thai children had a tendency to score higher than US children. In the age range 8-0 through 8-11, Thai children had a score interval from 0 -> 57, while US children had a score interval from 0 -> 47 (Table 4.17). In the age range 9-0 through 9-11, Thai children had a score interval from 0 -> 55, while US children had a score interval from 0 -> 50 (Table 4.18). In the age range 10-0 through 10-11, Thai children had a score interval from 0 -> 63, while US children had a score interval from 0 -> 53 (Table 4.19).

A probable explanation for this might be the different influencing factors which could lead Thai children to have a tendency to score higher than US children on the Visual–motor speed subtest. Potential factors may include such cultural and environmental experiences as the following:

1. The first factor may be that Thai children start entering school at the age of 2-3. Entering school from an early age may provide Thai children with a venue to explore a variety of activities which encourage them to get involved in diversified dimensions of writing. Benbow (1995), Benbow and Boardman (2012) gave examples of writing elements and activities in schools which encourage those elements such as using crayons, painting, scissor cutting, bead stringing, clay molding, lacing board activities, manuscript and cursive writing, practice of controlled line-drawing, e.g. for vertical drawing: from top to the bottom or from bottom to the top, and for horizontal drawing: from left to right or from right to left, training to draw lines from dot to dot, block design, etc.

Exner (2005) said that in kindergarten, children interact through a variety of activities to train their fine motor skills, e.g. use of crayons, scissors, small building materials and puzzles, small cooking and art projects. In kindergarten and primary school, the main activities of children are those which enhance their fine motor skills. These characteristics are considered in the test of visual-motor speed with the use of pencils to draw in a provided space; the test requires drawing 2 straight lines in big circles and crossing lines in small squares. In this case, the children need to have writing readiness at some levels, such as the ability to hold a pencil with correct posture, strength of hand muscles, visual perception control, and eye–hand coordination. The activities provided by schools may encourage use of hand elements in terms of preparing readiness in writing for Thai children. These factors might cause Thai children who enter school early (at the age of 2 or 3) to have a tendency toward higher visual-motor speed scores than US children.

2. The second factor may be that the curriculum and the study hours per day of Thai children are long for children in the age range 8-0 through 10-0 years old, who are in primary school 2 – 4. The writing abilities for children of this age range will be very significant. Reeves & Cermak (2002) said that children in this age range have the ability to take notes from their teachers and to submit homework. Besides, the characteristics of study activities in this age range also include setting a time frame to complete an assignment neatly. It is believed that Thai children receive very strong training abilities in writing. Thai children are taught 8 subjects: (1) Thai language, (2) Mathematics, (3) Science, (4) Social equity, (5) Religions and health culture, (6) Physical education, (7) Arts of professionals, and (8) Foreign languages and technology. (Ministry of Education, 2012). This is correlated to the study by McHale & Cemak (1992) examining the amount of time allocated to fine motor activities and the types of fine motor activities that school-age children were expected to be able to perform in the classroom. This study showed that 31% – 60% of activities in school each day are allocated for fine motor activities and 85% are paper and pencil tasks. Thai children in primary school are required to spend a long amount of time in class daily, from 8.30 – 16.00 hours (Ministry of Education, 2010). Therefore, it is apparent that Thai children have a many hours spent studying, and that implies more time spent on writing activities.

3. The third factor is the nature of Thai characters. It is evident that the Thai alphabet is different from the English alphabet. The Thai alphabet is composed of 44 letters, 21 vowels and 4 tonal marks, while the English alphabet has 26 letters. More letters are needed to form words, and the Thai language restricts the position of vowels to specific locations. A vowel can only be located above or under the correct letter (Thai-uboon, 2007). There might be more writing difficulties in te Thai alphabet than the English alphabet. Cross-cultural study results (Hau-Yi & Pauline, 1994) have found that the complexity of written Chinese, which has more letters than the English alphabet, works to accelerate the development of visual-motor perception, and results in Chinese children scoring higher on the test than American children. Therefore, it is possible that although Thai letters are more complex, with repeated training in writing over a long period of time, Thai children acquire writing abilities. This enables Thai children to be more able to control their writing direction and to do so more quickly. Thus, they show better score results on the visual-motor speed test which requires speed to draw lines in provided spaces.

However, a point of differentiation was found in the presentation of age equivalence in this research. That is, the results of this study only presented age equivalence scores on a 6 month basis (Table 4.21), not on a monthly basis as shown in US data. This was due to the limited number of the sample who contributed monthly ages. Therefore, calculations of age equivalence on a monthly basis were inapplicable.

5.4 Conclusion

The results of this study were summarized as follows:

1. The psychometric properties of the Thai version of the DTVP-2 had content validity in accordance with the examination conducted by the three occupational therapists. The Index of Conjugate (IOC) was 0.6 in subtests 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); and the IOC was 1 in subtests 2, 3, and 7 (subtest 2: Position in space, subtest 3: copying, and subtest 7: Visual–motor speed) (Table 4.3). Furthermore, the examination of reliability by test–

retest found that the Thai version of the DTVP-2 had high reliability for the entire DTVP-2 (r=0.89) and for each subtest (r=0.81-0.96) (Table 4.5).

2. The normative values of this study showed that as the age of the children increases, the children's test scores increase in every subtest. In addition, Thai children had a tendency to score higher on the visual-motor speed subtest than US children in the age ranges 4 – 5 years old and 8 – 11 years old. These likely results may from cultural and environmental experiences such as (1) Thai children enter school at a younger age, (2) Thai children spend a longer time on their curriculum and the amount of study hours per day, and (3) Thai characters have greater complexity. All of these factors may the development of writing elements, which may assist Thai children to develop writing readiness faster.

5.5 Application

In this section, an example is given of how to interpret test results from the DTVP-2 (Thai version). Thus, therapists will be able to use this example when they are interpreting test results from the DTVP-2 (Thai version).

Pavinee was a girl, aged 4 years 8 months old (use table 4.10, 4.20-4.23 to interpret). She was attending kindergarten 2 at a public school. She was screened for visual perception problems by an occupational therapist because her teacher reported that Pavinee showed difficulties regarding the sequence of letters and numbers; e.g., ball/dall, etc., problems in recognizing the shapes of objects, poor matching of geometric forms. The occupational therapist applied the DTVP-2 to screen for visual perception problems. The results from the DTVP-2 were interpreted as follows:

Pavinee's test results from the DTVP-2 (Thai version) are shown in Table 5.1, and her test results on the composite quotients are shown in Table 5.2.

Table 5.1 Pavinee's test results from DTVP-2 (Thai version)

Subtest	Raw Score	Standard Score	Percentile Rank	Rating of Descriptor	Age Equivalent
EH	158	13	84	Above Average	5-6 – 5-11
PS	7	7	16	Below Average	4-0 – 4-5
CO	24	11	63	Average	5-6 – 5-11
FG	9	11	63	Average	5-6 – 5-11
SR	13	7	16	Below Average	<4-0
VC	6	11	63	Average	7-0 – 7-5
VMS	22	15	95	Superior	6-6 – 6-11
FC	9	9	37	Average	5-0 – 5-5

Table 5.2 Pavinee's test results on composite quotients

Composites	Standard Score Sums	Quotients	Percentile Rank	Rating of Descriptor
General Visual Perception (GVPQ)	84	106	63	Average
Motor-Reduced Visual Perception (MRPQ)	38	89	12	Below Average
Visual-Motor Integration (VMIQ)	46	98-99	25-27	Average

For Pavinee's test results in Table 5.1, it can be concluded that:

1. Visual perception on subtests CO, FG, VC and FC is average.
2. Visual perception on subtest EH is above average.
3. Visual perception on subtest VMS is superior.
4. Visual perception on subtests PS and SR is below average.

Considering age equivalence, it is found that Pavinee's visual perception on subtests PS and SR demonstrate below average visual perception, 4-0 through 4-5 and < 4-0, respectively.

Besides, Pavinee's test results on composite quotients in Table 5.2 indicate that;

1. General Visual Perception and Visual-Motor Integration are average.
2. Motor-Reduced Visual Perception is below average.

From the above results, it can be determined that occupational therapists should take a role in improving Pavinee's visual perception skills, especially in PS and SR which had below average scores. However, her Motor-Reduced Visual Perception should be encouraged in general as well. The interpretation of each subtest and of the overall test can be of benefit in providing effective interventions for the individual visual perception problems of each child.

5.6 Limitation

The limitation of the study was the distribution of the sample: the data collected from the sample groups have no calculation of age equivalence on a monthly basis, which is different from the presentation of US children's age equivalence that shows scores on a monthly basis. This study only presents age equivalence on a 6 months basis.

5.7 Recommendations

For future research, these are some recommendations:

1. There should be further study of the psychometric properties of the DTVP-2 (Thai version) along other dimensions e.g., using a known-group method, concurrent validity with another Thai version of a visual perception test (if it is available in the future), inter-rater reliability and intra-rater reliability, etc.

2. It is recommended for the next study to control for bias, especially in selection of the sample, by organizing a plan to collect and distribute data by age range of sample groups in each month.