A VALIDITY STUDY OF DRAW A PERSON: A QUANTITATIVE SCORING SYSTEM

WUTHISAK NIMMALANGKUN

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A QUANTITATIVE SCORING SYSTEM

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Mr Wuthisak Nimmalangkun
Candidate

Assoc.Prof.Sucheera Phathrayuttawat,
M.Ed.,Ph.D.(Psychology)
Chair

Assoc.Prof.Chirdsak Kowasint,
Ed.D.(Research and Curriculum
Development)
Member

Assoc.Prof.Kanokrat Sukhatunga,
M.Ed.,M.Sc.
Member

Prof. M.R. Jisnuson Svasti,
Ph.D.
Dean
Faculty of Graduate Studies

Clin.Prof.Piyasakol Sakolsatayadorn,
M.D.,FRCST
Dean
Faculty of Medicine, Siriraj Hospital
Mahidol University

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Wthisak Nimmalangkun
THE VALIDITY STUDY OF DRAW A PERSON: A QUANTITATIVE SCORING SYSTEM

WUTHISAK NIMMALANGKUN 4636050 SICP/M

M.Sc. (CLINICAL PSYCHOLOGY)


ABSTRACT

The purpose of this research was to study the validity of the Draw A Person Test (DAP): A Quantitative Scoring System in Chiang Mai elementary school students, aged between 7 – 9 years old. The sample consisted of 100 students selected by Linderman’s Rule of Thumb from Watveruwan School, and 24 mentally retarded students from Kawila-anukun School.

The results revealed that the DAP test correlated with the CPM and VMI4R tests at the moderate level (r = .393 and .488) with a statistical significance of .001. After calculating by Conbach Alpha Coefficient technique, it was found that the DAP test had a high reliability (.8840). Therefore, the results demonstrated the effectiveness of the test in measuring intelligence of children.

In the study, a cut-off score was applied in order to discriminate between mentally retarded students and normal students. It was found that the cut-off score at 85 had a high level of sensitivity and specificity (95.83% and 98%), and had a low level of false discrimination (2.42%). Consequently, it was of both practical and clinical importance. The cut-off score of 65 had a high level of specificity (100%), although the level of sensitivity decreases (91.66%). The score of 101 had the highest sensitivity (100%), although the level of specificity decreased to 91%. Both the cut-off score level of 65 and 101 had higher levels of false discrimination than the cut-off score at a level of 85. Thus, using both scores ran the risk of interpreting normal students as mentally retarded, and vice versa. Nevertheless, the DAP should be used only as basic intelligence screening, for diagnostic purposes a standardized test is needed. In conclusion, the DAP test should not be used alone to measure intellectual ability, it should be used to supplement standardized intelligence testing instruments or to confirm the results of other tests.

KEY WORDS: INTELLIGENCE / VALIDITY / DAP / AGE 7 – 9 YEARS OLD / MENTAL RETARDATION
การศึกษาความตรงของแบบทดสอบ Draw A Person: A Quantitative Scoring System (THE VALIDITY STUDY OF DRAW A PERSON: A QUANTITATIVE SCORING SYSTEM)

วุฒิศักย์ นิมมลังกูล 4636050 SICP/M

วท.ม. (จิตวิทยาคลินิก)

คณะกรรมการควบคุมวิทยานิพนธ์: เชิดศักดิ์ โอวาสินทร์, กศ.ค., กนกรัตน์ สุขะจุฬา, กศ.ม., วท.ม.

บทคัดย่อ

การวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาความตรงของแบบทดสอบ Draw A Person (DAP): A Quantitative Scoring System ของเด็กนักเรียนระดับประถมศึกษา ช่วงอายุ 7 – 9 ปี ในจังหวัดเชียงใหม่ จำนวน 100 คน จากโรงเรียนวัดเวฬุวัน และคัดเลือกกลุ่ม Gold Standard จากเด็กนักเรียนที่มีภาวะปัญญาอ่อนจำนวน 24 คน จากโรงเรียนวัดสะพานแก้ว.

ผลการวิจัยพบว่า แบบทดสอบ DAP มีความเสี่ยงพื้นฐานแบบทดสอบ CPM และแบบทดสอบ VMI-4R ในระดับปานกลาง (r=.393 และ .448) ด้วยระดับนัยสำคัญทางสถิติ .001 และการคำนวณค่าลิบเทนส์ของ Conbach พบค่าความเที่ยงในระดับสูง (.8840) แสดงถึงแบบทดสอบ DAP มีประสิทธิภาพในการตรวจวัดเชาวน์ปัญญา.

ในการประยุกต์การใช้งานของแบบทดสอบ DAP และกำหนดจุดตัดคะแนนที่เหมาะสม พบว่าจุดตัดคะแนนที่ 85 มีค่าความไวและความจําเพาะอยูในระดับสูง (95.83% และ 98%) และมีอัตราความผิดพลาดในการจําแนกต่ํา (2.42%) แสดงถึงการมีความสัมพันธ์ทางปฏิบัติหรือความสัมพันธ์ทางปกตินิค ถึงแม้จะพบจุดตัดคะแนนที่ 65 มีค่าความจําเพาะ 100% แต่ค่าความไวต่ํา (91%) ดังนั้น ทั้งสองค่าจึงมีอิทธิพลที่มีในการกำหนดจุดตัดคะแนนที่เหมาะสม อย่างไรก็ตาม เนื่องจาก DAP ยังมีปัญหาในด้านการกําหนดความอิสระ ความสนใจ การวาดภาพ และการส่งเสริมของผู้ปกครองมากเกินไป จึงไม่ควรใช้แบบทดสอบ DAP เพียงผาแนบเดียวในการประเมินเชาว์ ปัญญาแต่ควรใช้ร่วมกับแบบทดสอบทางเชาว์ปัญญามาตรฐานอื่นๆ เพื่อถัดอันผลการตรวจร่วมกัน

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CHAPTER I
INTRODUCTION

Background and Significance of the Problem

Psychological measurement is an indirect technique used to understand mental function of an individual. Because of psychological tests are the products of conceptualization or construction of psychological theories. Consequently, the definition of term is an important thing when mentioning about individual behavior. An efficient psychological test should have an acceptable characteristic of measurement that includes validity, reliability, and effective items selected from item analysis. The mental functions which generally analyze by psychological tests include personality, conflict, frustration, aptitude, interesting, neuropsychological function, and intelligence. (1, 2, 3)

Among many mental functions, intelligence could be used to specify a person who is different from others. Intelligence contains variety of human abilities, including logical reasoning, memory, comprehension, planing, spatial relation, perception, adaptation, and neuropsychological function. In order to derive with an appropriate result, it depends on many factors, including attention and concentration of the subject, accurate test atmosphere, experience of administrator, plus of the characteristic of the test.

For each intelligence test, it is used for specific purpose such as for diagnosis, screening, or using with specific subject. Therefore, the administrator must understand the nature of difference tests. He must know how to select them, and the specific purpose of using them.

There are many kinds of standardized intelligence tests for children are used by psychologist. For example, Kaufman Assessment Battery for Children (K-ABC)
which based on the concepts of sequential and simultaneous processing. The sequential processing is the method of managing data by ordering or sequencing system. On the other hand, simultaneous processing is the management of the whole data at one time. The K-ABC test has 2 parts consisting of intelligence test, which measure skills of reasoning or logical thinking. Another part is the achievement test, which measures basic academic knowledge. In Thailand, the part of intelligence was more popularly than the achievement part. It is because the achievement part had more content of another culture. The Stanford-Binet Intelligence Scale form L-M. It uses for 2 – 17 years old children. In Thailand, this test used only for the age of 2 – 7 years old, because of the difference in cultural and language contents. The 4 components that the Stanford-Binet test was measured are verbal, abstract visual, quantitative reasoning, and short-term memory. Another intelligence test is the Wechsler scale, which has many versions. There are the WPPSI that used with 4 – 6 years old children, WISC and WISC-R used with 5 – 16 years old children, WISC-III developed from WISC and WISC-R used with 6 – 17 years old children. The tests of Wechsler could measure 2 parts of intelligence are verbal and performance capacities. However, these intellectual tests have the limit of cultural and language element when uses in difference countries, and they have time consumed. Thus for the purpose of screening or use with handicap subjects, the culture fair test such as Colored Progressive Matrices (CPM) is more beneficial. CPM is used to measure the intelligence of children, age between 6 – 11 years old. The CPM test consists of matrices or pattern figural stimuli that could measure the ability of perceptual function, and logical reasoning by completing the missing piece of the whole picture.

The psychological test that implicates with intelligence measurement is the developmental test. It is used for measuring maturity of neuropsychological function. The example of the tests in this group are Denver Developmental Screening Test (DDST) version I and II which use for measuring maturity of children age 0 – 6 years old. DDST measures 4 abilities personal-social, fine motor-adaptive, language, and gross motor. The visual-motor functions test is measured by copying a picture such as the Marianne Frostig Developmental, Benton Visual Retention, Bender-Gestalt, and Visual-Motor Integration (VMI) tests. These tests could measure the abilities of
visual-motor coordination, figure and ground perception, perceptual consistency, perception of spatial relation, and visual memory, which related to educational ability specifically in reading and writing. (4, 5, 6, 7)

The standardized and developmental tests were designed to use in normal situation when testing an individual. They are generally used in psychological setting or hospitals, which was administered and interpreted by clinical psychologists. For situation that verbal test could not be used, such as testing the handicap, limitation of time, and group testing. The nonverbal test and quantitative analysis are beneficial choices for intelligence screening.

The Draw A Person (DAP) test is one of the psychological tests that could measure intelligence of children. In general, the DAP test used as projective technique to measure the personality, conflict, or cause of the mental problem. Moreover, the DAP test could use as the intelligence measurement as developed by Florence Goodenough (8, 9, 10). She used The Goodenough Draw-A-Man Test to measure intelligence of children by analyzing the quality of picture and details, because children’s drawing is complete and has the right details when children grow up. These showed that maturity related to children drawing. In addition there are differences of scores between boy and girl in the picture drawing. Prasit Harinasut (11, 12) stated that, the children’s picture drawing is a method to measure the intelligence of children by considering from parts of body, and interpreting to Intelligence Quotient (IQ). The picture drawing is the basic job that children accept, comfortable, and could make the relationship between children and psychologist easier. Another benefit of picture drawing is needing only a few items only pencil and white paper, spending a little time, and capable of measuring trait of personality. Furthermore, it could show the skills of fine motor control that related with visual-motor function, and predict some of attention and concentration of children. The children could perform this job easily, because no verbal language needed to be used. Moreover, for the set of psychological testing, drawing test could be used first to measure children’s ability. Nathakarnt Hathapant (13) mentioned about the interpretation of the DAP test, that the test could be direct with the picture drawn because the picture be the integration of intelligence.
and neuropsychological functions. Further, this test could be used of all age, sex, education, and capacity of subject.

One of the human figures drawing tests that interesting is the Draw A Person (DAP): A Quantitative Scoring System test that developed by Jack A. Naglieri (14, 15) in 1988. This test was designed to screen nonverbal intelligence. It has no academic content that benefit children with visual, auditory, language handicapped, anxious, and mentally retarded children. The performance of the test is drawing the 3 pictures of a man, a woman, and self. The advantage of this test is the culture fair measurement, spending little time and item, scoring and interpreting easily. The multidisciplinary staff who had been trained could be applying this test with less errors comparing with the American norm. The study to investigate the quality of measurement could be done without difficulty. Thus, the DAP test is an interesting intelligence test to apply with Thai children in screening their intelligence, and discriminating mentally retarded children from normal children in order to set efficient education for them.

The mentally retarded children have been a subject of study by multidisciplinary staff for a long time. In Thailand, Dr. Allen Stroller (16) studied about etiology of mental retardation with World Health Organization (WHO) in 1957 and found the prevalence of syndrome was 1 – 3 % of population. The purposes of his survey were for prevention, helping or managing the education to improve their abilities. The Diagnostic and Statistical Manual of Mental Disorders, 4th edition (DSM-IV) (17) defined the mental retardation that consist of the IQ score below 70 from individually formal testing, could not adapt in daily life, and onset before 18 years old. Unfortunately, the mild mentally retarded children might not clearly show their symptom, and some of them study in normal classroom that made them felt unhappy because of disability of learning. Therefore, it has many benefits that mentally retarded children was detected by their teacher, caregiver, or parent with the efficient test and easy to use as the DAP test. These might lead to their development would be improved with the specific technique or special learning.
Because the usefulness of DAP, it was interesting to study the quality of the test when apply to elementary school students. Moreover, early detection of intelligence is an importance thing to identify with the problem of mental retardation, and behavior or emotional disturbance. The student aged between 7 – 9 years old have maturity of brain functions. These abilities helped children to control their eye-motor coordination related to drawing, writing, and reading abilities. Auditioning, picture drawing in this age range would perform reality or systematically characteristic, right details, and in a single form. This drawing ability could develop at school and help them to continue studying at higher levels. As the test, which was bought from other cultures should refer to the criterion and interpretation local norm. So, for the suitable of testing, the study of characteristic and making standard norm should be done. As mentioned earlier, the study of the DAP test had almost been done around Bangkok area. For more variety of subjects, Chiang Mai province was selected in this study because life style of the people was difference from Bangkok. Watveruwan School was selected to use as a target group of Chiang Mai student because this school are a moderate in size, not far from Chiang Mai city, and has the variety of student backgrounds and socio-economic status.

**Research Objectives**

1. To study the validity of the DAP test with the CPM and VMI-4R tests by using Pearson product moment correlation coefficient.

2. To study the efficient cut-off score of the DAP test by using sensitivity and specificity to develop the screening criterion that has power to discriminate normal and mentally retarded students.
Research Instruments


2. The Colored Progressive Matrices (CPM) test that developed by Raven J.C in 1938.


Benefits and Expected Outcome

1. Obtain the intellectual ability screening technique for 7 – 9 years old elementary school students, which has the power to discriminate mentally retarded student from normal student.

2. Able to apply the DAP test for screening the children who have intellectual disability or limitation of using by other standardized test and use the result for academic preparation and medical treatment.

Definition of Terms

Intelligence refers to maturity of cognition and neuropsychological function, which consist of understanding, reasoning, perceiving ability, and systematically data managing.

Validity refers to criterion related validity of the DAP test with the CPM and VMI-4R test by using Pearson product moment coefficient correlation.

Cut-off Score refers to the score with the power to discriminate mentally retarded student from normal student by considering from sensitivity and specificity.
The range score, which calculated sensitivity and specificity of each scale, is between the mean of mentally retarded student group plus half of its standard deviation and the mean of normal student group minus half of its standard deviation.

**Sensitivity** refers to the probability that the DAP test is positive when given to a group of mentally retarded student of at least 80%.

**Specificity** refer to the probability that the DAP test will be negative among students who have no mental retardation of at least 80%.
CHAPTER II
LITERATURE REVIEW

This research aimed to studying the validity of Draw A Person test (DAP): A Quantitative Scoring System by focusing on the correlation coefficient with The Colored Progressive Matrices (CPM) and The Visual-Motor Integration, 4th Edition, Revised (VMI-4R) in Chiang Mai elementary school student. The literatures related topics are as follow:

1. Intelligence: Definition, Development, and Mental Retardation
2. Development of Drawing
3. Intelligence Measurement
4. The Draw A Person test (DAP): A Quantitative Scoring System
5. The Colored Progressive Matrices test (CPM)
7. Conceptual Framework
1. **Intelligence: Definition, Development, and Mental Retardation**

   It is an importance thing to understand the intelligence of person for psychologist, because intelligence could specify an individual from other persons. Intelligence is an abstract word that is difficult to lay down a specific definition because this word is not clears both in theory and practical concepts. There are many definitions interpreted by many psychologists as follow.

   Alfred Binet (19, 20, 21, 22) said that intelligence consists of judgement, common sense, creativity, and adaptation ability. Wechsler (19, 20, 21, 22) said that intelligence is abilities of human activities with goal, reason, and adaptation. These could divide into 2 parts, verbal or reasoning ability, and performance or practice ability. Spearman (19, 20, 21, 22) pointed at 2 factors of human intelligence. The first is general factor (g-factor) which has 3 general abilities are logical, mechanical, and spatial abilities. These make an individual different from others. The second factor is specific factor (s-factor), which is a specific ability of a person to do something. Vernon (19, 20, 21, 22) studied spearman’s 2-factors theory and discovered hierarchical theory. This new theory pointed out that brain activity consists of fluid intelligence and crystallized intelligence, which must contain from ability of verbal education and practical education to develop the intelligence.

   Some theories viewed that the intelligence consists of many factors for example the theory of Guildford (19, 20) whose concept of intelligence consists of 3 dimensions with 180 factors. The first dimension is content, which has figure, symbolic, semantic, and behavior factor. The second is operation dimension, which has cognition, memory, divergent thinking, convergent thinking, and evaluation factors. The last is product dimension, which has units, classes, relations, system, transform, and implication factor. Thondike (18) discriminated the intelligence into 3 categories, which are abstract intelligence, mechanical ability, and social intelligence. Beside, Thurstone and Thurstone (19, 20) found that primary mental ability or primary factor of individual that consist of 7 factors of abilities, consisting of verbal comprehension or V-factor, word fluency or w-factor, number or n-factor, perception
speed or p-factor, association memory or m-factor, reasoning or r-factor, and space or s-factor.

Some theory paid attention to the information processing could be compared to computer processing. This theory believes that the brain function processes data with symbolic form. The processes consist of the ability of interpretation, acting on, and storage information. These are the processes of structural components that composes the detail of specifically processing such as sensory, short-term memory, long-term memory etc. Include with functional components, which is the sequencing of performance or reaction. This theory has 2 mental function processing that consist of Simultaneous Processing that is processing of the whole activity management in the same time. Another is sequential or successive processing that is the mental processing to management data by sequence. The person might use the best method to manage situation that up to passed experience.

The Piagetian perspective pointed out the cognitive structure of children that has a difference function from adult. They consist of 2 domains of reasoning abilities, which are structure and function. This group believed that the intelligence processes similar to the same of general biological activity. This means it use the activity of adaptation and equilibrium. The adaptation consists of assimilation that is containing new situation and bring them to passed experiences, and accommodation that passes experience with new situation. The equilibrium is processing adjust to the cognition structure with the situation by using ability of rearranging, enlarging, and continuing higher development.

Conclusion, intelligence has many concepts that as defined by psychologists. It consists of general activity, problem solving, calculating, verbal understanding, logical reasoning, comprehension, memory, and efficiency response. These were resulted from brain processing that use the past experience, and bring them to use or adjust in perception.
In the part of human development, there are many changes both of somatic and mental in development. The intelligence is the one of them that always developing in life span. It begins with the fertilized cell or zygote was containing dominant and recessive genetic from mother and father. These are permanent characteristic that could not be change. During pregnancy period, it is an importance thing to care about feeding, drinking, containing medicine, and living life style of mother that could directly result to a baby who is parasite in this period. The developmental during pregnancy almost are about changing or improving the physical (23, 24).

Thereafter, the baby would change from parasite to individuality called infancy or babyhood. Psychologist pays attention to the first 2 year of baby’s age because this period is very important to build a base of developmental. The intelligence is one of them that could be built during this period. The baby who has a chance to play would develop their intellectual ability, verbal communication, and sensory motor. Piaget (25, 26, 27) said that, human cognitive structure develops from reflect action. If the children have activity with their environment, they will learn to adjust and adapt, called Schema. Moreover, verbal understanding is related with cognition and developing from babyhood to complete in adolescent period and learn more experiences. The period of newborn to 2 years old is in the stage of sensory motor. First, reflect activity is activating during the age between 0 – 1 month. The age between 1 – 4 months, reflect of sensory and motor are cooperated. The age between 4 – 8 months, children learn to imitate behaviors from persons surrounding them. They start to have an autistic behavior, and perceive themselves individual. The age between 8 – 11 months, they know how to seek for pleasure. The age up to 11 months, they are naughty, lively, need to serve sensory organ. During the age of 12 months to 2 years old, they can improve there thought by thinking to in-appear object, can start to use easy language to communicate, and can solve some problems.

The next period is called early childhood or pre-school age. Children improve their cognition to the stage of pre-operational. They can understand languages and concrete reasons. The brain abilities develop memory, reasoning, conceptualization,
and imagination. During the period of 2 – 4 years old, children could not discriminate a thing and become egocentric. When they grow up to 4 – 7 years old, they could discriminate an object that improves their classification or categorization ability, and develop associative thinking. Children at this period could use ability of calculation and conservation of quality until they are 5 years old. Next, they could understand the conservation of weight that has an abstract content during the age of 6 years old.

The late childhood or school age begins at 6 to 12 – 13 years old. This period, children could understand about conservation of volume. The cognition at this stage is a concrete operation mixed with abstract thinking. They can be discriminate different objects, use verbal and numberal symbols, and prepare to develop formal operations. The Piaget’s cognitive theory which has 4 stages is performed in table 1.

**Table 1 The Piaget developmental of cognition theory**

<table>
<thead>
<tr>
<th>Stage of development</th>
<th>Characteristic</th>
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<tr>
<td>1. Sensory Period</td>
<td>Knows object in difference direction, perceive themselves an individual, seeking for pleasure, understand from sensory, incomplete verbal communication.</td>
</tr>
<tr>
<td>Age: new born – 2 years old</td>
<td></td>
</tr>
<tr>
<td>2. Preoperational though period</td>
<td></td>
</tr>
<tr>
<td>2.1 Preoperational</td>
<td>Egocentric though, can generalize but can not discriminate.</td>
</tr>
<tr>
<td>Age: 2 – 4 years old</td>
<td></td>
</tr>
<tr>
<td>2.2 Intuitive</td>
<td>Can discriminate by category or classification, knows relation of number, comparison thought, conservation of quality, weight, and volume</td>
</tr>
<tr>
<td>Age: 4 – 7 years old</td>
<td></td>
</tr>
<tr>
<td>3. Concrete operation</td>
<td>Reasoning thought, reversing of thought, understands mathematics symbol, categorization or classification by ordering.</td>
</tr>
<tr>
<td>Age: 7 – 11 years old</td>
<td></td>
</tr>
</tbody>
</table>
Stage of development | Characteristic
--- | ---
4. Formal operation | Abstract thinking, imagination, conceptualization, Analyzation, interpretation, and investigation.
Age: 11 – 15 years old | 

From table 1, developmental of cognition must improve by steps of maturity with environment contacting. It would be negative effect if children do not develop step by step or engage in too much stimulation by their parents. At the age of 7 years old, it is a critical period of neuropsychological and perceptual development. Although, for some children are delay in their developmental stage, which effected by cognitive maturity, called mental retardation. Thus, the early detection of mental disability is a very important thing to do to help and stimulate them to improve their skill.

The study of mental retardation was an interesting from multidisciplinary staff such as educator, psychologist, physician, lawyer, and social worker in the purpose of aiding management. Furthermore, mental retardation relates with age, syndrome, culture, and society. The screening of mental retardation is a difficult thing to do because of this symptom appear in many syndromes such as emotional and behavior disturbance, learning disability, and autistic. The main symptom of mental retardation is the delay of intelligence in many abilities when compare with children of the same age. The mentally retarded children could not seek for knowledge. They have disability of memory to store - restore data, delay of learning, become under-achievement, could not understand abstract or symbolic contents, and disable of planning (28, 29, 30).

In the past, an indicator to judge mental retardation is only by using score from the standardized test such as Stanford-Binet Intelligence Scale and Wechsler’s test. After 1959, more indicators added, which are the abilities of adaptation and adjustment of person including the ability of general activity, responsibility, and capability to adapt with peer group or culture. The symptom of mental retardation could observe from the delay of fine motor, verbal language, abnormal of somatic for
example eyes, fingers, legs, arms, deaf, lack of body balance, having abnormal neuropsychological functions, or unable to pass the exam in the late elementary school. The Diagnostic and Statistic Manual of Mental Disorder 4th edition (DSM-IV) (17) and the American Association on Mental Retardation (AAMR) (20) regulate the meaning and diagnosis of mental retardation by multiaxial system in AXIS II. These include symptoms of personality disorder, mental retardation, and defense mechanism. The diagnosis criterion follows as:

A. Having a score of intelligence quotient below 70 from individual testing. An infant diagnosed from the medical evaluation with the same meaning of score very low from the average score.

B. Having ability less than others at the same age and in the same culture, or could not adapt or adjust in environment at least in 2 ways, including: communication, self care, house living, community usage, social skills, having their own aim, having skills of learning, working, resting, health caring, and safeness.

C. Onset before 18 years old.

The classification of several degrees of mental retardation could be separated into 4 levels. Only IQ score is not enough to diagnose mental retardation but must includes maladjusted with the environment. If the child had an IQ score at the level of mild mental retardation but he could adjust and adapt with real life, he would not be a mentally retarded child. Thus, mental retardation level could classification as follow:

Level 1: Mild Mental Retardation (MMR), the score from IQ testing between 50 – 55 to 70. This group has about 85% of all children with mental retardation. They could study in elementary school with normal class by special teaching and planning.

Level 2: Moderate Mental Retardation, the score of IQ between 35 – 40 to 50 –55. This group has about 10% of all children with mental retardation. They have brain damage or pathology of oganicity that could observe by the somatic and
neuropsychological disability for example fine, and gross motor. They could study in school with special program and self-caring.

Level 3: Severe Mental Retardation, the score of IQ between 20 – 25 to 35 – 40. This group has about 3 – 4% of children with mental retardation. There is physical disorder which could be observed. The limit of neuron controlling made them need the help-keeper nearby. They could speak some word for communicate with others, could not join with social or peer by themselves so that they have little social stimulate, but they could do some simple works with their caregivers.

Level 4: Profound Mental Retardation, the score of IQ is below than 20 – 25. They are 1 – 2% of children with mental retardation and strongly need the caregiver during their life. They must stimulate about motor skill, self-care, and communication skills because this group has many handicaps.

Last: Mental Retardation, Severity Unspecified. This group has strong evidence to diagnose symptoms but could not measure from psychological testing. Because of disability, or children do not help themselves and in stage of infancy.

Except for the classification by severity on mental retardation, the classification by educability expectation of mentally retarded children is another method which could be used to classify. The method involves educational philosophy that is education keeping for all intelligence and abilities. The American Association on Mental Deficiency: AAMD (20) was separate mentally retarded children by this method into 3 groups as follow:

First is Educable Mental Retardation (EMR). This group is difficult to know because they have unclear symptom until they go to school. They can develop ability for communication, sensory organ, and could study in elementary school. The educator strongly pays attention to keep support for this group because they can develop their abilities, if they have the efficient stimulation.
Second is Trainable Mental Retardation (TMR). This group has intellectual ability below the first group. Generally, they can speak in early childhood, have delay of sensory and motor development, can not study in normal classroom but could learning in special program, and can be trained to work with in-complex job.

The Last is custodial group. This is the lowest of intellectual ability group. They can not be train and must have their caregiver nearby during lifetime.

The mental retardation has many classifications and the causes of symptom are differences too. The main causes of this symptom consist of the abnormal of chromosome such as Trisomy 21, Triple X syndrome, or the abnormal of genes such as Fragile X, Prader-Willi syndrome. Cause of inborn metabolism disorder such as Phenylketonuria, Galactosemia. The abnormal of neuron system consist of tuberous sclerosis. The abnormal of mother during pregnancy consist of Thyroid toxin, diabetes, German lesion. Moreover, there are causes that come from the children themselves such as seizure, epilepsy, some disease, accident, lack of food or nutrition, contain lead, brain tumor, and lack of stimulation.

2. Development of Drawing

The children’s drawing in clinical psychology is the first thing to do when testing. Because of it is an easy method that does not made children be scared or anxious, using little time and items, and capable to make the relationship between children and the tester. Generally, children often draw their love-object and things custom to them such as members in their family, friends, pet, house, tree. The first picture might incomplete. It may have only some part that they are interested or impressed. These could be use for clinical interpretation to understand the mental function for example intellectual capacity, visual-motor coordination, perceptual function, emotional and social adjustment.

The factor that involve with children drawing conducted by perceptual function is the ability to response with stimulus both of creature and abstract symbols
such as language, culture, tradition, and moral. They use ability of sensory organ to receive the touch of affect, and bring it to interpretation with their past experience to understand the meaning of such a touch. This process called perception. The perception that related with children figure drawing is the visual perception and maturity. The process of perception is by selecting the quality of touching, categorizing the same and difference of characteristic. These make the children perceive the constancy of object, color, shape, size, and location.

Another theory that related with visual perception is the figure and ground theory of Gestalt psychology (4, 5, 19). The methodology of this theory believes that human perceive the objects by perceiving the whole picture rather than details. The picture that has a limit of space or form called Figure, and the unclear part calls Ground. This methodology is the Law of perceptual grouping, which consist of:

The principle of nearness or Proximal is a method of stimulus ordering by nearness. This means the stimulus appears in the same place and closeness. Human must perceive them in the same group.

The principle of similarity is a method to order things that are of sameness. This is an important concept to perceive the complete picture.

The principle of continuing or common fate is a method of the stimulus ordering by appearance of the object in the same direction in order to easily perceive a picture.

The principle of closure is a method of stimulus ordering by building the part of what is missing in order to complete a picture.

These principles are important concepts that help a person to perceive a complete picture. They involve with the brain function specifically in the areas of visual association cortex, angular gyrus, and calcarine cortex, which work together.
The figure and ground perception is developing by step of ages similar to the cognition development. Initially, children tend to perceive the whole picture before paying attention to details. The development of perception begins during the age of 6 months. Children could discriminate the distance of picture first and develop the perception of constancy of sizes and shapes of objects. Then they could perceive in 3 dimensions. At the age between 3 – 6 years old, they could perceive the whole picture and do not pay attention to parts of details. They pay attention to color of the object rather than its shape. At the age of more than 7 years old, they could perceive details and discriminate parts of picture. The human figure drawing should be complete at this period.

Other concept that related with visual perception and children’s drawing development is the eye-hand coordination. Theses bases on the fact that the hand is controlled by a conduct of visual perception and the coordination with gross motor. In newborn babies, the movement of hand would be indirect. Their fingers would switch between gripping and opening. When baby need to touch an object, the postural mechanism is working to balance this function. The age between 4 – 5 years old, children could perceive width, height, and depth of the objects that made them capable to copy a cross and a square picture. For the age between 6 – 7 years old, children could better hold pencil that made them able to write orderly and small alphabets because the efficiency of motor controlling.

Gessell (13) classified the development of children’s picture drawing in each age, while Brigance (31) classified the ability to copy a picture of children show in table 2.
Table 2 The development of picture drawing and copying by age

<table>
<thead>
<tr>
<th>Age</th>
<th>Picture Copying</th>
<th>Picture Drawing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 year</td>
<td>Line</td>
<td></td>
</tr>
<tr>
<td>2 years</td>
<td>Circle</td>
<td></td>
</tr>
<tr>
<td>3 years</td>
<td>Cross</td>
<td>Circle</td>
</tr>
<tr>
<td>3 years and 6 months</td>
<td>Cross</td>
<td></td>
</tr>
<tr>
<td>4 years</td>
<td>Square</td>
<td>Square</td>
</tr>
<tr>
<td>5 years</td>
<td>Triangle</td>
<td>Triangle</td>
</tr>
<tr>
<td>6 years</td>
<td>Rectangle</td>
<td>Sun, Radiance, Mandalus</td>
</tr>
<tr>
<td>7 years</td>
<td>Rectangle</td>
<td>Sun, Radiance, Mandalus</td>
</tr>
<tr>
<td>8 years</td>
<td>Cross (2 dimension)</td>
<td>Diamond</td>
</tr>
<tr>
<td>9 years</td>
<td>Tube</td>
<td></td>
</tr>
<tr>
<td>11 years</td>
<td>Cube</td>
<td></td>
</tr>
</tbody>
</table>

When children have maturity of visual perception and eye-hand coordination, they could draw a completely picture. Burn (32) classified the 7 stages of drawing development as follow:

1. The stage of scribble drawing appears during the age between 2 – 3 years old.

2. The stage of a line drawing during the age of 4 years old instead of scribble but unable to draw parts of body collectedly.

3. The stage of descriptive or symbolic drawing at the age between 5 – 6 years old. At this stage, children have a pattern of drawing that made the proportion, location, and the size of picture complete.

4. The stage of realism drawing in the age between 7 – 9 years old. Children could draw a symbolic picture to describe the environment with right details, patterns, and details of the costume and ornament.
5. The stage of visual realism drawing during the age between 10 – 11 years old. This stage, the pattern and characteristic of drawing are developed that made the children able to reproduce the other, or draw a picture from the environment. The picture has a 2 dimension with the right structure, lighting, or could draw an overlapping picture, and draw the view into the background of picture.

6. The stage of repression of drawing during age between 11 – 14 years old. This stage, children come to adolescent period and have the emotional conflict. The development of drawing are delaying or developing slower than before, but they could pay attention to beautification of drawing, thus there are ornament and dressing in the picture drawing.

7. The stage of reviving ability of drawing in the age during early adolescent but many children could not pass this stage. They could perform their story by using color, pattern, line, and other technique to communicate their thought. This ability could not found in the age before 11 years old except in children with high intelligence.

Goodenough (33) observed the human figure drawing of children found that they draw a scribble line with their imagination or experience. When they growth up, the motor function could developed. The movement and controlling of motor would be improving with their reasoning. Then, the picture drawing would be clear, complete, has a right details, and meaning. Younger children draw an unrealized picture but they confirmed that their picture is being real. It because of their maturity of perception is not yet complete, and they use more sensory to perceive environment than older children. The picture drawing would be complete, have a right detail with the abstract meaning by maturity of visual perception, motor function, and cognition.

The development of human figure drawing begins at the age of 2 years old. The younger children often please to use a hand to draw lines. The scribbling that might not have the meaning could be seen at this period.
The age of 3 – 4 years old, the scribbling line would change to geometric form such as circle, square, and triangle. These are developed with their verbal and writing language. The human figure drawing must appear like the tadpole that consists of a circle cross with the lines.

Next, children would be interested to draw a head and a face. When they grow up, they add another circle to be a body part of the picture, but the circle of the head part would be bigger than the body part of 4 – 5 years old. At 6 years old, they draw a belly button between the body parts with the right details of face.

The children develop their drawing by drawing basic lines to build a single form. They must draw a picture of the nearby environment such as their father, mother, or their pet. This shows that they become egocentrism with pre-operational stage of cognition. At the age of 8 – 10 years old, they add the hands with the spiky fingers into the human figure drawing. The structural of width, height, and depth can be seeing at this age. The picture could describe their intelligence and reasoning by the characteristic and details of the drawing.

In their teen, the children have more experience and maturity of intelligence. The picture drawing shows characteristics of realizing with the secondary sex. Brigance (31) demonstrated that parts of body in human figure in the drawing of children would increase with their age as shown in table 3.

<table>
<thead>
<tr>
<th>Age</th>
<th>Part of body</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 years old</td>
<td>2 – 3</td>
</tr>
<tr>
<td>5 years old</td>
<td>4 – 6</td>
</tr>
<tr>
<td>6 years old</td>
<td>7 – 9</td>
</tr>
<tr>
<td>7 years old</td>
<td>10</td>
</tr>
</tbody>
</table>

Prapatsorn Niyomthum (34) described the development of children’s human figure drawing in 8 stages as followed.
1. Drawing a scribbling line. Children during 2 – 3 years old discovered their environment and perform their emotion by drawing scribbling lines. The picture would consist of vertical, horizontal, diagonal, circular, curving, waving, and dots.

2. Building the line. Children could draw the basic form and be better with sequencing. They could adjust lines and forms in many directions. These abilities are shown in 2 – 4 years old.

3. Building the form. Children age of 3 years old could control their fine motor. They could discriminate form and used their experience to perform the geometric drawing.

4. Design the basic drawing. Children during 3 – 5 years old of age could design the drawing by using basic lines and forms together such as drawing a circle into a square.

5. Drawing the mandalus, sun, and radials. At this period, children could draw a cross overlapped with a circle or square. This ability would develop the drawing of a sun, radials, and human picture during the age of 3 – 5 years old.

6. Drawing a picture of human. The children age between 4 – 5 years old could develop the human figure drawing from mandalus. They draw a head with face and details of arms and legs. The suns and radials would change form to be the ears, arms, legs, hair, and others on the head. The picture drawing of 6 years old children done by drawing a circular form with a cross.

7. The single formed of picture drawing. During 4 – 6 years old, the children could draw a picture with the meaning. They start to draw a human picture first and would develop another picture such as pets, tree, flower, house, etc.
8. The picture with meaning. The children could draw a picture with the right details and forms. They could bring many forms and lines to build a complete picture that has the meaning during 5 – 7 years old.

In conclusion, the development of drawing and perception of children are improving gradually by their maturity of cognition, and experiences. The ability of picture drawing relates to intelligence in the domain of the maturity of neuropsychological function, visual perception, cognition, and brain processing. Consequently, the human figure drawing of children is capable of showing children’s intelligence.

3. Intelligence Measurement

Intelligence is the one of many human abilities that could specify individual from others, which could tell the advantage and drawback, comparing with other of the same age. The measurement of intelligence is important for psychologist to manage the plan for individual. In the past, psychologists tried to measure the intelligence of human by comparing chronological age with the real age that called ratio intelligence quotient, but this method could be misunderstanding of individual ability. After that, the deviation intelligence quotient was developing by using the gap between testing score and standard score to interpret the meaning of intelligence.

Spearman (35, 36, 37) believed that g-factor is a co-factor of intelligence that found in human of all of nations, languages, and education. Genetic is an importance thing with g-factor, while s-factor influenced by environment and learning. The intelligence should measure about the general factor than specific factor because general factor involves with all brain activities. The intelligence should predict behavior of individual in other situations. Then, the effective intelligence test should measure ability of abstract thinking, relations, and association. The neogenesis method describes the basic thought of human can be demonstrated below.
1. The apprehension of experiences is the method of person to perceive or learn from environment and brings them to be an experience.

2. The education of relation is the association between 2 things that appears in the same time.

3. The education of correlation is the appearance of related things making the person knows the relationship of their characteristic.

The history of intelligence measurement began with Alfred Binet (25, 36, 37) who cooperated with Theodore Simon and built the intelligence test by using medical methodology. The Binet - Simon scale test was used to measure the decision and reasoning of children. The project was supported by France government. After that, Lewis M. Terman and other staff of Stanford University improved the scoring of this test, and changed the name to Stanford – Binet Intelligence Scale. Next, this test improved again with the 2 formats is form L and M. In 1960, the 3rd revisit of this test was released by mixed the domain of format L and M together.

In the 1st world war, the intelligence test name US Army Alpha, which is the verbal test, and Army Beta, which is non-verbal test, were used to select the soldiers. Next, Wechsler (35, 36, 37) developed the individual intelligence test in 1939 name Wechsler – Bellevue Intelligence score. This test had 3 formats of using consisting of formats for adult the age more than 15 years old, for children the age between 7 – 15 years old, and for pre-school children the age between 4 – 6 years old. Next, the adult format was improved and rename to Wechsler Adult Intelligence Scale or WAIS. The Wechsler test has 2 parts that consist of part of verbal and performance. In 1949, the Wechsler Intelligence Scale for Children or WISC was developed as WAIS.

The intelligence tests of Binet and Wechsler are not culturally fair because they contained many verbal and cultural experiences. As a result, the nonverbal test was developed by Raven that is Raven’s Progressive Matrices Test, which is a culturally fair and has less of bias of cultural content.
In the 19th century, there were many intelligence tests. The one of them is the Goodenough Draw-A-Man Test (33) that based on the theory of development of children drawing. In 1920, the measurement of intelligence by human figure drawing was popular. The scoring could be done by calculating from the part of body and adjust to be a mental age score. This method is difference form the classical tests such as the Wechsler and Binet test because it uses human figure drawing to measure children intelligence. In 1963, the criteria of the test was edited and renamed to Goodenough – Harris Drawing Test, but precise criteria could not be laid down. Consequently, Naglieri developed a new criterion of human picture drawing, and made the new test that is Draw A Person: A Quantitative Scoring System.

In 1988, Naglieri Jack A. developed the DAP test to improve the objective scoring criteria, and made the standard score. These criteria used for a man, woman, and self picture that consists of 4 categories (appearance, details, proportion, and bonus) and 14 criteria (arms, ears, eyes, feet, fingers, hair, legs, mouth, neck, nose, trunk, attachment, and costume).

In conclusion, the purpose of intelligence measurement has been used to understand ability of individual and to help them managing their activities life whether in working, learning, or medicating. The result that measured by intelligence test could shown or describe the ability of an individual when compared with average population. Therefore, the efficient intelligence test must measure the real ability of individual with a recent norm.

4. Draw A Person (DAP): A Quantitative Scoring System

The Draw A Person (DAP): A Quantitative Scoring System Test developed by Naglieri Jack A. (14, 38) in 1988. This test used for 5 – 17 years old children with the purpose of objective intelligence measurement by human figure drawing and does not make children scare or anxious. The DAP test is a non-verbal and a culturally fair test that is useful for screening children intelligence and administering individual or group
testing. Also it can be used to confirm result from another test. The norm was collected from the large size of American children, and the standard score conditioned range of 3 months during the age of 5 - 8 years old, range of 6 months during the age of 9 – 10 years old, and during the age of 11 – 17 years old could be use the same range.

When children draw a picture, they use abilities of 2 parts. First is logical reasoning, which consists of ability of communication, verbal understanding, perception, memory, storage and restores processing, environment contacting, and recognition. Another is performance ability consist of eye-motor coordination, planning, conceptualization, figure and ground perception, and training. The 2-part ability could tell the intelligence of children similar to the Wechsler and Vernon theory which consist of verbal or reasoning ability, and performance or practice ability. Involving with g-factor of Spearman, Piaget’s theory, perception theory, and children drawing theory show that the DAP test could measure these component of intelligence.

The DAP test could be used both for individual and group testing. The time spent is only 15 – 20 minutes. The items used are 3 white papers sized A4 (8 ½ X 11 inches) to draw a man, a woman, and self, a black pencil, an eraser, and a stop watch. The scoring has 14 criteria that consist of arms, ears, eyes, feet, fingers, hair, head, legs, mouth, neck, nose, trunk, attachment, and costume. In the each of criteria there are 4 categories including appearance, details, proportion, and bonus that have 3 – 7 items. The maximum score of each picture is 64 points. The mean of standard score is 100 with 15 SD. The classifications of standard score from the manual of the test shown in table 4.
Table 4 Classification of standard score by the DAP test.

<table>
<thead>
<tr>
<th>Standard Score</th>
<th>Percentile</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Above 130</td>
<td>Up to 98</td>
<td>Very Superior</td>
</tr>
<tr>
<td>120 – 129</td>
<td>91 – 97</td>
<td>Superior</td>
</tr>
<tr>
<td>110 – 119</td>
<td>75 – 90</td>
<td>High-Average</td>
</tr>
<tr>
<td>90 – 109</td>
<td>25 – 74</td>
<td>Average</td>
</tr>
<tr>
<td>80 – 89</td>
<td>9 – 24</td>
<td>Low-Average</td>
</tr>
<tr>
<td>70 – 79</td>
<td>3 – 8</td>
<td>Borderline</td>
</tr>
<tr>
<td>Below 69</td>
<td>Less than 2</td>
<td>Intellectual Deficient</td>
</tr>
</tbody>
</table>

However, the examiner must be trained before using the test. He must score the result carefully; interpret the result following the manual. More importantly, he must not use only the DAP test to judge the intelligence of person but should use it with other standardized intelligence test to interpret the result together.

Validity of the DAP test

Naglieri (14, 38) studied the construct validity of the DAP test and found that the raw score of each picture and total score would be increased by children’s age. Specifically for the age between 5 – 11 years old found the correlation with statistical significance between age and raw score of a man (r = .58), woman (r = .62), self (r = .64), and total score (r = .64). The correlation study between the DAP test’s criterion and the Goodenough-Harris test’s criterion found a high correlation level (r = .75 - .84).

The criterion related validity study, Naglieri (14, 38) studied the correlation between the DAP test with the Matrix Analogies Test – Short Form (MAT-SF) and the Multilevel Academic Survey (MAST). The result showed that the mean of the DAP test was 98.8, the MAT-SF was 99.8, and the correlation between a picture of man, woman, self, and total score with MAT-SF had statistical significance (r = .31, .29, .28, and .30). Moreover, this studied found the standard score of the DAP, MAT-
SF, and MAST tests were close to 100 that showed the efficient of the DAP test measurement.

Thitiwan Futrakun (32) developed a standard score of the DAP test in 5 – 17 years old student, by using 1,080 samples, in the central part of Thailand. The studied found the DAP test was correlated with the MAT-SF with statistic significance (r= .25 - .38). Then, she adjusted the raw score to be a standard score for her research.

Niyot Sangtonglaun (31) studied the correlation between the DAP and CPM test in elementary school student in Bangkok metropolitan area. The studied showed both of the tests had a correlation with statistical significance of .001. Then, he suggested to use the DAP test for measure intellectual ability of children in different situations and capacities.

Naglieri (14, 38) analyzed the difference between sex and nationality by comparing the score of boys and girls classified by age, nationality, and place of testing. The t-test showed that the girls had higher score than the boys and with statistic significance. However this difference was 1/5 of standard deviation that had less effect to perform the test. As a result, there was no standard norm between boy and girl. For the factor of nationality, there was no difference between American-African and white student with statistical significance.

Prawida Cheuncheuy (39) studied of children drawing in Bangkok elementary school student grade 4 – 6. The sample was 180 students. Data collected by using the DAP test and the survey forms. The results revealed the student grade 5 did the best score. Next were student grade 6 and 4 respectably. They felt happy and fun when drawing and wanted their teacher to teach more about some technique of human figure drawing.


Reliability of the DAP test

Naglieri (14, 38) studied about internal consistency of the DAP test by Conbach alpha coefficient with 14 criteria. He found a high level of reliability from the man, woman, self, and total scores .83 - .86, which was .86 of median.

Then, he studied the test-retest reliability of the result from 112 students in 4 weeks later. He found that the coefficient of score between .60 - .89 and the median were .74. Similar to the study of Thitiwan Foottrakun (32), as she found the result from test-retest reliability of the DAP test between .72 - .89. Moreover, Naglieri (14, 38) studied Interrater reliability by compare the scoring system from the DAP test with Goodenough-Harris by the 2 testers. He found the high level of correlation of the 2 testers (.95 in elementary, and .93 in junior high school).

5. The Colored Progressive Matrices test (CPM)

JC Raven (4, 19, 21) developed the Raven’s Progressive Matrices to measure the intelligence consisting of 3 forms. There are the Colored Progressive Matrices (CPM) for 5 years – 11 years 11 months children and for the elder, the Standard Progressive Matrices (SPM) for 12 years old children to adult, and the Advanced Progressive Matrices (AMP) for the same group of SPM with higher ability. The G-factor of Spearman was based theory of these tests. There are consisting of Eductive and Reproductive ability. The Eductive ability is the understanding, insight, and decision process. Reproductive ability is the cognitive behavior with memory, language, and learning process. Moreover, the Gestalt psychology theory involves with this test. The figure and ground concept comprise the perception of human of principle of nearness or proximal, principle of similarity, principle of continuity or common fate, and principle of closure that are the laws of perceptual grouping.

JC Raven described the intelligence development of children by step follow: First, children must discriminate the same thing with another. Next, they paid attention to the whole picture in perceptual field. They could compare the same
characteristic in many dimensions. Thereafter, they could understand and analyze the important and additional part. Lastly, they could build the scatter part to complete the picture. The 3 years old children could put the collect block into the form board with trial and error ability. Children at 4 years old could see the different form of any other blocks. 5 years old, children could put the right form to the same shape hole. For 7 years old, children could understand the spatial relation of block forms. 8 years old, children could understand the relation of the picture in the matrices and complete them. Children of more than 10 years old could think forward and backward from perception, and could complete the missing picture by themselves. These are similar to Piaget’s cognitive development theory. The CPM test could measure the intelligence of children with component of cognitive maturity, visual perception, verbal or reasoning ability, general factor, and training.

The CPM test could measure children’s intelligence by completing the geometric picture form in the matrices. It was ordering by difficulty related with the age. The children must select a piece of picture and add to the whole picture using a reason of completing a pattern, complete an analogy, introducing systematic permutation, and systematically resolve figures into the part. This test is effective with 5 – 11 year old children and the elder. This cultural fair test has the purpose to apply in a field of anthropology and psychology. There are 3 sub-tests of the CPM that consist of set A, AB, and B with 12 items in the each set.

The scoring system is giving 1 point with the collect answer in the each of item. Then use the total score compare with percentile norm that arranged by age. The interpretation can be separated into 5 classes show in table 5.
Table 5 Classification of the CPM test.

<table>
<thead>
<tr>
<th>Classification</th>
<th>Percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very-superior</td>
<td>More than 95</td>
</tr>
<tr>
<td>Superior</td>
<td>75 – 94</td>
</tr>
<tr>
<td>Average</td>
<td>25 – 74</td>
</tr>
<tr>
<td>Low-average</td>
<td>5 – 25</td>
</tr>
<tr>
<td>Deficient</td>
<td>Less than 5</td>
</tr>
</tbody>
</table>

The Validity of the CPM test

From the study of Fletcher, Todd and Satz (40) found the CPM test correlated with the IPAT culture fair test was .63, and WAIS was .68. Martin and Weichers found the level of correlation between the CPM and WISC was .91. These showed the CPM test could measure the intelligence of children. Moreover, Sucheera Phatrayutawat et. al. (41) and Witchayar Moleechart (43) revealed that the CPM could measure the ability of cognition and perception which inducted from g-factor ability of Spearman.

The Reliability of the CPM test

Raven (42) studied reliability of the CPM test by using internal consistency technique. He found the rate of reliability between .85 - .90, but this rate decreased when subject of the test changed to mentally retarded children. After, he studied test-retest technique and found that the rate of reliability was more than .80. Sucheera Phatrayutawat et. al. (41) developed Thai standard norm and studied internal consistency of reliability by Kuder-Richardson 20 found the rate to be .91. The study of characteristic of the CPM test in 6 – 18 years old Thai children, Siree Udomphol (44) who studied in northern part of Thailand found reliability was .92. Benjawan Runsewa (45) who studied in southern part of Thailand found that reliability was .91. Chantanee Mungkhetklang (46) who studied in Bangkok metropolitan found reliability was .90. Wararat Intuptim (47) who studied in eastern of Thailand found
reliability was .92. Witchayar Moleechart (43) who studied in north-eastern part of Thailand found reliability was .92. Sudarat Sirisakpanit (48) who studied in central part of Thailand found reliability was .92. Finally Sureerat Palakas (49) who studied in western part of Thailand found reliability was .92. These confirmed the CPM test has a characteristic of the intelligence measurement, built upon the standard norm arranged by the age and grade of the students.


The VMI-4R test was developed by Beery K.E. (50) in 1997. The test aimed to measure the neuropsychological function specific in visual-motor coordination by copying the 27 geometric pictures, which based on difference stage of children development. This test is a virtually cultural fair because it could be used for children of difference culture. In 1964, this test named the developmental form sequence test. After the studied of standard norm in America, the name of this test changed to VMI, and VMI-2R in 1981. After that the study of cross validation in America found the result of testing was not difference in the each of states. Thus, the VMI-3R was releasing in 1989 that use for 2 – 18 years old children. Since 1977, the VMI-4R was released and used for measure visual – motor function of children. This version was developed to include the scoring system, standard score, standard deviation, standard error, and international content.

The VMI-4R contains the 27 pictures of lines and geometric forms ordering by development of children drawing. This could test both of individual and group situations, and only needs 10 – 15 minutes to finish the test. Scoring is by giving 1 point if the child could perform as criteria. Then, change the raw score to standard score following by age, or compare with percentile table.

Purpose of this test is for measuring neuropsychological ability with input-output function. This is useful for children with Neuropsychology disability such as learning difficulty, learning disability, and having behavioral-emotional problem. The neuropsychological function specifically visual – motor coordination is important for
children to read, write, and thus, their achievement. Moreover, the sensory-motor function involves with the intelligence development and abstract thinking.

The visual perception is important with human development, and will improve by age. The factors that influenced with this ability are Nativism and Empiricism concepts. The Nativism concept is a mental process of human. Whereas, the Empirical concept is the mental process that develops from experience. Theses are involving with practice and adjustment ability of children. The disability in perceptual function might deal with learning and achievement problems of children. Because of perceptual function are about reading, writing, drawing of children that could improve their intelligence, the children develop their ability by balancing new experience, or adjusting themselves to a new situation.

Moreover, the visual perception and eye-hand coordination related with intelligence in component of cognition and neuropsychological maturity, perceptual function, spatial relation, logical reasoning, and abstract thinking. Moreover performance ability from intelligence theory of Wechsler, Vernon, and g-factor of Spearman showed the VMI-4R test could measure the neuropsychological components of children.

The study of characteristic of the VMI-4R, Beery K.E. (5, 50, 51, 52, 53) can be shown as follow.

**Validity of the VMI-4R test**

The study of correlation between visual-motor coordination and the age of children showed a high correlation at the rate .89. The correlation study with Primary Mental Abilities test (PMA test) showed the VMI-4R correlated with PMA test in grade 1 student at the rate .59, grade 4 students at .37, and grade 7 students at .38. The correlation study between the VMI-4R and WISC-R test found the VMI-4R correlated with verbal part at .49, performance part at .56, and full scale at .56. Another, the VMI-4R correlated with Slossen Iqs at .50, and Stanford-Binet Suzuki at .38 - .45.
The correlation between the VMI-4R and achievement was .50, and increasing when compare with mathematic scored.

When use the VMI-4R in mentally retarded children and children with visual impairment it was found they could perform the test with less of quality, although not difference between children with speech delaying and normal children. Another, the correlation between the VMI-4R and Forstig test showed a high correlation (r. =80).

**Reliability of the VMI-4R test**

The study of reliability by using interrater technique found reliability between .58 - .99. Using of test – retest technique found reliability between .63 - .92 with .81 of median. Using of split – half technique by division to 2 subtests with the each of 12 pictures found the correlation between .66 - .92 with .78 of median. The study by using odd – even splits technique after 1 year found the internal correlation between .76 - .91 with .85 of median.

Keerati Bannakulroj (5) studied the standard norm of the VMI3R in elementary school student in Bangkok metropolitan. He found that the student had the different score when compared with age and sex with statistical significance of .05, but there were no difference between difference schools. Another, he found that the Thai standard score was higher than standard score in manual of the VMI-3R test.

**7. Conceptual Framework**

The DAP test is the psychological tests that measures the intelligence by scoring form human figure drawing, which must use ability of input – output process. When the children heard the instruction, sensory organ reacts and responses to interpretation at the brain. The process in the brain is managing data to understand the instruction by using ability of verbal function, memory, restore, imagination, and cognition. These based on the theory of cognition maturity, visual perception, with reasoning ability, and performance ability to perform the product. Theory of Gessell
and other development of children drawing can help the children’s intelligence. While, the CPM test is using to measure intelligence by completing the missing parts of the whole picture. This performance must using ability of visual perception, logical reasoning ability, educative and reproductive ability to complete the answer. Raven J.C. used these concept to condition the problem solving ability in the matrix that consist of visual analyzing, spatial relation, similarity, understanding, and identifying of object. The processes used to complete the picture by using ability of building, discriminating, logical reasoning, forward and backward thinking. These are similar verbal or reasoning ability of Wechsler and Vernon theory. The VMI-4R test has the purpose of neuropsychological measuring by copying a line and geometric form. These processes must use ability of perceptual function specifically visual perception. It includes object perception, constancy of direction, color, size, shape, and location. Other theory is figure and ground theory of Gestalt psychologist group. This theory said about law of visual perception that consist of rule of nearness, rule of similarity, rule of continuity, and rule of closure. Another is Nativism and Empirical concept that close to cognitive maturation of children. The output function performed by psychomotor system that related with maturity and training. The psychomotor system consists of fine motor, eye – hand coordination, and gross motor. These are basic abilities to write, read, and draw a line, picture, and alphabet that help the children to seek more knowledge from learning and improve their intelligence.

All of 3 tests were related by theory structure as shown in table 6 which consist of verbal understanding, maturity, visual perception, visual memory, recognition, logical reasoning, creativity, planning, eye-motor coordination, and productivity of the characteristic of DAP test. While the CPM measure visual perception ability, and VMI-4R measure eye - hand coordination ability. Therefore, they were used as the external criteria of this study.
Table 6 The structural theory correlation between the DAP, CPM, and VMI-4R

<table>
<thead>
<tr>
<th>CPM</th>
<th>DAP</th>
<th>VMI-4R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal Understanding</td>
<td>Verbal Understanding</td>
<td>Verbal Understanding</td>
</tr>
<tr>
<td>Maturity</td>
<td>Maturity</td>
<td>Maturity</td>
</tr>
<tr>
<td>Visual Memory</td>
<td>Visual Memory</td>
<td>Visual Memory</td>
</tr>
<tr>
<td>Recognition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Logical Reasoning</td>
<td>Logical Reasoning</td>
<td>Eye-Motor Coordination</td>
</tr>
<tr>
<td>Creativity</td>
<td></td>
<td>Productivity</td>
</tr>
<tr>
<td>Planning</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CPM and VMI test were used as the external criteria to check the characteristics specific for validity with the DAP test. Because of the CPM test measures the visual perception and reasoning ability, and the VMI test measures the eye – hand coordination ability. They could covers both of logical reasoning and performance ability like intelligence test of Wechsler and Stanford-Binet.
CHAPTER III
MATERIALS AND METHODS

This research was designed to study the validity of Draw A Person (DAP): A Quantitative Scoring System by focusing on the correlation coefficient with The Colored Progressive Matrices (CPM) and the Visual-Motor Integration, 4th Edition, Revised (VMI-4R). The subject was Chiang Mai elementary school students, aged between 7 – 9 years old, which studied in 2nd semester of academic year 2005. The procedures of study were as follow:

1. Population and Sample
2. Materials of the Study
3. Data Collecting
4. Data Analysis

Population and Sample

Population

The population in this study was Chiang Mai elementary school students, both boy and girl, aged between 7 – 9 years old, who were studying in 2nd semester of the academic year 2005 at schools under the office of the national elementary education commission in Chiang Mai province. From the literatures it was found that the age between 7 – 9 years old are of the critical period of many developmental systems specifically in neuropsychology, psychomotor, eye-motor integration, perceptual function and concrete thinking. All of these prepare children to read, write, draw, and think that improves their higher cognitive function. At this age, children could draw a picture with the real characteristic and systematic that showed the maturity of cognition to seek for knowledge in the education system.
Sample

The sample of this research was calculated by Linderman’s rule of thumb (18) and selecting the sample by purposive and quota sampling from the target population. The process was as follow:

1. The 100 Chiang Mai elementary school students were calculated by Linderman’s rule of thumb. His rule conditioned the acceptance minimum size at least 100 cases or 20 cases per 1 variable in the correlation research that study factor, path, or discriminant analysis. This research had 3 variables consisting of the validity of the DAP test, the correlation between the DAP and CPM test, and the correlation between the DAP and VMI-4R test. As mentioned, there were 60 cases from calculation that less than the least size of the rule. For more accurate the sample was extended to 100 cases.

2. Watveruwan School at Amper Sarapee was selected to represent the Chiang Mai elementary school under the office of the national primary education commission. Because of this public school has a moderate size (500 – 1,499 students), the location not far from Chiang Mai city (about 10 kilometers), and the students came from all districts of Amper Sarapee, some from Amper Meung and Amper Sankampaeng. This showed Watveruwan School has the variety of students both of the socioeconomic status and having located in Chiang Mai province. After that, the simple random sampling was used for the 7 – 9 years old students who were studying in 2nd semester academic year 2005 to be the samples.

3. The studied to apply the efficiency cut-off score, 24 mentally retarded students, both boys and girls, aged between 7 – 9 years old, from Kawila-anukoon School, which is a special education school were selected to consider the effective sensitivity and specificity.

4. The numbers of sample from Watveruwan and Kawila-anukoon schools were shown below
Table 7 Distribution of students from Watveruwan and Kawila-anukun schools.

<table>
<thead>
<tr>
<th>Schools</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Watveruwan</td>
<td>50</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>Kawila-anukun</td>
<td>12</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>62</td>
<td>124</td>
</tr>
</tbody>
</table>

Selection Criteria

The mentally retarded students in this research were Mild Mental Retardation (MMR) or Educable Mental Retardation (EMR) who diagnosed by the physician. They had the IQ range between 50 – 70, could understand the instruction, having no visual impairment or deaf.

Materials of the study

1. Draw A Person test (DAP): A Quantitative Scoring System is a nonverbal intelligence test for 5 – 17 years old children. It was developed by Jack A. Naglieri in 1998. The instruments of this test consist of pencil, rubber, stopwatch, and 3-paper size A4 to draw a man, a woman, and self. The criterion analysis consists of criteria, categories, and Items from 12 parts of the body (arms, ears, eyes, feet, fingers, hair, head, legs, mouth, neck, nose, and trunk) with attachment and clothing. Scoring from 4 considerations are presentation, details, proportion, and bonus scores. Maximum of 5 minutes per a picture was allowed to complete the drawing.

2. The Colored Progressive Matrices (CPM) is a nonverbal intelligence test for 5 years – 11 years 11 months children. It developed by Raven J.C in 1938. The CPM has 3 sub-tests consist of set A, AB, and B that contained 12 items in each of set. The items were the 36-matrices question booklet and answer sheet. 30 – 45 minutes were allowed to complete the matrix questions.

3. The Visual-Motor Integration, 4th Edition, Revised (VMI-4R) is a neuropsychological test for 3 – 18 years old developed by Beery K.E. The instrument
was a 27-item booklet that arranged by children development. 10 – 15 minutes was allowed to copy the 27 geometric in the blank space under the model picture.

**Data Collecting**

The researcher conducted the tests by himself during 2nd semester of academic year 2005 at classroom location.

The 100 normal students divided into 13 small groups. Eleven groups had eight students and two groups had six students each for appropriately took care of the students.

**Stage of Collecting Data**

1. Applied the DAP and VMI 4R tests because both tests could use to make the relationships with children easily, and help them to prepare themselves with the following more difficult task.

2. Then giving the CPM test which measure abilities of logical reasoning that need more attention and concentration, and spent more time than the DAP and VMI-4R test.

Mentally retarded students who be used as a gold standard were individually tested. Because they had limitation of understanding, attention, concentration, and impulsivity. They need paid more attention or encourage to perform the test.
Data Analysis

The personal data and the results of the tests were analyzed by using the SPSS/PC+

1. Using basic statistic to calculate the children intelligence and neuropsychological function measured by:

   1.1 Draw A Person (DAP): A Quantitative Scoring System.
   1.2 The Colored Progressive matrices (CPM).
   1.3 The Visual-Motor Integration, 4th Revised (VMI 4R).

2. The analysis of psychometric properties of the DAP test.

   2.1 Criterion related validity by using Pearson Product Moment Correlation Coefficient to study the intellectual ability score measured among DAP with CPM and VMI 4R tests.

   2.2 Reliability analysis with the 14 criteria of DAP test, which consist of arms, ears, eyes, feet, fingers, hands, hair, head, legs, mouth, neck, nose, body, attachment, and costume, by using Conbach alpha coefficient.

3. Analyzing for efficiency cut-off score by considering sensitivity and specificity from intelligence score measured by the DAP test between normal student and mentally retarded student.
CHAPTER IV
RESULTS AND DISCUSSION

The purpose of this research was to study the validity of Draw A Person (DAP): A Quantitative Scoring System in 100 Chiang Mai elementary school students, aged between 7 – 9 years old. The external criteria to study correlation coefficient were The Colored Progressive Matrices (CPM) and The Visual Motor Integration, 4th Edition, Revised (VMI-4R) tests. In the part to study the cut-off score of the DAP test, 24 known cases of mentally retarded children were used to consider the effective sensitivity and specificity. The results show in 3 parts by descriptive table follow:

Part 1: Demographic data of the sample.
Part 2: Statistical value of the DAP test.
Part 3: The applying study to set the cut-off score of the DAP test.
Part 1: Demographic data of the sample.

A sample of this research had equal numbers of boys and girls. The normal students were not different in number of 7 – 7 11/12 years old and 8 – 8 11/12 years old (42% and 53%). However the group of 9 – 9 11/12 years old had a few numbers (5%) that might not be good to apply with the target group of this level. The sample was studying grade 1 and 2 with the nearly number. But the group of mentally retarded student had majority in the aged of 9 – 9 11/12 years old (45.83%), studying in grade 1 (62.50%). These bring a consideration that the symptoms of this group was delaying of development and learning that effect to educational participation.

Part 2: Statistical Value of the DAP test.

The psychological characteristic of measurement of the DAP test was done by calculated validity and reliability as follow:

Validity

The validity of the DAP test analyzed by Pearson product moment coefficient correlation with the CPM and VMI-4R tests.

| Table 8 The correlation among the DAP test with the CPM and VMI-4R tests. |
|-----------------|-----------------|-----------------|
|                 | DAP             | CPM             | VMI-4R          |
| DAP             | .393*           |                 |                 |
| CPM             |                 | .488*           | .318*           |
| VMI-4R          |                 |                 |                 |
| Mean            | 126.20          | 21.20           | 18.47           |
| SD              | 18.28           | 7.44            | 3.21            |
| Min.            | 66              | 3               | 7               |
| Max             | 165             | 34              | 24              |

*P < .05
Table 8 showed score of the DAP test correlated with the CPM and VMI-4R tests at the moderate level accompanying by statistically significance at level .001. Even though, the DAP test is more correlated with the VMI-4R test than the CPM test (r= .488 and .393). This is because the structure of theory and administration of the DAP and VMI-4R test are more similar than the CPM test. The DAP and VMI-4R tests measures the function of verbal understanding, maturity, visual perception, visual memory, eye-motor coordination, and productivity to complete the whole picture. The CPM and DAP test measure verbal understanding, maturity, visual perception, and logical reasoning to variety the performance. Besides, the correlation between the CPM and VMI-4R test was at the moderate level (r=.318) of statistically significance at .001 level, which was less than the correlation between the DAP with CPM and VMI-4R test. Because the nature or structure of the CPM and VMI-4R test are not for the same purposes, but they have the same of structural theories, which are verbal understanding, maturity, and visual perception.

From calculation by basic statistic of the DAP, CPM, and VMI-4R test. It was found that the DAP test had more appropriate dispersion of score than the CPM and VMI-4R test. Concluded with the minimum score from 3 tests had done by the same person. It might be that the student was a mentally retarded child, which the parents never known. Because the CPM and VMI-4R test are the standardized and accepted by psychologist to use clinically for measuring the intelligence and neuropsychological function of children, for the appropriate management, he should be retested with formal intelligence test to give him the right management.

Reliability

The reliability analysis in this research was laid down by Conbach alpha coefficient from 14 criteria of the DAP test. These include arms, ears, eyes, feet, fingers, hair, head, legs, mouth, neck, nose, trunk, attachment, and clothing. The result of calculation was .8840.
From the study of measurement of the DAP test studied revealed that the DAP test had a moderate correlation with the CPM and VMI-4R test (r = .393 and .488) by statistical significance of .001 level, and had a high reliability (.8840) from calculation the Conbach alpha coefficient. This showed that the DAP test had sufficient of psychometric property to measure the intelligence of 7 – 9 years old students.

Part 3: The applying study to set the cut-off score of the DAP test.

In the part of applying study to set the cut-off score, 24 mentally retarded children used as the gold standard. The details of score from the DAP test in this part performed in the table as follow:

Table 9 Statistical values between normal and mentally retarded students on the picture of man, woman, and self.

<table>
<thead>
<tr>
<th></th>
<th>Man</th>
<th>Woman</th>
<th>Self</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal Student</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>43.01</td>
<td>42.02</td>
<td>41.17</td>
<td>126.20</td>
</tr>
<tr>
<td>SD</td>
<td>6.72</td>
<td>6.87</td>
<td>6.69</td>
<td>18.28</td>
</tr>
<tr>
<td>Min.</td>
<td>19</td>
<td>25</td>
<td>22</td>
<td>66</td>
</tr>
<tr>
<td>Max.</td>
<td>57</td>
<td>60</td>
<td>57</td>
<td>165</td>
</tr>
<tr>
<td>Range</td>
<td>38</td>
<td>35</td>
<td>35</td>
<td>99</td>
</tr>
<tr>
<td>CV</td>
<td>15.62</td>
<td>16.34</td>
<td>16.24</td>
<td>14.48</td>
</tr>
<tr>
<td>Mentally retarded student</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>14.17</td>
<td>12.17</td>
<td>9.92</td>
<td>37.00</td>
</tr>
<tr>
<td>SD</td>
<td>7.30</td>
<td>7.83</td>
<td>6.99</td>
<td>19.65</td>
</tr>
<tr>
<td>Min.</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>21</td>
</tr>
<tr>
<td>Max.</td>
<td>32</td>
<td>38</td>
<td>31</td>
<td>101</td>
</tr>
<tr>
<td>Range</td>
<td>24</td>
<td>34</td>
<td>26</td>
<td>80</td>
</tr>
<tr>
<td>CV</td>
<td>51.51</td>
<td>64.33</td>
<td>70.46</td>
<td>53.10</td>
</tr>
</tbody>
</table>

Table 9 showed that the score of a man, woman, and self-picture from the group of normal student were not greatly different of the mean score. Additionally the dispersion of score was suitable. Furthermore, the CV analysis showed the value
nearly 15% similar to the CPM and VMI-4R tests, which used as external criteria. Moreover, this result was close to the standardized intelligence test as the Wechsler, which has the standard score at the level 100 with 15 SD. Consequently, the score of the DAP test in this research could be adjust to 100 and can be use as standardized intelligence test.

The result of the mentally retarded student could take the performance in drawing a man picture better than a woman and self picture. Also, the standard deviation, range, and CV showed too much of score dispersion. These might be of the biological factor, severity, duration, and treatment differences for each child in this group. In conclusion drawing skill and aptitude of this group might effect to the random error in this research.

In the part of cut-off score studied by calculating sensitivity and specificity taken by considering the score that could discriminate mentally retarded student from normal student. That score set by calculating from mean of the mental retarded group and added ½ of its standard deviation to the mean of the normal group minus of its standard deviation could be shown in table 10.

<table>
<thead>
<tr>
<th>Scores</th>
<th>Sensitivity (%)</th>
<th>Specificity (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>91.66</td>
<td>100</td>
</tr>
<tr>
<td>66</td>
<td>91.66</td>
<td>99</td>
</tr>
<tr>
<td>~</td>
<td>~</td>
<td>~</td>
</tr>
<tr>
<td>85*</td>
<td>95.83</td>
<td>98</td>
</tr>
<tr>
<td>~</td>
<td>~</td>
<td>~</td>
</tr>
<tr>
<td>95</td>
<td>95.83</td>
<td>96</td>
</tr>
<tr>
<td>96</td>
<td>95.83</td>
<td>94</td>
</tr>
<tr>
<td>~</td>
<td>~</td>
<td>~</td>
</tr>
<tr>
<td>99</td>
<td>95.83</td>
<td>92</td>
</tr>
<tr>
<td>~</td>
<td>~</td>
<td>~</td>
</tr>
</tbody>
</table>
Tables 10 shows the range of score between the mean of mentally retarded student group plus of ½ its standard deviation to the mean of normal student group minus ½ of its standard deviation. All of score in this range has a high level both of sensitivity and specificity (more than 90%). At the score level 85, it shows a high level both of sensitivity and specificity (95.83% and 98%). At the score level 65, it has the top score of specificity (100%) but score of sensitivity decreases (91.66%). And at the score level 101, it has the top score of sensitivity (100%) but score of specificity decreases (91%).

Table 11 The event proportion of mental retardation between sample and gold standard group from the DAP test.

<table>
<thead>
<tr>
<th>Mental Retardation</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive (Less than 85)</td>
<td>23</td>
<td>25</td>
</tr>
<tr>
<td>TP</td>
<td>23</td>
<td>2</td>
</tr>
<tr>
<td>FP</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td>Negative (More than 85)</td>
<td>1</td>
<td>99</td>
</tr>
<tr>
<td>FN</td>
<td>1</td>
<td>98</td>
</tr>
<tr>
<td>TN</td>
<td>99</td>
<td>99</td>
</tr>
<tr>
<td>24</td>
<td>100</td>
<td>124</td>
</tr>
</tbody>
</table>

Table 11 showed the proportion of event relationship between mental retardation and the sense of intelligence measured by the DAP test appeared with 4 characters as follow:

1. True Positive (TP): had positive score from the DAP test (less than 85) and be mentally retarded.
2. False Positive (FP): had positive score from the DAP test (less than 85) but no mental retardation.
3. True Negative (TN): had negative score from the DAP test (more than 85) and no mental retardation.

4. False Negative (FN): had negative score from the DAP test (more than 85) but be mentally retarded.

The DAP test was correct in measuring the 23 mentally retarded student (true positive: TP) and 98 normal students (true negative: TN), and was false in measuring 2 normal students (false positive: FP) and 1 mentally retarded student (false negative: FN). From these proportions could calculate the sensitivity, specificity, and the false proportion to discriminate symptom at the level 85 as table 12

Table 12 The formulation of sensitivity, specificity, and the false proportion to discriminate symptom, and the results of the cut-off score level at 85

<table>
<thead>
<tr>
<th>Lists</th>
<th>Formulation</th>
<th>Result (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity of testing</td>
<td>[\frac{TP}{TP+FN}]X100</td>
<td>95.83</td>
</tr>
<tr>
<td>Specificity of testing</td>
<td>[\frac{TN}{TN+FP}]X100</td>
<td>98.00</td>
</tr>
<tr>
<td>The false proportion to discriminate symptom</td>
<td>[\frac{(FP+FN)}{(TP+TN+FP+FN)}]X100</td>
<td>2.42</td>
</tr>
</tbody>
</table>

Table 12 showed the cut off score level at 85 had the high level both of sensitivity and specificity of testing (95.83% and 98%) and less of false proportion to discriminate symptom (2.42%). These showed the effective of this cut-off score that could discriminate students with mental retardation from normal students by gold standard with less of false proportion to discriminate symptom.
Discussion

1. The characteristic of psychological measurement of the DAP test.

1.1 Validity of the DAP test

This research was investigate the validity of the DAP test with the CPM and VMI-4R tests.

1.1.1 Correlation coefficient analysis between the DAP and CPM tests.

The Pearson product moment correlation coefficient analysis found that the score from the DAP test had correlated with the CPM test in a moderate level (r= .393) by statistical significance of .001. These showed that the 2 tests based on the same nature or structural theories, which are verbal understanding, maturity, visual perceptions and logical reasoning. The same result of Niyot Sangthongluan (31) who studied the correlation between the DAP and CPM test in Bangkok students found the correlation of these tests by statistical significance of .001. These showed that the DAP and CPM test had the correlation of intelligence structure specifically in the part of visual perception domain. Kirati Bunnakulroj (5) said that, the children age more than 6 – 7 years old should develop their visual discrimination. The visual perception advances with their development. It begins with object perceiving and would develop their visual discrimination later. This is similar to Piaget’s developmental of intelligence theory. The children age between 7 – 11 years old are in the stage of concrete thinking. They can use the reasons of mathematics, discriminating, ordering, categorizing, and sequencing to adjust their perception. In this period, there has a sign to show that the children could be using the comparison thought to compare the object. But their ability is incompletely developed that made them perceive only object that appear with their perception, which might not collect with real object. The children before this period could not understand about conservation. They could not reversion of though or systematic thinking. Formanek and Gurian (54) said about the factor of conservation that consist of comparison
understanding, perceiving 2-dimension object, understanding of whole and detail, and reversing of thought. Then, the visual perception and reasoning thought related with children development by step. Virash Jabthanom (55) studied the reasoning function of the elementary school student and found that older students used the logical reasoning more than the younger. Karnkeaw Pong-udom (5) studied about the logical reasoning of children found that this ability would more be effective in higher-grade level children than the lower one.

Moreover, the developmental of visual perception and intelligence related with children’s human figure drawing. Gesell (13), Brigance (31), Burt (32), and Prapatsorn Niyomthum (34) said that the line or picture drawing of children would develop by their age. The older children could draw a picture more complete with right details than the younger. At the age between 7 – 9 years old, they should draw a 2-dimension line, geometric, and multi-angle form and the 3-dimension drawing such as tube and cube form follow. This ability would develop with verbal and writing language. They could understand about width, height, and depth that made the picture drawing would complete with the right details. Furthermore, the drawing is a method of using the basic lines and geometric forms related in the right detail and location. These used ability of spatial relationship and reasoning. As mentioned, the quality of picture drawing could tell children’s intelligence. Raven (42) said, the quality of intelligence in matrices relationship that begin with the discrimination of the same stimulus from others stimulus. Children could compare the sameness of the object when it changed. They could perceive the important thing and details that use ability of figure and ground discrimination, and could complete the scatter figure. These abilities are developing with age. At the age of 7 years old, the children should understand the scatter spatial relationship. They should perceive the object or picture in many dimensions both of stability and moving dimensions. Then, the age and maturity would increase with the motor and intelligence development that involve with children’s drawing.

The picture drawing from the DAP test and completing the scatter picture in the CPM test are relating with visual perception and intelligence development theory.
Moreover, it involves with G-factor concept, which is the general of intelligence ability of Spearman’s theory. There consist of Eductive that is method of understanding from passed experience, and Reproductive that consist of memory, language, and learning ability. Beside, the intelligence theory of Wechsler and Vernon involved in the part of verbal or reasoning ability. This brain activity contains the factor of verbal reasoning to solve the problem. Then, when calculate the correlation between score of the DAP and CPM test found that they correlated at moderate level ($r=.393$), at the statistical significance of .001. These showed that the DAP test could measure the children intelligence with ability of visual perception, logical reasoning, and spatial relationship effectively.

1.1.2 Correlation coefficient analysis between the DAP and VMI-4R tests.

From the calculating by Pearson product moment correlation between the DAP and VMI-4R test found that there had correlated at the moderate level ($r=.488$) with statistical significance of .001. Because they have the same structural theory specifically in the part of verbal understanding, maturity, visual perception, visual memory, eye-motor coordination, and productivity to complete the picture drawing. This is the same for Gessell (13) and Brigance (31) who said to the line and geometric form that the 7 – 9 years old children could draw. It begins from copying of the 2 dimension and they would develop to draw the 3-dimension picture such as tube and cube form gradually. Burt (32) said that the characteristic of children’s picture drawing would develop step by step. The age between 7 – 9 years old is the stage of realistic of picture drawing. They could draw a picture with right details systematically. Prapatsorn Niyomthum (34) said that children could draw a complete human picture at the age between 5 – 7 years old. Similar with Goodenough (33) who said that children could build the details into the whole picture with single form at the age of 7 years old. This is the same result of Prapaijit Suksawat (57) who studied the development of size perception in children. The result showed the children drawing ability improves by age similar to Piaget theory. As mentioned, when the children grow up they would contact with the environment more than when they were younger.
which this could affect to cognition development. Porn Detchaiyan (58) who studied the developmental of conservation and visual perception in 7 – 9 years old children, she found that the sample was increasing of cognitive ability with the age. Manee Lertpanyanutch (59) studied the conservation of length, spaces, and content in 6 – 13 years old students. This study showed all of the conservation developed with age as well. As a result, the developmental of children’s picture drawing and maturity of neuropsychological system are improving with their age and environment contacts.

Many studies show that picture drawing would be more complete in mature children. Besides, Piaget (19, 20, 21, 22) said that the cognition development would improve by maturity. The age between 7 – 9 years old is the stage of concrete thinking. The children could think with logical reasoning, calculating, discriminating, categorizing, ordering, and sequencing ability. Naglieri (14, 15) who studied American children, Saklofske et al. (60) who were studying in Japanese children, and Thitiwan Futrakun (32) who studied children from the central Thailand found that the score from the DAP tested were increasing by the age or maturation of children. Moreover, the picture drawing ability relates with theory of Spearman (19, 20). The G-factor theory of Spearman specifically in the part of reproductive that consists of memory, language, knowledge, and cultural learning involve with thinking behavior. In addition, another theory that relates with picture drawing is the Wechsler and Vernon theory. These theories involves with drawing ability in the part of performance or practical education, which is the activity of motor movement and practice.

As mentioned, the DAP test related with the VMI-4R test at the moderate level (r= .488) with statistical significance of .01. This showed the DAP test could measure the intelligence of children specifically in the part of verbal understanding, maturity, visual perception, visual memory, eye-motor coordination, and productivity. These are the same as Piaget developmental of cognition, Spearman g-factor theory, Wechsler and Vernon theory in the part of performance ability or practice education. Then, the DAP test could be use for measuring the intelligence of children effectively with statistical significance.
1.2 Reliability of the DAP test

From reliability analysis by Conbach alpha coefficient calculation in the group of sample who were normal students aged between 7 – 9 years old. Reliability of the DAP test was .884 which close to Naglieri’s result (14, 15). Naglieri studied in American children age between 5 – 17 years old, found reliability between .83 - .89 and .86 of the median. Then, the Conbach alpha coefficient showed that the 43 criterions from 3 pictures had a high level of the measurement by internal consistency technique. These showed the 42 criterions from 3 pictures were correlated. The result revealed that the human figure drawing from the DAP test is a homogenous concept. Additionally, the score of the sample was efficiency dispersing (SD=18.28) and wide range (range=99), concluded with sufficient of sample size and the test was easy to response. These affects to the characteristic of the test. Similarity Pawida Sheunsheuy (39) who surveyed the attitude on children’s human figure drawing found that many children felt happy and fun in their art session. The painting is the favorite thing that children need to do, and they need to learn more about the technique of human figure drawing.

In addition Pearson product moment coefficient between the DAP with CPM and VMI-4R test found the moderate level of correlation (r= .393 and .488) with statistical significance of .001 level. Then, calculating for reliability using Conbach alpha coefficient technique it was found that the high level of reliability (.8840). These showed the DAP test had a characteristic of intelligence measurement in the 7 – 9 years old student. Thus, the DAP test could be used to measure intelligence of children effectively.
2. The applying study to set the cut-off score of the DAP test

The efficient cut-off score that had the power to discriminate mentally retarded student from normal student was level at 85. This cut-off score had the high level both of sensitivity and specificity (95.83% and 98%), and less of false proportion to discriminate (2.42%), which used as purpose of screening and diagnosis. For the best accuracy of diagnosis, the cut-off score level 65 should be used because it had a highest level of specificity (100%), but the level of sensitivity would be decreased (91.66%). However, for purpose of screening, the score level 101 had the highest sensitivity (100%) but the level of specificity decreased to 91%.

The cut-off score level at 85 was close to other study. First is the study of Naglieri (14, 15), she was studying the DAP test and set the American standard norm. The cut-off score in children age between 7 – 9 years old was between 72 – 95. Thitiwan Footrakool (32) was studied in central part of Thailand found the cut-off score was between 91 – 109 which was not significant different from American and this research cut-off score. Plus of Saklofske et al (60) studied in Japanese children found the cut-off score not significantly higher than American cut-off score too.

It was found some error of the gold standard group, the cut-off score level at 85 had the sensitivity level at 95.83% and specificity level at 98%. The sensitivity level at 95.83% means that the 23 gold standard detected by this cut-off score, but 1 of them was falsely negative. The specificity level at 98% means that the 98 normal students were true negative but 2 of them were falsely positive. The false proportion to discriminate in this research revealed 2.42%. This means from 124 students consist of normal student and gold standard group, the DAP test was a false of measurement for 3 cases that consist of 2 false positive and 1 false negative.

However, the error from the measurement by the DAP test could be described into 2 situations. First situation is the false positive in 2 normal students. This situation found that the one of them had the lowest score from all of 3 tests. It could be that student had the symptom of mental retardation and the parents never knew.
Another case was a random error of this research because the score from the CPM and VMI-4R tests were average. Another situation is false negative in a mentally retarded student. This student could perform and got score from the DAP criterion but had less of quality of drawing. These show the limitation and error of the test that uses only a quantitative analysis technique but not qualitative analysis. In conclusion, the DAP test should not be used alone to measure intelligence but it should be used as supplements to standardized intelligence test or to confirm the result of the other tests.
CHAPTER V
CONCLUSION AND RECOMMENDATION

The research conducted with Chiang Mai elementary school students who were studying in 2nd semester of the academic year 2005, aged between 7 – 9 years old. The objective was to study the validity of Draw A Person test (DAP): A Quantitative Scoring System by correlation to the Colored Progressive Matrices (CPM) and The Visual-Motor Integration, 4th Edition, Revised (VMI-4R) tests. The sample in this study was 100 students from Watveruwan School calculated by Linderman’s rule of thumb, and 24 mentally retarded students from Kawila-anukun School used as gold standard.

Conclusion

Part 1: The Sample

A sample of this research included the equal number of boy and girl. The normal students were not different in number of 7 – 7.11/12 years old and those of 8 – 8.11/12 years old (42% and 53%). But the group of 9 – 9.11/12 years old was fewer in numbers (5%) that might not be appropriate to apply with this level target group. The samples were studying grade 1 and 2 with the nearly number. But the group of mentally retarded student was mostly in the aged of 9 – 9.11/12 years old (45.83%), studying in grade 1 (62.50%). These brought a consideration that this group was delaying of development and learning.

The investigation for validity and reliability of the DAP test found the DAP test related with the CPM and VMI-4R test at a moderate level (.393 and .488) at statistical significance of .001, which calculated by Pearson product moment coefficient. Although there was a high reliability (.8840) that calculated from Conbach alpha coefficient technique. These showed that the DAP test had ability to use in measurement children intelligence significant.

Part 3: The study to apply the efficiency cut-off score of the Draw A Person: A Quantitative Scoring System.

The score from DAP test of normal students in this research were efficient dispersing plus the CV near 15%. These could be adjust the score of the DAP test to the standard score at 100 similar to the CPM, VMI-4R, and Wechsler tests. But the CV and score of the students with mental retardation were greatly diverted. These might be because of their symptom, treatment, ability of drawing, plus attention and concentration while they took the test that made the random errors of this result.

The applied study to develop the efficient cut-off score, from consideration studied of the sensitivity and specificity, it was found that the score level at 85 had a highest power to detect the mentally retarded student. It had the level of sensitivity at 95.83% and specificity at 98% with low rate of false proportion to discriminate at 2.42%. This score could be used for the purpose of screening and diagnosis. Then, the result showed that the DAP test had quality of intelligence measurement with a practical or clinical importance, although there were some random errors in the research.
Recommendation

1. Recommendation on applying the result

1.1 The resulted of this research revealed that the DAP test had a moderate level of correlation with the CPM and VMI-4R test at statistical significance .001. Plus with the study to develop the efficiency cut-off score it was showed that it had a power to discriminate the student with metal retardation from normal student by considering sensitivity, specificity and false proportion to discriminate. In conclusion, the dispersion and CV of score in the group of normal student showed it could adjusts to standard score at level 100 and standard deviation 15 likes the CPM, VMI-4R, and Wechsler tests. These confirmed that the DAP test had an enough characteristic to measure the intelligence with statistical significance and practical or clinical importance. These could apply to measure intelligence of the elementary school student with purpose of screening and diagnosis. As mentioned earlier, the multidisciplinary staff who was trained about the DAP criterion scoring could use this scoring to screen children’s intelligence in order to confirm the result of other intelligence tests.

1.2 For helping intelligence screening purpose of teacher and parent, researcher made the example guideline to observe the human figure drawing of mentally retarded student as follow:

a) Drawing a very big head or have only head with face, legs, and arms.
b) Disappearing of neck, body, and costume.
c) Drawing the arms and legs with 1 or 2 dimension line likes a cross shape.
d) Drawing a circle mouth and eyes.
e) Using the single lines to draw the fingers and hair.

These signs should be relied upon with caution because other problem child might produce similar results even in a small normal child.
2. **Recommendation on further research**

2.1 For the efficiency in applying, the number of members should not be set too differently in each group. These could prevent errors when using the result of the research to measure the intelligence of elementary school students.

2.2 For more public utility, norm and standard score of Thai student would be created for effective intellectual interpretation from the DAP test.
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APPENDIX A
The Draw A Person: A Quantitative Scoring System Scoring Form: Example

ชื่อ-สกุล.............................................เพศ......วันที่ทดสอบ..............................
อายุ...............การศึกษา...............โรงเรียน..............................................

ค่าคะแนนในการทดสอบ

ระบบการให้คะแนน DAP มีกระบวนการที่เป็นมาตรฐานในการตรวจสอบ ผู้ให้กำลังทดสอบต้องปฏิบัติตามระบบการให้คะแนนที่กำหนดไว้อย่างเคร่งครัด โดยผิดกฏการวิเคราะห์ได้ผลอย่าง
ระบบตอบแทนของการให้คะแนนของ DAP (The DAP Scoring System) ซึ่งระบุเกณฑ์ไว้ในแต่ละข้อ โดยให้ 1 คะแนนหากผู้รับการทดสอบสามารถทำได้ตามเกณฑ์ และให้ 0 คะแนนหากผู้รับ
การทดสอบไม่สามารถทำได้ตามเกณฑ์.

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<td>• รายละเอียด 1 : แขนทั้งสองข้างเป็น 2 มิติ (หนึ่งข้างถูกเป็นรูปหน้าเสียะ) มีทั้งความยาวและความกว้าง</td>
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APPENDIX B
The Picture Drawing of Normal Student
Aged between 7 – 9 years old

MAN
The Picture Drawing of Normal Student
Aged between 7 – 9 years old
The Picture Drawing of Normal Student
Aged between 7 – 9 years old

SELF
APPENDIX C

The Picture Drawing of Student with Mental Retardation
Aged between 7 – 9 years old

MAN
The Picture Drawing of Student with Mental Retardation
Aged between 7 – 9 years old

WOMAN
The Picture Drawing of Student with Mental Retardation
Aged between 7 – 9 years old

SELF
APPENDIX D
The Ethical Committee on Research Involving Human Subject
Mahidol University, Bangkok
<table>
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<tr>
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<td>POSITION&amp;OFFICE</td>
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