A STUDY OF THE CORRELATION OF INTELLECTUAL ABILITY MEASURES BETWEEN DRAW A PERSON TEST AND THE COLOURED PROGRESSIVE MATRICES TEST IN PRIMARY SCHOOL STUDENTS IN BANGKOK

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE (CLINICAL PSYCHOLOGY) FACULTY OF GRADUATE STUDIES MAHIDOL UNIVERSITY 2004

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ACKNOWLEDGEMENTS

I would like to express my appreciation to Assoc. Prof. Kanokrat Sukhatunga, Major-Advisor and Lect. Kanitta Santikul, Co-Advisor for their guidance, invaluable advice, supervision and encouragement throughout. I am grateful to Assoc. Prof. Dr. Sucheera Phattharayuttawat for the advice in statistical analysis of the data and Lect. Nakorn Srisukho for his helpful and support as the external examiner.

Moreover, I would like to thanks Directors of Raewadee School, Wat Hong Rattanatam School, Wat Amarin Dhararam School, Wat Mahannop School, Rajaborpit School, Bhadungsit Pittaya School and Prachanives School for allowance in data collecting. Also, I wish to thanks teachers and parents of the students for the helpfulness and cooperation during data collection, these are including all students also. Furthermore, I extremely appreciate to Miss Suphattra Chuenberkban who always help, suggest, and support me.

Finally, I wish to express deep appreciation to my family, Dr. Tuenchitt Sangtongluan, Dr. Duangchitt Sikkarinkul and Miss Warapa Sangtongluan who always encourage me, all of my relatives and friends, Miss Kunnaree Na-Takuatung and Mr. Pramuk Nipharuk who never give up supporting and staying behind this success.

Niyot Sangtongluan
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ABSTRACT

The objective of this research was to study the correlation of intellectual ability measures between Draw A Person Test (DAP) and The Coloured Progressive Matrices Test (CPM) and to compare the mean of intellectual ability of subjects from DAP and CPM within a range of ages. The sample was 396 students, ages ranging from 6 years to 11 years 11 months (similar sample sizes of boys and girls), studying in schools overseen by 3 administrations in Bangkok: Office of the National Primary Education Commission, Office of the Private Education Commission and Bangkok Metropolitan Administration. The obtained data were analyzed by using Pearson Product Moment Correlation Coefficient, t-test and F-test at the statistically significant level of .05.

The results of this study revealed that the mean intellectual ability from Draw A Person Test (DAP) and the mean intellectual ability from The Coloured Progressive Matrices Test (CPM) in primary school students in Bangkok were different at the age range of 6 years to 9 years 11 months, but they were not different at 10 years to 11 years 11 months which can be explained by the character of the tests. There was a significant correlation between intellectual ability from DAP and CPM at the .001 level. The results imply that it is more appropriate to use different types of tests depending on the age of children being tested and the differences in testing environment to make up for differences in childrens’ abilities and limits in responding to the test.

KEY WORDS: INTELLECTUAL / TEST / DRAW A PERSON / COLOURED PROGRESSIVE MATRICES

68 pp. ISBN 974-04-4514-4
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บทคัดย่อ

การศึกษาวิจัยครั้งนี้มีวัตถุประสงค์เพื่อศึกษาความสามารถพื้นฐานระหว่างระดับชววัยของนักเรียนที่วัดจากแบบทดสอบวาดภาพคน (DAP) และแบบทดสอบ The Coloured Progressive Matrices (CPM) โดยพิจารณาผลเฉลี่ยของระดับชววัยที่ได้จากแบบทดสอบทั้งสองตามด้านอายุ กลุ่มตัวอย่างเป็นนักเรียนอายุระหว่าง 6 ปีถึง 11 ปี 11 เดือน ในกรุงเทพมหานครที่ศึกษาในโรงเรียนสังกัดสำนักงานคณะกรรมการการศึกษาแห่งชาติ (สปช.) สังกัดสำนักงานคณะกรรมการการศึกษาเอกชน (สช.) และกรุงเทพมหานคร (ภทม.) จำนวน 396 คน เป็นชายและหญิงจุดละเท่ากัน โดยวิธีการสุ่มตัวอย่างแบบง่าย วิเคราะห์ความแตกต่างของค่าเฉลี่ยของระดับชววัยที่วัดจากแบบทดสอบทั้งสองโดยใช้ t-test และ F-test และหาค่าสัมประสิทธิ์สหสัมพันธ์แบบเพียร์สัน โดยถือความมีนัยสัมพันธ์ทางสถิติที่ระดับ .05 เป็นเกณฑ์ ผลการศึกษาพบว่า ค่าเฉลี่ยของระดับชววัยที่วัดจากแบบทดสอบ DAP และแบบทดสอบ CPM ของนักเรียนมีความแตกต่างกันในช่วงอายุ 6 ปีถึง 9 ปี 11 เดือน แต่ไม่แตกต่างกันที่ช่วงอายุ 10 ปีถึง 11 ปี 11 เดือน และการวัดระดับชววัยที่วัดจากแบบทดสอบทั้งสองมีความสัมพันธ์ที่มีความสัมพันธ์ในสถิติระดับเกิน .05 และ .01 ดังนั้นจึงเสนอแนะให้ใช้แบบทดสอบทั้งสองในการวัดระดับชววัยของผู้เรียนที่แตกต่างกับหรือการทดสอบในสภาพแวดล้อมที่แตกต่างกันเพราะเด็กแต่ละคนอาจจะมีความสามารถหรือมีข้อจำกัดที่แตกต่างในลักษณะที่จะตอบสนองต่อแบบทดสอบแต่ละชนิดได้

68 หน้า ISBN 974-04-4514-4
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CHAPTER 1
INTRODUCTION

Background and Significance of the Problem

It is highly essential need to take into account factors associating with some behaviors, for examples; gender, nationality, religion, culture and norm, child development, intellectual ability when making an understanding on abnormal behaviors of children (Wichitpanee Charoenkwan, 2531 : 94-99). This information can be collected using the important tool, i.e. interview those who are close to the children such as parents, caretakers, or relatives. For the information that cannot be obtained from questioning or observation, such as intellectual ability, it can be measured using the test and conducted by psychologist.

Generally, psychologists use several standardized intelligence tests to measure intellectual ability of children such as Wechsler Scales, Stanford-Binet Intelligence Scales or K-ABC. These tests cover language and cultural aspects and be individual testing. As taking these tests is time consuming, the children may not have long interest or concentration to complete the test, particularly, when having physical illness. Hence, results cannot be analysed. From these reasons, the researcher is interested in measuring intellectual ability by Draw A Person (DAP) : A Quantitative Scoring System method developed by Jack A. Naglieri. This test takes only 15 minutes or less and can be used either individually or in a group, so it is recommendable for testing a large amount of children. Besides, drawing can create good relationship between the children and persons who conducting the test. Moreover, this test is very economical as only pieces of paper, pencil and eraser are needed. In addition, human figure drawing is less influenced by linguistic variables as had in the Wechsler scales. Finally, the scoring system can provide reliable information about intellectual status to supplement other intelligence test data and it

For this research, the researcher is interested in studying the correlation of intellectual ability measures between Draw A Person test and the Coloured Progressive Matrices test. For the coloured progressive matrices test, individuals taking the test need to fill in the missing parts by selecting them from the parts provided. One set of test is for one individual. For the DAP, individuals taking the test need to draw a picture of human consisting a man, a woman, and the individual themselves. Both tests can determine the intellectual ability in term of “g-factor” under the Charles Spearman’s concept of intellectual structure, which is the ability for general problem solving as well as the ability in observing, spatial aptitude, inductive reasoning, perceptual accuracy and accuracy of observation on the development of conceptual thinking (Ansatasi, 1988: 304). Thus, if the intellectual ability measured by DAP and the Coloured Progressive Matrices are not different, they can be used in place on one another to measure “g-factor” of children who take the test under different testing environment because each child has own ability and limitation in response to the test. For the formal studied of the DAP the results revealed as follows; the study conducted by Jiranan Prasertsri (2535) and Titiwan Foo-trakoon (2542) on DAP clearly explain the advantages of this test, e.g. gender has little effect on drawing scores which is in line with the study conducted by Naglieri (1988: 22). Furthermore, it was found that financial status of parents had no impact on the test while location of school also had no effect on the drawing score and family type is not a variable that differ intellectual ability in children. Other studies on relationship between artistic ability and scores obtained from human figure drawing tests (Jensen, 1980 cited by Naglieri, 1988: 3) found that ratings of the artistic quality of the drawings show almost no correlation with IQ scores derived from the drawings. Characteristic of the DAP itself reveals that points are given for inclusion, elaboration, and proportionality of body parts, not for realism or esthetic quality. Similarly, although motor coordination is important for drawing, points are not given for features that require complex or exact motor skills. The DAP score, therefore, is only minimally influenced by artistic
and motor skills. Under the above mentioned convenience and advantages, the researcher is interested in developing the DAP test as an alternative for standard measuring intellectual ability of children.

Research Objectives

1. To study mean and standard deviation of result of intellectual ability of primary school students in Bangkok measures by using Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM).

2. To study correlation between intellectual ability of primary school students in Bangkok measured by Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM).

Research Hypotheses

1. Mean of intellectual ability of primary school students in Bangkok measured by Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM) are not different in the same ages ranged.

2. Intellectual ability of primary school students in Bangkok measured by Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM) are correlated.

Scope of the Research

Population

Population in this study was Grade 1-6 primary school students in Bangkok aged 6 years to 11 years and 11 months old who were studying in Semester 1, academic year 2003 at schools under the Office of the National Primary Education Commission, Office of the Private Education Commission, and Bangkok Metropolitan
Administration. It was found from the database that there were 159,287 students aged 5-12 years whose names are registered in the central registration (Registration Bureau, Local Administration Department, Ministry of Interior, 2002).

Sample Group

The sample group consisted of 396 students aged 6 years to 11 years and 11 months old who studied in semester 1, academic year 2003 at 7 schools in Bangkok.

Variables

- Independent variables are ages divided into 6 ranges, 1 year each; as follows: 6 – 6·11 years, 7 – 7·11 years, 8 – 8·11 years, 9 – 9·11 years, 10 – 10·11 years and 11 – 11·11 years.

- Dependent variables are intellectual ability measured by Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM).

Benefits of the Research

1. Knowing the correlation between the intellectual ability measured by Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM). If both test do not give different results, it can be alternative used in measuring intellectual ability of children with limitations such as having physical health problems, language problem or being impatient to take the test with fixed format or need to rational in order to get the answers like in CPM test. Thus, DAP can be used in stead as it is drawing of human figure close to them and it is always a preferable activity for any children.

2. Having a tool that can be used aiding for treatment because both Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM) can explicit an intellectual ability that have less involvement of language issue. Besides, DAP can be used to create relationship between the children and person conducting the test as drawing is a kind of familiar activity which has no fear or worries in doing so.
3. DAP can be applied for screening children with learning problems if they have intellectual disability or limitation language communication. This result assists in further remedial.

**Definitions of Terms**

**Intellectual ability** is the ability in learning, memorising what is learnt, general problem solving, as well as ability in observing, being rational, creating intangible concept, logical thinking, and precision of perception. This can be assessed into interval of intellectual ability by using the Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM).

**Draw A Person (DAP)**: A Quantitative Scoring System is an intellectual ability test that lets an individual taking the test to draw a picture of human. It was developed by Jack A. Naglieri in 1988. The assessment of the intellectual ability uses the total drawing scores of 3 pictures and convert them into standard scores or level of intellect by using the table of normal range of DAP test for students age 5-17 years in the central region of Thailand developed by Titiwan Foo-trakoon (2542).

**The Coloured Progressive Matrices (CPM)** is the one of progressive matrices test developed by J.C. Raven, an English Psychiatrist, in 1938 modified in 1956, and universal use until now. For this test, the normal range of the coloured progressive matrices of Thai population developed by Sucheera Phathharayuttawat et al.(2546) was used to determine the level of intellectual ability.

**Primary school students in Bangkok** are Grade 1-6 primary school students aged 6 years to 11 years and 11 months old who were studying in Semester 1, academic year 2003 in 7 schools under the Office of the National Primary Education Commission, Office of the Private Education Commission, and Bangkok Metropolitan Administration.
CHAPTER 2
LITERATURE REVIEW

This research aimed at studying the intellectual ability measures among primary school students in Bangkok by Draw A Person (DAP) test and The Coloured Progressive Matrices (CPM). The researcher has collected related concepts, theories, and studies such as intellectual development in middle and late childhood, concepts and theories of drawing in middle and late childhood, intelligence testing by Draw A Person (DAP) test and by the Coloured Progressive Matrices (CPM).

Intellectual development in middle childhood

Middle childhood covers the age of 6-9 years which is important stage as children will start going to school and that is the important change in their life as they will need to adjust themselves (Sucha Jun-em, 2536 : 121). If children have been physically, emotionally, intellect and socially trained, it would be easy for them to adjust themselves into new environments. This stage will also lead to their success and failure in their study as well as like and hate in school because it is the stage when their world is widen socially and in term of thinking. Studying diligently, having many friends and variety of study subjects enable children to develop their intellectual ability suitable for their age. Thus, this age is suitable for providing children fundamental education, reading, writing, calculation, and fine motor such as easy activities, more complicate drawing, as well as some important life skills.

Sriruen Kaewkangval (2538 : 299) mentioned that children at these ages can develop their thinking and intellect very fast because they are able to think rationally, understand basic intangible concept, and understand basic mathematics concept. Children with suitable development will be able to count backward, tell the time, and
can remember multiplication table. Besides, children will be able to be more reasonable, can identify causes and effects, can criticize as well as can better understand various rules.

A cognition psychologist (Piaget, cited by Shaffer, 1996 : 62) believes that all children progress through the stages in exactly the order in which they are listed. There is no skipping of stages because each successive stage builds on the previous stage and represents a more complex way of thinking. Piaget also says that individuals’ cognition begin at birth. From infancy to 2 years old, babies have sensory ability and motor to wonder around which help them to have a basic understanding of surrounding environments. Contacting their surroundings is important for development of intellect and thinking in children (Piaget, cited by Pannee Ch. Jenjit, 2528 : 87). Drawing ability can be seen at the age of 18 months and more when children will develop their motion and drawing on paper unintentionally and without purpose like scribble of pencil or wax colours. At this stage children do not have good muscle motion and their hands and eyes are not working together well. Thus, drawing at this age is just scribble with clear pushing forces (Primp Rao Disayavanich, 2544 : 275). Children will move their arms in regular rhythm on a paper and be gain immense pleasure simply from making marks on the paper (Berryman, et al., 1991 : 150).

At the ages of 2-7 years old, children cannot think reversibly but can only understand conservation of substances and start to decentralize. However, they cannot use their intelligence to solve problems. Also, they can have concepts of things but not complete and reasonable. At the age of 3-4 years old they can use descriptive symbolism by bringing details of drawing together. Drawings are simple in structure and mostly using circle to symbolise parts of the drawing as it is easy to draw. The fact is that the circle is the simplest pattern, the universally selected pattern, and the most common form in nature (Di Leo, 1973 : 4). The children will continue to use it as he represents a variety of perceptions – head, eyes, mouth, trunk, ears, and even hair or combine the head and body together and draw lines as legs with other circles as eyes, mouth, and hands.
Development of knowledge and understanding at middle childhood age 6-9 years overlaps with intuitive thought at the ages of 4-7 years old and concrete operation at the ages of 7-11 years old. That is after the age of 4, children can have more reasonable thought. However, their thought is rather perception than understanding. They start to react toward the environment, be curious, imitate behaviours of adults close to them, and use language for communication. At the age of 7, the development will reach reasonable thought, tangible operation and understanding conservation of their surroundings through an understanding that though substance is changed in form but weight or volume is still the same. From these reasons, pictures drawn by children age 4-7 years will have more realistic details. For example, A man’s arms may be drawn through his shirt sleeves because the child knows they are there rather than because they can necessarily be seen – this is called a “Transparency” (Berryman, et al.,1991:150). Moreover, clothing and decorative detail will appeared (Burt, 1921 cited by Harris, 1963:18). The picture is improved from combining a head and body in one circle to separating the head from the body with detailed fingers and clothing. At the age of 8 years old, their drawing pictures will be visual realism. Drawing is more improved and drawn from what children have seen and pictures will be in 2 dimensions, i.e. having structure and shading, or having scenery behind with obvious depth. At the late childhood, age 9-10 years old, it is the repression level, children will have more drawing techniques. They can draw cartoons or imitating pictures but not having much variety.

Intellectual development in late childhood

The formal-operational stage occurs after the age of 11. Children at this stage can engage in abstract thinking. In additional, children can think more scientifically, in that they can form hypotheses for how things work, test these hypotheses, and accept or reject them based on the evidence. Consequently, children at this stage can think about cause and effect, understanding how the past can influence the future, rather than thinking in the here and now; thus they can develop general rules, principles, and theories to predict future events. Children at this stage can also engage in
metacognition, meaning that they can reflect on their own thinking. However, not all adults reach this stage of cognitive development (Hall & Barongan, 2002: 121). During formal operations, in contrast, thinking soars into the realm of the purely abstract and hypothetical. The capacity for abstract reasoning can be seen in responses to questions (Crain, 2000: 130).

Drawings of children at eleven to fourteen years show a deterioration or regression. Progress becomes laborious and slow. Some of this deterioration may be ascribed, perhaps, to emotional conflicts, but cognitive and intellective factors are also assuredly involved. There is increased self-criticism, increased power of observation, and increased capacity for esthetic appreciation. Growing ability to self-expression through language plays a large part. The human figure becomes rare in spontaneous drawings, but geometrical, ornamental, and decorative drawing becomes very common, when drawing of any kind is attempted.

In early adolescence, children’s drawings will reach a stage of Artistic revival. They are now made to tell a story; they approximate more to the methods of the professional (e.g., use of portraits or bust). Definite esthetic elements appear, notably interest in color, form, and line as such. Boys may become interested in technical drafting. Artistic talents can rarely if ever be discerned before a child enters this stage, and special artistic powers are rarely discernible before age eleven, even in the most precocious (Harris, 1963: 18-19).

**Intelligence**

Sattler (2001: 138) said that Charles E. Spearman (1863-1945) was one of the early proponents of a factor analytic approach to intelligence. Spearman (1927) proposed a two-factor theory of intelligence to account for the patterns of correlations observed among group tests of intelligence. His theory stated that a general factor (g) plus one or more specific factors (s) per test account for performance on intelligence tests. Spearman thought of the g factor as general mental energy, with complicated
mental activities containing the greatest amount of g. The g factor is involved in deductive operations linked with the skill, speed, intensity, and extent of intellectual output. Spearman recognized that scores on each test are also influenced by measurement error (e) and that each test also measured some specific factor (s) that was unique to each test and independent of one’s level of general intelligence. For example, scores on a verbal comprehension test are determined largely by one’s level of general intelligence, but they are also affected by one’s specific ability to perform verbal comprehension tasks, independent of one’s general intelligence. He also explained further that a good intelligence test will be highly g loaded (Spearman, cited by Murphy & Davidshofer, 2001 : 21). There are some examples of the test such as The Wechsler Intelligence Scales (Anastasi, 1988 : 248-249), DAP (Di Leo, 1973 : 30) and Raven Progressive Matrices (Gregory, 1996 : 235).

Several psychologists define “intelligence” differently depend on their belief and understanding. However, operational definition of intelligence will cover ability to do works by expressing their intelligence toward stimulus designed by psychologists as well as using intelligence test (Rattana Siripanij et al., 2544 : 282). Besides, intelligence is ability in knowing, understanding, complicate learning, memorizing, basic creative, integrating facts together, solving problems, adapting oneself to new environment, and having quality thoughts. This is in line with Piaget’s statement that intelligence as a basic life function that helps the organism to adapt to its environment. He adds that intelligence is a form of equilibrium toward which all cognitive structures tend. His point is simply that all intellectual activity is undertaken with one goal in mind: to produce a balanced, or harmonious, relationship between one’s thought processes and the environment (such a balanced state of affairs is called cognitive equilibrium, and the process of achieving it is called equilibration). Piaget stressed that children are active and curious explorers who are constantly challenged by many novel stimuli and events that are not immediately understood. He believed that these imbalances (or cognitive disequilibria) between the child’s modes of thinking and environmental events would prompt the child to make mental adjustments that would enable her to cope with puzzling new experiences and thereby restore cognitive equilibrium. So we see that Piaget’s view of intelligence is an interactionist model,
which implies that mismatches between one’s internal mental schemes (existing knowledge) and the external environment stimulate cognitive activity and intellectual growth (Piaget, 1950 cited by Shaffer, 1996 : 244). Underlying intelligence are the cognitive structures of thought, which differ sharply at different ages and it develops through interaction with the environment. This interaction involves maturation, experience with the physical environment, the influence of the social environment, and the child’s own self-regulatory processes, which keep trying to establish an equilibrium (Piaget, 1976 cited by Hoffman et al., 1994 : 316).

The rise of Intelligence Tests

Anastasi (1988 : 238-241) said that Binet and his co-workers devoted many years to active and ingenious research on ways of measuring intelligence. Many approaches were tried, including even the measurement of cranial, facial, and hand form and the analysis of handwriting. The results, however, led to a growing conviction that the direct, even though crude, measurement of complex intellectual functions offered the greatest promise. Then a specific situation arose that brought Binet’s efforts to immediate practical fruition. In 1904, the Minister of Public Instruction appointed Binet to the previously cited commission to study procedures for the education of retarded children. It was in connection with the objectives of this commission that Binet, in collaboration with Simon, prepared the first Binet-Simon Scale. This scale, known as the 1905 scale, consisted of 30 problems or tests arranged in ascending order of difficulty. The 1908 scale was the first age scale; and the 1911 scale introduced minor improvements and additions. The age range covered by the 1911 revision extended from 3 years to the adult level. Among the many translations and adaptations of the early Binet tests were a number of American revisions, of which the most viable has been the Stanford-Binet.

The first Stanford revision of the Binet-Simon scales, prepared by Terman and his associates at Stanford University, was published in 1916. This revision introduced so many changes and additions as to represent virtually a new test. Over
one third of the items were new, and a number of old items were revised, reallocated to different age levels, or discarded. The second Stanford revision, appearing in 1937, consisted of two equivalent forms, L and M. In this revision, the scale was greatly expanded and completely restandardized on a new sample of the U.S. population. A third revision, published in 1960, provided a single form (L-M) incorporation the best items from the two 1937 forms. Without introducing any new content, it was thus possible to eliminate obsolescent items and to relocate items whose difficulty level had altered during the intervening years owing to cultural changes. The next stage was the 1972 restandardization of Form L-M. This time the content remained unchanged (except for very minor changes in two items), but the norms were derived from a new sample, was chosen from communities stratified in terms of size, geographical region, and economic status.

The Fourth Edition of Stanford-Binet was published in 1986. This revision reflected intervening developments in both theoretical conceptualizations of intellectual functions and methodology of test construction. Continuity with the earlier editions was maintained in part by retaining many of the item types from the earlier forms. For the Fourth Edition, the authors decided that four areas of cognitive ability should be appraised: verbal reasoning, quantitative reasoning, abstract/visual reasoning, and short-term memory. It was also decided that the revised scale would continue to provide a composite or overall score that would represent g, or general reasoning ability (Thorndike et al., 1986: 9). The lately revision is Stanford-Binet Intelligence Scales – Fifth Edition, was published in 2003.

The first in a series of tests developed by David Wechsler, an American Psychologist at Bellevue Hospital in New York City, was the Wechsler-Bellevue Intelligence Scale, published in 1939. The primary impetus for the development of this test was the growing awareness that the Stanford-Binet, which was designed primarily for children, did not at that time provide an adequate measure of adult intelligence. Not only was the use of mental age inappropriate in measuring adult intelligence, but, as Wechsler pointed out, the content of Stanford-Binet items was typically oriented toward the interests and concerns of school age children rather than those of adults. In
addition, Wechsler noted that adults often were penalized by the emphasis on speed of response characteristic of many Stanford-Binet items. Older persons often work more slowly than young children, and adults do not always take instructions to work quickly at face value. To overcome these limitations, the Wechsler-Bellevue was designed as an adult-oriented point scale of intelligence that placed little emphasis on speed. (Murphy & Davidshofer, 2001 : 261). This well known test was used for individual administration. (Kanokrat Sukhatunga, 2538 : 42). The test was many times revision and has separate by age level into 3 tests as follow:

1. Wechsler Preschool and Primary Scale of Intelligence (WPPSI) : for children ages 4 to 6½.
2. Wechsler Intelligence Scale for Children (WISC) : for children ages 6 to 15 years, 11 months.
3. Wechsler Adult Intelligence Scale (WAIS) : for adults ages 16 and over.

Besides Binet’s test and Wechsler Bellevue Intelligence Scale, human figure drawing is one of the oldest methods used for clinical evaluation in children and adults. (Primprao Disayavanij, 2544 : 19). This technique was developed for the first time by Florence Goodenough in 1926. She believed that development and drawing steps were the expressions of learning and training and the use of muscles. Thus, what is drawn can identify their thought toward things because young children draw what they know, not what they see, so their realism was said to be intellectual, not visual. (Di Leo, 1973 : 27). From such concepts, intellectual test through drawing was developed which can also be used for screening level of intelligence. This is called Goodenough Draw-A-Man Test which has different test process from Binet’s and Wechsler’s tests. This test can measure intelligence promptly through a picture drawn by a child which was widely used. Then, in 1963 Dale Harris added the broader and more detail scoring system as well as drawing of a woman and a child him/herself. This test is thus renamed Goodenough-Harris Drawing Test and used for measuring intellectual maturity, not artistic skill (Gregory, 1996 : 244). It is also known as the Draw-A-Man Test and pediatricians and psychologists use it as a screening method for measuring intellectual ability in school-age children (Primprao Disayavanij, 2544 : 383). It can
be said that human figure drawing is a reliable method and the value of drawings as expressions of general intelligence (Di Leo, 1973 : 30).

**Psychological Concepts and Theories of Drawing**

Unstructurally drawn pictures are, in fact, very meaningful because children need cooperative movement of their hand, wrist and arm. Besides, the drawn pictures are influenced by visual observation and experience (Somsong Suwannalert and Ladda Ayawong, 2509 : 137-138). At the beginning of learning drawing, children will mostly draw lines like curves. Anyhow, they satisfied the ability and repeated drawing again and again until it becomes more structural. When the kids are grown up with the strengthen muscles together with drawing experience, the curve become close to circles and circles eventually.

Muscle function is related to the drawing (Schiller, cited by Somsong Suwannalert and Ladda Ayawong, 2509 : 138-139). Schiller believed that functions of the muscles such as grabbing, touching, shaking, holding or pulling are foundation for their learning. When the children are grown up, their drawing become more structural and meaningful. Moreover, teaching or stimulating from surrounding people can motivate children to develop their learning pattern, perception and understanding. If children are learning reading and writing, their drawing will imply their experience as well as their perception and understanding. At this stage, children may draw pictures of what they see even it is not similar but children mostly confirm. It can be said that what children draw indicate their concrete thoughts because their perception still depend on tactual experience and kinesthetic cue. But when they grown up, drawing had more structure, details and meaning, which imply an understanding in abstract properties of substances. Thus, maturity of children which cover in muscle growth, better muscle function, and intelligence are influences of their drawing.

Harris (1963 : 175-179) believed that the structure of children’s drawings evolves, at least in part, through inherent features of children’s physical and mental
development is implicit in many discussions. To greater or lesser degree such a theory is implicit in all so-called “developmental” approaches to creativity or to the expression of aptitudes. The notion, expressed most simply, is that the urge to express oneself is bound up with the potential, or capability, of the individual. That drawings are governed by laws of structure and form in the stimulus field is held in one way or another by many who are not formally identified as Gestalt theorists. Obviously, drawings require at least two psychological processes – perceptual (visual sensory) and expressive (motor). A third process, cognition, presumably mediating between perception and behavior, is sometimes posited also. The Gestaltists hold that perceptual processes, controlled by hypothesized neural actions in the brain, cause all stimulus situations to be experienced as patterned into figure–ground relationships. The responding organism is thus selectively oriented to the stimulus field. His motor responses are likewise patterned by neural activity, and may also be subject to Gestalt principles.

Children’s drawings have an intrinsic or inherent character whereby it evolves from simple to more complex forms. However, graphic art follows a natural sequence only when untrammeled by artificial instruction. Though the end result is representative drawing, the child’s early efforts are not to portray what he sees, what he remembers, or what he conceives abstractly. Rather, his drawings follow strictly developmental laws, based on Gestalt principles of the contrast of figure and ground, the contrast of horizontal and vertical, and the achievement of unity in this variability. The child uses a form of conceptualization different from abstract conceiving, which results from knowledge. Their existence can be explained only as the result of a definite mental activity of conceiving relationships of form in the realm of pure vision – an activity that may be called visual conceiving and its pictorial realization, which is visual conception. What the child draws is, thus, not an idea resulting from a visual model. He draws much more than he knows; he draws a visual structure not based on knowing but on this inner process of visual conceiving.

A much more psychologically sophisticated treatment of graphic art from the Gestalt viewpoint has resulted from the extensive work by Rudolph Arnheim (1954),
who also owes an intellectual debt to Britsch. Arnheim’s theory is systematic, and uses the laws and principles of Gestalt psychology, behavior, to explain the observed facts of children’s drawings. For Arnheim, every act of seeing is a visual judgment, which is not affected by the intellect, but is spontaneous. While Organismic theories of Children’s Drawings represented under this broad term have stressed the continuing interaction of organism and environment as a developmental, adjustive process. These theories have been phenomenological, describing behavior from the viewpoint of the experiencing self or agent. They have drawn an analogy between the concepts of physical growth and concepts of behavior organization. Thus, they have used concepts of behavioral maturation and learning, stressing successive stages.

**Intelligence Testing by Draw A Person Test**

Human figure drawing can be used as a psychological test in two ways. First is qualitative assessment by projective techniques to study personality and aiding diagnosis. Second is quantitative assessment such as intelligence test which have a scoring table to identify level of intelligence (Primpao Disayavanij, 2544 : 17). Goodenough, Harris, Koppitz, and Naglieri (1988) are well known for Draw-A-Person test.

Most children enjoy drawing human figures and do so routinely and spontaneously (Gregory, 1996 : 244). Since the early 1900s, psychologists have tried to tap into this almost instinctive behavior as a basis for measuring intellectual development. The first person to use human figure drawing (HFD) as a standardized intelligence test was Florence Goodenough (1926). Her test, known as the Draw-A-Man test, was revised by Harris (1963) and renamed the Goodenough-Harris Drawing Test. More recently, the HFD technique has been adapted by Naglieri (1988).

Goodenough (1926 : 39-40) substituted the age norms as given in the table for the point score earned on the drawing, the approximate mental age of a child may be found. The intelligence quotient (or IQ) is then obtained by dividing the mental age by
the chronological age. Chronological ages above 13 years are considered as 13 only in calculating the IQ, since the scale does not measure mental ages above 13 as follows:

<table>
<thead>
<tr>
<th>Ages</th>
<th>Norms</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>7</td>
<td>18</td>
</tr>
<tr>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>9</td>
<td>26</td>
</tr>
<tr>
<td>10</td>
<td>30</td>
</tr>
<tr>
<td>11</td>
<td>34</td>
</tr>
<tr>
<td>12</td>
<td>38</td>
</tr>
<tr>
<td>13</td>
<td>42</td>
</tr>
</tbody>
</table>

The Goodenough-Harris Drawing Test is a brief, nonverbal test of intelligence that can be administered individually or in a group. Goodenough (1926) published the first edition of this test, while Harris (1963) provided important refinements in scoring and standardization, including the use of a deviation IQ. Strictly speaking, the Goodenough-Harris test doesn’t fit the criteria for nonlanguage tests insofar as the examiner must convey certain instructions in English or through a translator. However, the instructions are brief and basic (“I want you to draw a picture of a man [or woman]; make the very best picture you can”). The Goodenough-Harris test is, for all practical purposes, a nonlanguage test.

The purpose of the Goodenough-Harris Drawing Test is to measure intellectual maturity, not artistic skill. Thus, the scoring guide emphasizes accuracy of observation and the development of conceptual thinking. The child receives credit for including body parts and details, as well as for providing perspective, realistic proportion, and implied freedom of movement.
The 73 scorable items were selected according to the following criteria:

1. The items should show a regular and fairly rapid increase with age, in the percentage of children passing the point.
2. The items should show a relationship to some general measure of intelligence.
3. The items should differentiate between children scoring high on the scale as a whole and those scoring low on the scale as a whole (Harris, 1963).

A number of investigations, some of them truly experimental studies, cast light on the conceptual aspects of drawing the human figure. Ames (1943,1945) found that children under the age of five depicted more details when adding to an incomplete figure than they did when told merely to draw a man, but that the reverse was true with children over five. However, the Gesell Incomplete Man, which was the model used, does not suggest the need of many details for its completion. A more sophisticated drawing might have yielded different results. The number of parts added to the incomplete man (1943) shows a more consistent and steady age relationship than do the specific parts added. This conclusion is in agreement with the basis of the Goodenough test (Harris, 1963:22).

The development of directionality in drawing was the subject of an extensive investigation by Gesell and Ames (1946). Approximately 1,500 drawings were secured from children between the ages of eighteen months and seven years, most of whom were tested semiannually, and from twelve adults. The tasks included drawing a vertical and a horizontal stroke in imitation of the examiner, copying a cross, a circle, a square, and a rectangle with a diagonal, and copying a diamond from a printed form. Of the reported findings, the following seem to be reliably established: (1) For both the vertical and horizontal strokes the average length of line increases as age increases. This probably reflects more purposeful action as well as improved control in use of the hand. (2) Symmetry in the form of the cross improves with age, as does the tendency to make the cross by means of two intersecting lines (rather than half-lines to the point of intersection, then completed by a separate line). (3) Younger children commonly draw both the square and the diamond using four separate lines. Older children and adults usually draw the square using a single continuous line, but are likely to use four
downward strokes for the diamond (Harris, 1963: 159). Moreover, Brigance (1978: 75) was classified the skills in imitates or copies designs as follow:

<table>
<thead>
<tr>
<th>Ages</th>
<th>Imitates models drawn</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 years</td>
<td>Circle</td>
</tr>
<tr>
<td>3 years</td>
<td>Cross</td>
</tr>
<tr>
<td>4 years</td>
<td>Square</td>
</tr>
<tr>
<td>5 years</td>
<td>Triangle</td>
</tr>
<tr>
<td>6 – 7 years</td>
<td>Rectangle</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ages</th>
<th>Copies models printed</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 years and 6 months</td>
<td>Circle</td>
</tr>
<tr>
<td>3 years and 6 months</td>
<td>Cross</td>
</tr>
<tr>
<td>4 years and 6 months</td>
<td>Square</td>
</tr>
<tr>
<td>5 years and 6 months</td>
<td>Triangle</td>
</tr>
<tr>
<td>7 years</td>
<td>Rectangle</td>
</tr>
</tbody>
</table>

For human figure drawing, Brigance (1978: 74) said that number of body parts present in picture with recognizable as follow:

<table>
<thead>
<tr>
<th>Ages</th>
<th>Number of body parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 years</td>
<td>2-3</td>
</tr>
<tr>
<td>5 years</td>
<td>4-6</td>
</tr>
<tr>
<td>6 years</td>
<td>7-9</td>
</tr>
<tr>
<td>7 years</td>
<td>10</td>
</tr>
</tbody>
</table>

Moreover, body parts included in picture such as head, legs, eyes, nose, mouth, trunk, hands, ears, neck, feet and arms.
The Draw A Person (DAP) : A Quantitative Scoring System was developed by Jack A. Naglieri in 1988. He developed a quantitative scoring system and renormed the human-figure-drawing procedure. This test uses for examinee ages 5 to 17 years and 11 months. The DAP requires the examinee to draw three pictures (Man, Woman, and Self) on three separate pages of the Response Form. Allow a maximum of 5 minutes for completion of each drawing. If the child finishes in less than 5 minutes, go on to the next drawing. The test may be administered in either a group or individual setting. The scoring system was devised to reduce the influence of current styles of dress, especially in areas that might differentially influence the scores obtained from the Man and Woman drawings (Naglieri, 1988 : 2). The assessment of the intellectual ability uses the total drawing scores of 3 pictures and convert them into standard scores. Reviewers praise the DAP for its clear scoring system, strong reliability, and careful standardization (Cosden, 1992 cited by Gregory, 1996 : 245).

The DAP scoring system is organized into three major components : criteria, categories, and items. Fourteen criteria in the examinee’s drawing, most of which are parts of the body, are scored on a number of specific characteristics of the drawing, or items. These items generally are of four types or categories : Presence, Detail, Proportion, and Bonus. The 14 criteria include 12 parts of the body (Arms, Ears, Eyes, Feet, Fingers, Hair, Head, Legs, Mouth, Neck, Nose, and Trunk), placement of certain body parts in relation to each other (Attachment), and Clothing (Naglieri, 1988 : 25-28).

Each criterion can determine by met to varying degrees, based on the number of items correctly completed. For example, the items for the Arms criterion include Arms Presence, Arms Detail 1, Arms Detail 2, Arms Proportion, and Arms Bonus. This organization allows for as few as three and as many as seven items organized according to the four categories for any one of the 14 criteria. Within these criteria, items are organized into four categories :

1. Presence : Thirteen of the criteria (all except Attachment) are scored for Presence. A point is given if the drawing includes a particular body part or piece of
clothing. This category represents the most basic way an individual may earn credit, and requires only the crudest type of representation. If the examiner recognizes the body part or piece of clothing as present, one point is given.

2. Detail: Twelve criteria are scored for at least one detail. Credit is earned if the examinee includes specified details in the drawing of the particular body part or piece of clothing. The detail score is intended to credit the elaborations of the criterion beyond a simple representation. For example, the item Hair Detail 1 gives credit for hair that is drawn on more than just the top of the head, and Hair Detail 2 gives additional credit if the hair is drawn in a distinct style.

3. Proportion: Ten criteria are scored for proportion. This category is intended to credit relatively realistic productions of the body part. For example, credit is given for the item Trunk Proportion 1 if the trunk is longer than it is wide. Other body parts are similarly scored. The Proportion category is scored by comparing the greatest measurement of each of the dimensions (with the single exception of the Proportion 1 item of the Fingers criterion). Thus, if the body part is drawn so that its length varies according to where one measures it, the longest measurement should be used. Similarly, the width of the body part is measured at its widest point. If these two measurements differ in the direction specified in the item (e.g., length is greater than width), then credit is given. Credit is given regardless of the amount by which the measurements differ (i.e., no minimum difference is required), so that subjectivity of scoring is reduced.

Scoring the Proportion category often requires measuring the drawing. When measuring the body part, compare the longest dimensions, regardless of the orientation of the drawing. For example, if the head is tilted 45 degrees, the measurements will be based upon the orientation of the head, not upon the horizontal and vertical dimensions of the page. Similarly, if the examinee draws an arm that is bent, and the cumulative length is greater than the width, credit is given.

4. Bonus: For each of the 14 criteria, additional credit is given if all items for that criterion are scored as correct. For example, in order to give credit for Arms Bonus, the previous items (Arms Presence, Arms Detail 1, Arms Detail 2, and Arms Proportion) must all be scored as correct. This category is included to provide additional points at the upper end of the distribution of scores.
One point is given for each item which is correctly completed in the drawing, for a maximum total score of 64. The assessment of the intellectual ability uses the total drawing scores of 3 pictures and convert them into standard scores or level of intellect by using the table of normal range of DAP test for students age 5-17 years in the central region of Thailand developed by Titiwan Foo-trakoon (2542).

<table>
<thead>
<tr>
<th>Standard Scores</th>
<th>Percentile Range</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>130 and above</td>
<td>98 and above</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>69 and below</td>
<td>2 and below</td>
<td>Deficient</td>
</tr>
</tbody>
</table>

Darannee Utairatanakij (2538 : 2) mentioned about uses of DAP scoring system that DAP did not make children who take the test fear or worried. Moreover, it easy uses than the Wechsler Intelligence Scale for Children Revised (WISC-R) because DAP has very little language involvement. Moreover, race has no influence to this test. Although DAP is developed for screening or individual assessment but can also used in group with reliable result. Besides, DAP can use as projective techniques for personality assessment.

Nonsukri Kathancharoen (2523) studied intellectual ability of elementary school students using Goodenough-Harris test and found reliability coefficient of the drawing ranged .91 - .96. Besides, it was found that intelligence maturity would increase through aging and positively correlated to reading readiness. Similarly, a study on statistical properties of DAP test (Naglieri, 1988 : 13-16) found that internal consistency coefficient was .56 - .78, test-retest reliability was .60 - .89 and interrater reliability was .93 - .95 which is good. This is also similar to Titiwan Foo-trakoon (2542) on the study of reliability, validity and norms of DAP test among students aged...
5 years to 17 years and 11 months in the Central region of Thailand and found that the test-retest reliability of raw scores was .89. In term of validity (Naglieri and Prewett, 1990 cited by Titiwan Foo-trakoon, 2542 : 36), the validity of DAP and Goodenough-Harris Draw-A-Man Test, found that the validity coefficient was .70 - .90 which is quite high. Besides, the study of correlation between total scores obtained by 51 students aged 6-16 years using DAP and WISC-R (Naglieri and Wisniewski, 1988) found that the correlation of both was .51. Jiranan Prasertsri (2535) also studied intellectual ability using the DAP and Wechsler Intelligence Scale for Children (WISC) test among 60 Grade 2 students aged 8 years to 8 years and 2 months who studied at schools under the Education Department, Bangkok Metropolitan Administration and found that intellectual ability measured by DAP was positively correlated to the intellectual ability measured by WISC with statistical significance at .05 and correlation coefficient at .3586.

The study on score difference (Naglieri and Bardos, cited by Titiwan Foo-trakoon, 2542 : 36) by using DAP scoring system with 2 sample groups, i.e. children of American and Greece found that scores were not significance different. This is similar to the study by Bardos et al. conducted with American children and Canadian children revealed that difference in races did not affect scores obtained from the DAP. For gender difference, Naglieri (1988 : 20) conducted the DAP test to determine if boys and girls had different ability by comparing their scores in age groups, races and places where the test was taken. This study found that females’ scores had higher scores than males with statistically significance. However, since such difference was very little, i.e. only about one-fifth of a standard deviation, so it had very little effect. Therefore, standard scores are not substantially different for males and females between the ages of 5 and 17 years. It can be said that gender variable has very little effect on intellectual ability measured by the DAP test which is in line with Titiwan Foo-trakoon (2542) and Jiranan Prasertsri (2535).

Titiwan Foo-trakoon (2542) conducted a study on criterion related validity by determining correlation between DAP and Matrix Analogies Test – Short Form (MAT-SF) and found the fact that DAP could measure intellectual ability without
language use. Pavida Chuenchey (2543) studied drawing a picture of human among Grade 4-6 students in primary schools under Bangkok Metropolitan Administration by using the DAP test developed by Naglieri and found that the total scores of Grade 5 students was the highest, followed by Grade 4 and 6, respectively.

**Intelligence Testing by The Coloured Progressive Matrices Test**

The Coloured Progressive Matrices or CPM test is one of the Progressive Matrices Test developed by J.C. Raven, a British psychologist, in 1938 and regularly modified until 1956. The CPM is a nonverbal test of reasoning ability based on figural stimuli. It can be administered individually or to a group. The test measures the ability to form comparisons, to reason by analogy, and to organize spatial perceptions into systematically related wholes (Sattler, 2001 : 561). Sangsuree Samangkul (2539 : 205) mentioned that Raven’s test could be used for testing observing skill and thought because each problem needs framework of thought for finding answer and problem prioritization. From these reasons, the test is called Progressive Matrices meaning a picture with complex structure. The test consists of matrices or patterns which are missing in each picture. This test will ask a person taking the test to select one from the 6 or 8 pieces provided to fill up the missing piece in the picture. The test divided into series, each series have 12 matrices pieces with progressive difficulty. In short, there are criterias for selecting piece to fill up pictures, changing pattern systematically, and separating pattern systematically (Sucheera Phattharayuttawat et al., 2546 : 61). Since this test measures maximum ability, all test questions need to be answered. The overall performance on the test has been found to relate to educational level (Colonna & Faglioni, 1966 cited by Golden, 1990 : 57).

Raven’s Progressive Matrices was developed to assess, as simply and unambiguously as possible, the two components of g identified by Spearman as **eductive** ability and **reproductive** ability. **Eductive** mental activity involves making meaning out of confusion; developing new insights; going beyond the given to perceive that which is not immediately obvious; forming (largely non-verbal)
constructs which facilitate the handling of complex problems involving many mutually dependent variables. These are the abilities required by children in developing a sense of the unwritten rules of language, or by managers of international businesses in their decision-making processes. *Reproductive* mental behavior involves mastering, recalling, and reproducing the (largely verbal) material which forms a cultural store of explicit, verbalized, knowledge (Raven et al., 1995: 3).

Raven et al. (1995: 2) said that young children rarely reason by analogy in the way adults do, and the context of problems is of great importance. Because of this finding, it was necessary to reconsider Spearman’s Principles of Cognition in the light of Gestalt theory, and to design problems of the type used in Set Ab, in which discrete figures could be apprehended as parts of an organized whole, or individual entity, appropriately orientated to the observer’s perceptual field. The main exponents of Gestalt Psychology, like Kurt Koffka (1935), Wolfgang Kohler (1947), and Max Wertheimer (1923), maintained that psychological phenomena could be understood only when viewed as organized, structured wholes and not when broken down into primitive perceptual elements. The term Gestalt roughly means “form,” “whole,” “configuration,” or “essence.” Gestalt psychology challenged atomistic views of psychology by arguing that the whole is more than the sum of its parts. For example, when we listen to music, we perceive whole melodies even though they are composed of separate notes (Zimbardo & Gerrig, 1996: 268). Gestalt psychologists tried to show with each perceptual law an illustration of how it has been or could be used in a learning experiment (Bower & Hilgard, 1986: 303-309); as follow:

1. Figure-ground relationships: The figure is what we focus attention on; it stands out and is more noticeable or salient than the background. Typically, a visual figure is defined by contours or discontinuities of a different brightness or color with respect to the background. In some cases, what is figure and what is ground in an environment is ambiguous, and the perceiver may organize it one way, then switch to seeing it another way.

2. The law of proximity: Elements of a field will tend to be grouped together according to their nearness or proximity to one another. The closer together two elements are, the more likely they are to be grouped together.
3. The law of similarity: The law of similarity states that items similar in respect to some feature (shape, color, texture, and so on) will tend to be grouped together, provided this is not overridden by proximity factors.

4. The law of simplicity: This law says that, other things being equal, the person will see the perceptual field as organized into simple, regular figures. That is, there will be a tendency toward the good gestalts of symmetry, regularity, and smoothness.

5. The law of common fate: When elements in the visual field are moving, similarity of motion also produces a powerful grouping. The law of common fate states that, all else being equal, elements moving in the same direction and at the same rate are grouped together (Zimbardo & Gerrig, 1996: 282).

J.C. Raven developed and distinguished at least five qualitative developments in the order of intellectual capacity conceptual as (1995: 22-24)

- Children are first able to distinguish identical figures from different figures, and later similar from dissimilar figures.
- Some time after this, they are able to appreciate the orientation of a figure with respect to themselves and to other objects in the perceptual field.
- Next, they can compare analogous changes in the characters perceived, and adopt this as a logical method of reasoning.
- Subsequently, they are able to analyze the perceived whole into its constituent elements, or characters, and to distinguish between what is given and what they themselves contribute.
- Finally, they are able to apprehend two or more discrete figures as forming a whole, or organized individual entity.

J. C. Raven related these developments to age as follows:

By the time children are 3 years old they can, given the Board form of the test, usually fit one of the pieces into the gap in the pattern. At first, any piece which fits is pleasing, and a child will often experiment with different pieces in turn as if surprised to discover that each will fit the space, or any of the depressions made to
hold the movable pieces. Some children will complete the first two or three patterns of Set A and leave the correct piece in position.

By age 4 the child usually notices that one of the pieces is like the pattern shown above it. At first, similarity of pattern is sufficient – the actual size or orientation of the pattern does not seem to matter. The child will often complete a series of horizontal lines with a series of similar vertical lines and appear to be perfectly satisfied with the result even after seeing the piece in position. At a later developmental stage, the size and orientation of the pattern are also attended to, and the child is usually aware of these when making the first choice of a piece to complete a pattern. Learning from the results of fitting a piece into the gap in the pattern appears to be a later development. From this stage onwards, “trial and error” trains the child in a method of working, and he or she need only be told to try to choose the right piece at the first attempt, if possible.

By age 5, children are sometimes satisfied if the piece inserted completes the pattern in one direction only. Later, they begin to choose pieces which complete a pattern in two directions simultaneously. A bright child will begin to manipulate the test material spontaneously for amusement. Having inserted a correct piece, such a child will sometimes deliberately remove it in order to test the effect of others.

By age 6, children often select figures which complete patterns correctly even when, as in item A8, the figure to be selected (No.2) is unlike any part of the pattern to be completed. It is at this stage of development that, regardless of age, a dull child begins to go wrong. Efforts are made to repeat part of the given pattern and to adopt this as a routine method of working. Even when the insertion of such a piece obviously gives the wrong answer, such children are often satisfied with the result.

By age 7, children are usually able to conceive discrete objects (such as those in Set Ab) as spatially related wholes, but apparently have difficulty analyzing them into their components. If a piece which repeats one of the three parts of the pattern is not selected, one which shows the whole pattern – including the given as well as the required part – may well be. In answer to item Ab4, for example, No.2 may be chosen. Ability to select the part designed to complete a pattern conceived as a whole seems to develop somewhat later. It is curious that some children, using the board form of the test, will be satisfied on choosing a whole square or circle in order to
complete the fourth quarter of a square or circle. Apparently, whether the test is presented in Book form or Board form makes little or no difference to their judgement.

By age 8, difficulty arises chiefly towards the end of Set B. Introductory examples designed to provide training in the method of reasoning do not seem to help a child to solve these problems. Rather than selecting the correlative figure required, a child of 8 years will usually repeat one or other of the figures already given in the matrix to be completed, and will adopt this as an appropriate method of working. If, for example, a child selects No.5 as the correct solution to B8, his or her response to later items will tend to be the choice of a piece which repeats the figure at the side or directly above the gap to be filled.

Those 7½ and 8 year-old children who have conceived that correlative figures are required to complete the matrices are able to solve many of the problems in the Standard Progressive Matrices Scale in much the same way as an adult. It would appear that, until this capacity is developed, the items towards the end of Set B are relatively meaningless, but that the same items are self-evident to those who have developed such a capacity. It has proved extremely difficult to construct problems intermediary between those in which success depends on selecting a figure to complete a group of discrete figures conceived as a spatially related whole, and those in which two figures must be compared, and the fourth figure inferred from the nature of a third. To the mature mind, these two kinds of problem seem similar and are apparently solved by more or less the same line of reasoning. To a child, they are apparently very different and seem to elicit different mental processes.

From age 10 onwards, the test responses of those with high, average, and low scores become increasingly different. When children are unable to solve a problem they tend to repeat what they have already perceived and assimilated. Secondly, they tend to make errors in orientation and the creation of correlates. They also tend to assimilate the perceptual field less adequately and, finally, make arbitrary choices according to the proximity of a figure to the space to be filled, and, least frequently of all, its proximity to themselves.

Raven’s Progressive Matrices comes in the following forms:
1. The Coloured Progressive Matrices (CPM) is designed for use with young children and old people, for anthropological studies, and for clinical work. It can be used satisfactorily with people who, for any reason, cannot understand or speak the English language, with people suffering from physical disabilities, aphasias, cerebral palsy or deafness, as well as with people who are intellectually subnormal or who have deteriorated (Raven et al., 1995: 1). This test consists of 36-item applicable at ages 5 to 11 and colors are used in this form to attract and hold the attention of the children (Sattler, 2001: 561).

2. The Standard Progressive Matrices (SPM) is normed for subjects 6 years and up, although most of the items are so difficult that the test is best suited for adult subjects. This test consists of 60 items grouped into 5 sets of 12 progressions (Gregory, 1996: 235).

3. The Advanced Progressive Matrices (APM) is similar to the Standard version, but has a higher ceiling. The Advanced version consists of 12 problems in Set I and 36 problems in Set II. This form is especially suitable for persons of superior intellect.

For CPM, the normal range of the coloured progressive matrices of Thai population developed by Sucheera Phattharayuttawat et al. (2546) was used to determine the level of intellectual ability.

The Progressive Matrices tests are not written test in structure and have become very well-known due to their convenience, non-complication, not time consuming and they can be used for individual or group test. The test has least cultural and language influences. It implies ability in observation, visual perception, though and conflicting rationale of a person being tested. The results are reliable compared to other standardized test such as The Wechsler Intelligence Scales due to the value of correlation with verbal tests at .58 and performance tests at .70 (Somsong Suwannalert et al., 2511: 207).

Supa Malakul (2500) studied the norms of Thai children using Coloured Progressive Matrices developed by Raven among 1,385 Grade 1-9 students aged 7-12
years in public schools in Bangkok, Chiangmai, and Chunthaburi. The study found that sample groups of different ages had different mean of intellectual ability but the scores increased through age. This is similar to Narongsak Talapat and Somsong Suwannalert (2509) whose study on norms of Coloured Progressive Matrices developed by Raven conducted among 2,000 students aged 7-14 years who studied at private and public schools in Bangkok. The results revealed that sample group of different ages had different mean of intellectual ability with regular interval. It can be said that this test can divide intellectual ability of children in each age group and can be used for comparing with the norms of Thai children.

In 2501, Prasit Harinsut and Somsong Suwannalert studied the Progressive Matrices among Thai children using the same sample groups as the study conducted by Supa Malakul (2500) to determine correlation between scores of final tests of the sample groups and scores from Raven’s Coloured Progressive Test, as well as studied the intellectual development of children aged 7-12 years comparing to the previous study and how much such test could measure intellectual ability of Thai children. It was found that scores from the final test were not correlated to scores from CPM test because scores from final test included scores from the test that needed skill involvement such as physical education. Besides, the CPM only measured ability in the brain not other specific skill.

Moreover, it was found that within 1 year, the level of intellectual development increased through age. This test can also use for children age over 12 years. Tippawan Surinya (2524) studied the correlation between intellectual ability measured by Coloured Progressive Matrices and level of development under Piaget’s theory of cognition among 208 children aged 5-11 years randomly selected from primary schools in Bangkok and found that scores from the CPM increased through age in accordance to mean of intellectual ability measured by Piaget’s theory.

Bundee Watcharakuldilok (2527) studied norms of the CPM for Thai children living in Bangkok by conducting the test with 334 students aged 5-12 years who studied in elementary school to grade 12 in 13 public and private schools. It was
found that the reliability of the test was .56 - .90 and increased through age whereas age 5-7 years had the highest reliability after that it has tendency to decrease until the age of 12 years old. Therefore, this test is suitable for children age 5.5-11 years. The mean time spent for taking the test is 6.0-12.4 minutes.

The study on norms of Raven’s Coloured Progressive Matrices conducted by Suntorn Tunjee (2528) among students aged 5.5-11 years old in the Central region of Thailand found that mean of intellectual ability of the sample group increased through age and it was different at .01. Sudanee Wuthiprom (2528) also conducted a study on mean of intellectual ability among students aged 5-11 years in the Northeast region of Thailand. The study found that children in different genders had no different mean of intellectual ability. While the one who had different ages found different mean at .01 and mean increases by age. This was similar to the study of Suwaree Rerkjaree (2528) among students in the South of Thailand.

Raven (1995 : 25-33) gathered several study of others about using The Coloured Progressive Matrices Test as follow:

A substantial study by Jensen (1974) investigated the responses of 1,662 young children (kindergarten to sixth grade) covering three ethnic groups (Anglo, Black, and Hispanic). A split-half reliability estimate of .90 was reported, with no differences by ethnicity or sex. While age differences were not reported in that study, a subsequent report by Jensen and Carlson (1981) has analyzed the data from 783 of the respondents to find an overall split-half estimate of .85. Reddington and Jackson (1981) reported a Queensland study of 737 children around seven midyear points (5½-11½ years). 693 were White and 44 Aborigines. At the youngest age (5½) a Cronbach alpha of .80 was reported, with values rising to .93 at age 11½. The authors noted a particularly high reliability for non-English speaking origin children (Cronbach’s alpha = .94). Similarly, Miao and Huang (1990), working with a large normative sample in Taiwan, found split-half reliabilities up to .93 depending on age.

Test-retest reliability studies of the CPM now show encouraging evidence of stability in various cultures, at least when the retest interval is short (10 days). Li
and Others (1988) found a reliability of .95 with a composite CPM/SPM test used with Chinese children in Shanghai. Roa and Reddy (1968), with 1,017 pupils in grades 1 to 5 in India, retested a sample of 100 after 2-3 weeks, and reported a value of .86. This closely resembles Elley and MacArthur’s (1962) study of 27 Canadian children in which a retest value of .87 was found. Similarly, Freyburg (1966) reported retest reliabilities of .87, .83, and .81 for samples of 5, 7, and 8-year-old pupils respectively. Miao and Huang (1990) reported values up to .92 after one month with Taiwanese school children.

Carlson (1972) has related the CPM to Piagetian conservation concepts, noting a development in the reasoning process required for CPM solutions from perceptual to conceptual. Carlson and Wiedl (1977) found high loadings for both perceptual and conceptual items on the factor defined as simultaneous processing. This supports the work of Das (1973) and Kirby (1976) whose loading of about .8 among fourth grade children has been often quoted.

Besides, the study to create the normative scores of the Standard Progressive Matrices (Sucheera Phattharayuttawat, et al., 2543 : 45-56) and the Coloured Progressive Matrices (Sucheera Phattharayuttawat, et al., 2546 : 58-70) in the Thai Population concluded that genders had no effect to intelligence. Even male’s visuospatial ability is better than female’s (Hyde & Plant, 1995 cited by Santrock, 1997 : 337).

Goodenough – Harris and Raven, mention that ability in learning, memorizing what have been learned, general problem solving, ability in observation, being rational, concrete thinking, progressive thinking, and accuracy of perception, or what is call intelligence, develop through age. In other word, when individual is older, ability to think become more complicated. Only reliable tests method are needed to measure general intelligence. Such tests are human figure drawing in Draw A Person (DAP) test and selecting correct pieces in Coloured Progressive Matrices (CPM) test. Since a picture can reflect conceptualization of a person drawing it, anyone who can think and understand abstract rationale, having complete organs and can functions
them properly should be able to draw it. Likewise, ability to perceive relationship, logical thinking and differentiating the like and the difference can be expressed through the CPM test. Intellectual ability occurs naturally resulted from reaction with the environment and physical readiness. Thus, measuring intellectual ability using the Draw A Person (DAP) and in Coloured Progressive Matrices (CPM) tests should obtain the same result of intellectual ability which implies that both test can be used in place on one another to measure “g-factor” of children. Conceptual framework of the research is presented as follow:

Conceptual framework of the research

- physical readiness
- interaction with surrounding
- visual conceiving
- abstract thinking
- ability in planning
- ability in concept formation

DAP

CPM

- physical readiness
- interaction with surrounding
- ability to form comparisons
- ability to reason by analog
- ability to organized spatial perceptions into systematically related wholes

Intellectual ability
CHAPTER 3
METHODOLOGY

The descriptive research aiming at studying intellectual ability measurement in primary school students by focusing on the correlation between the intellectual level measured by Draw A Person test and The Coloured Progressive Matrices (CPM). Compositions of this research are as follows:

1. Population and Sample group
2. Variables
3. Research tool
4. Data collection and analysis

Population and Sample group

Population in this study was Grade 1-6 primary school students in Bangkok aged 6 years to 11 years and 11 months old who were studying in Semester 1, academic year 2003 at schools under the Office of the National Primary Education Commission, Office of the Private Education Commission, and Bangkok Metropolitan Administration. It was found from the database that there were 159,287 students aged 5-12 years whose names are registered in the central registration (Registration Bureau, Local Administration Department, Ministry of Interior, 2002).

The method of Yamane was used for determining size of the sample group (Yamane, cited by Sucheera Phattharayuttawat, 2541 : 59) with error accepted in randomization at .05 and reliability at 95%. The sample group consisted of students aged 6 years to 11 years and 11 months old who studied in semester 1, academic year
2003 at 7 schools in Bangkok. The number of sample derived by simple random sampling was 396 of schools information are as follow :

<table>
<thead>
<tr>
<th>Administration</th>
<th>School</th>
<th>District</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office of the National Primary Education</td>
<td>Wat Amarin Dhararam</td>
<td>Bangkok Noi</td>
</tr>
<tr>
<td>Commission</td>
<td>Wat Hong Ratanaram</td>
<td>Bangkok Yai</td>
</tr>
<tr>
<td>Office of the Private Education</td>
<td>Raewadee</td>
<td>Phyathai</td>
</tr>
<tr>
<td>Commission</td>
<td>Bhadungsit Pittaya</td>
<td>Bangsue</td>
</tr>
<tr>
<td>Bangkok Metropolitan Administration</td>
<td>Rajaborpit</td>
<td>Phra Nakorn</td>
</tr>
<tr>
<td></td>
<td>Wat Mahannop</td>
<td>Phra Nakorn</td>
</tr>
<tr>
<td></td>
<td>Prachanives</td>
<td>Jatujak</td>
</tr>
</tbody>
</table>

Students were randomized by year level from the total of 6 ranges. The sixty-six students from each year were selected; as follow: 6 – 6·11 years, 7 – 7·11 years, 8 – 8·11 years, 9 – 9·11 years, 10 – 10·11 years and 11 – 11·11 years.

**Variables**

- Independent variables are ages divided into 6 ranges, 1 year each.
- Dependent variables are intellectual ability measured by Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM).

**Research tool**

1. **Draw A Person (DAP)**: A Quantitative Scoring System is an intellectual ability test that lets an individual taking the test to draw a picture of human. It was developed by Jack A. Naglieri in 1988. This test is a nonverbal test of intelligence that can be administered individually or in a group and use for ages 5 to 17 years, 11 months. The DAP requires the examinee to draw three pictures (Man, Woman, and Self) on three separate pages of the Response Form. Allow a maximum of 5 minutes.
for completion of each drawing. If the child finishes in less than 5 minutes, go on to
the next drawing. The DAP scoring system is organized into three major components:
criteria, categories, and items. Fourteen criteria in the examinee’s drawing, most of
which are parts of the body, are scored on a number of specific characteristics of the
drawing, or items. These items generally are of four types or categories: Presence,
Detail, Proportion, and Bonus. The 14 criteria include 12 parts of the body (Arms,
Ears, Eyes, Feet, Fingers, Hair, Head, Legs, Mouth, Neck, Nose, and Trunk),
placement of certain body parts in relation to each other (Attachment), and Clothing.
Each criterion can determine by met to varying degrees, based on the number of items
correctly completed.

The assessment of the intellectual ability uses the total drawing scores of 3
pictures and convert them into standard scores or level of intellect by using the table of
normal range of DAP test for students age 5-17 years in the central region of Thailand
developed by Titiwan Foo-trakoon (2542).

2. The Coloured Progressive Matrices (CPM) is the one of progressive
matrices test developed by J.C. Raven, an English Psychiatrist, in 1938 modified in
1956, and universal use until now. The Raven Progressive Matrices Test was
originally designed as a measure of Spearman’s g factor. In particular, to correctly
answer items on the RPM, examinees must identify a recurring pattern or relationship
between figural stimuli organized in a $3 \times 3$ matrix. The items are arranged in order of
increasing difficulty, hence the reference to progressive matrices. The Coloured
Progressive Matrices is a 36 item test designed for children from 5 to 11 years of age.
Raven incorporated colors into this version of the test to help hold the attention of the
young subjects.

For the coloured progressive matrices test, individuals taking the test need to
fill in the missing parts by selecting them from the parts provided. One set of test is for
one individual. For this test, the normal range of the coloured progressive matrices of
Thai population developed by Sucheera Phattharayuttawat et al.(2546) was used to
determine the level of intellectual ability.
Data collection and analysis

The researcher conducted the test by himself during the first semester of academic year 2003 from June 2003 – September 2003 with the following 3 steps:

1. Practice for having skill of administration and scoring both of the DAP and CPM tests.
2. Data collection and Data analysis
   2.1 The researcher asked for cooperation in taking the test and inform the objectives.
   2.2 Conducted the DAP test first and followed by the Coloured Progressive Matrices test. The tests were conducted in groups. For the kids aged 6-9 years who might not understand instruction well were administered in small groups with assistance by the researcher.
3. The personal data and the results of the tests were analyzed by using the SPSS/PC+ as:
   3.1 Calculating mean and standard deviation of intellectual ability measured by Draw A Person test and The Coloured Progressive Matrices test.
   3.2 Pearson Product Moment Correlation Coefficient used to study between the intellectual ability measured by Draw A Person test and The Coloured Progressive Matrices test.
CHAPTER 4
RESULTS

The descriptive research conducted in primary school students in Bangkok with the objective was to study the correlation of intellectual ability measured between Draw A Person Test and The Coloured Progressive Matrices Test in age variables. The subjects were 396 students in schools under the Office of National Primary Education Commission, Office of the Private Education Commission and Bangkok Metropolitan Administration. The results of this research presented in three parts as:

Part I  :  Name of the Schools and ages ranged of students
Part II :  Means and standard deviation of the Intellectual ability measured by DAP and CPM of primary school students in each age group
Part III :  The Correlation of intellectual ability measured by DAP and CPM of primary school students
### Table 1  Distribution of students classified by schools and age ranges

<table>
<thead>
<tr>
<th>Ages Ranged</th>
<th>Raewadee</th>
<th>Wat Hong Ratanaram</th>
<th>Wat Amarin Dhararam</th>
<th>Wat Mahannop</th>
<th>Raja - borpit</th>
<th>Bhadungsit Pittaya</th>
<th>Prachanives</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 years – 6 years and 11 months</td>
<td>7</td>
<td>4</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>4</td>
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<td>Total</td>
<td>11</td>
<td>7</td>
<td>8</td>
<td>7</td>
<td>11</td>
<td>11</td>
<td>11</td>
<td>66</td>
</tr>
<tr>
<td>7 years – 7 years and 11 months</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>7</td>
<td>6</td>
<td>5</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
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<td>9</td>
<td>66</td>
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<td>8 years – 8 years and 11 months</td>
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<td>4</td>
<td>6</td>
<td>5</td>
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<td>5</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>10</td>
<td>11</td>
<td>10</td>
<td>9</td>
<td>8</td>
<td>11</td>
<td>7</td>
<td>66</td>
</tr>
<tr>
<td>9 years – 9 years and 11 months</td>
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<td>3</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
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<td>10</td>
<td>11</td>
<td>7</td>
<td>14</td>
<td>7</td>
<td>4</td>
<td>66</td>
</tr>
<tr>
<td>10 years – 10 years and 11 months</td>
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<td>12</td>
<td>11</td>
<td>4</td>
<td>11</td>
<td>11</td>
<td>7</td>
<td>66</td>
</tr>
<tr>
<td>11 years – 11 years and 11 months</td>
<td>7</td>
<td>5</td>
<td>7</td>
<td>5</td>
<td>6</td>
<td>2</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
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<td>33</td>
<td>33</td>
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<tr>
<td>Total</td>
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<td>63</td>
<td>62</td>
<td>41</td>
<td>63</td>
<td>58</td>
<td>43</td>
<td>194</td>
</tr>
</tbody>
</table>

Table 1 shows the 396 students with equal of boys and girls aged ranges from 6 years to 11 years 11 months from the 3 administration of schools. The Office of the National Primary Education Commission; Wat Amarin Dhararam School and Wat Hong Ratanaram School, Office of the Private Education Commission; Raewadee School and Bhadungsit Pittaya School and Bangkok Metropolitan Administration; Rajaborpit School, Wat Mahannop School and Prachanives School.
Part II

Table 2 Comparisons between Means and Standard deviations on Intellectual ability measured by DAP and CPM in primary school students divided by age

<table>
<thead>
<tr>
<th>Ages Ranged</th>
<th>Intellectual ability measured by DAP</th>
<th>Intellectual ability measured by CPM</th>
<th>t</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>S.D.</td>
<td>Mean</td>
<td>S.D.</td>
</tr>
<tr>
<td>6 years – 6 years</td>
<td>103.23</td>
<td>17.15</td>
<td>82.52</td>
<td>9.83</td>
</tr>
<tr>
<td>and 11 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 years – 7 years</td>
<td>100.47</td>
<td>12.83</td>
<td>86.14</td>
<td>9.33</td>
</tr>
<tr>
<td>and 11 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 years – 8 years</td>
<td>100.50</td>
<td>10.78</td>
<td>91.74</td>
<td>8.87</td>
</tr>
<tr>
<td>and 11 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 years – 9 years</td>
<td>100.89</td>
<td>11.42</td>
<td>97.32</td>
<td>8.28</td>
</tr>
<tr>
<td>and 11 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years – 10 years</td>
<td>100.11</td>
<td>10.58</td>
<td>100.38</td>
<td>7.52</td>
</tr>
<tr>
<td>and 11 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 years – 11 years</td>
<td>98.58</td>
<td>11.76</td>
<td>101.15</td>
<td>6.49</td>
</tr>
<tr>
<td>and 11 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 2 shows that means of intellectual ability from Draw A Person Test (DAP) and means of intellectual ability from The Coloured Progressive Matrices Test (CPM) in primary school students were different at the age 6 to 9 and 11 months, while no different found at 10 years to 11 years 11 months ranged.
Table 3  Comparisons of means of intellectual ability measured by DAP in each age ranged

<table>
<thead>
<tr>
<th>Ages Ranged</th>
<th>Intellectual ability measured by DAP</th>
<th>Mean</th>
<th>S.D.</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 years – 6 years and 11 months</td>
<td></td>
<td>103.23</td>
<td>17.15</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 years – 7 years and 11 months</td>
<td></td>
<td>100.47</td>
<td>12.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 years – 8 years and 11 months</td>
<td></td>
<td>100.50</td>
<td>10.78</td>
<td>.941</td>
<td>.454</td>
</tr>
<tr>
<td>9 years – 9 years and 11 months</td>
<td></td>
<td>100.89</td>
<td>11.42</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years – 10 years and 11 months</td>
<td></td>
<td>100.11</td>
<td>10.58</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 years – 11 years and 11 months</td>
<td></td>
<td>98.58</td>
<td>11.76</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows that no difference in means of intellectual ability measured by DAP was found in each age ranged of primary school students.

Table 4  Comparisons of means of intellectual ability measured by CPM in each age ranged

<table>
<thead>
<tr>
<th>Ages Ranged</th>
<th>Intellectual ability measured by CPM</th>
<th>Mean</th>
<th>S.D.</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 years – 6 years and 11 months</td>
<td></td>
<td>82.52</td>
<td>9.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7 years – 7 years and 11 months</td>
<td></td>
<td>86.14</td>
<td>9.33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 years – 8 years and 11 months</td>
<td></td>
<td>91.74</td>
<td>8.87</td>
<td>54.942</td>
<td>.000</td>
</tr>
<tr>
<td>9 years – 9 years and 11 months</td>
<td></td>
<td>97.32</td>
<td>8.28</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years – 10 years and 11 months</td>
<td></td>
<td>100.38</td>
<td>7.52</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 years – 11 years and 11 months</td>
<td></td>
<td>101.15</td>
<td>6.49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 4 shows that means of intellectual ability measured by CPM in primary school students had different in the age ranged.
Table 5  Post-Hoc of means of intellectual ability measured by CPM in each age ranged

<table>
<thead>
<tr>
<th>Ages Ranged</th>
<th>6 years - 6 years and 11 months</th>
<th>7 years - 7 years and 11 months</th>
<th>8 years - 8 years and 11 months</th>
<th>9 years - 9 years and 11 months</th>
<th>10 years - 10 years and 11 months</th>
<th>11 years - 11 years and 11 months</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 years - 6 years and 11 months</td>
<td>-3.62</td>
<td>-9.23*</td>
<td>-14.80*</td>
<td>-17.86*</td>
<td>-18.64*</td>
<td></td>
</tr>
<tr>
<td>7 years - 7 years and 11 months</td>
<td>-5.61*</td>
<td>-11.18*</td>
<td>-14.24*</td>
<td>-15.02*</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 years - 8 years and 11 months</td>
<td>-5.58*</td>
<td>-8.64*</td>
<td>-9.41*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 years - 9 years and 11 months</td>
<td></td>
<td></td>
<td>-3.06</td>
<td>-3.83</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 years - 10 years and 11 months</td>
<td></td>
<td></td>
<td></td>
<td>-.77</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11 years - 11 years and 11 months</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P<.05

Table 5 shows no different between aged 6 to 6 and 11 months and 7 to 7 and 11 months, aged 9 years to 9 years 11 months was not different from 10 years to 10 years 11 months and at 11 years to 11 years 11 months. While the aged 8 to 8 and 11 months had significantly difference from the others age ranged.

Table 6  Comparisons of means of intellectual ability measured by DAP in primary school students divided by administration of the school

<table>
<thead>
<tr>
<th>Administration</th>
<th>Intellectual ability measured by DAP Mean</th>
<th>S.D.</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office of National Primary Education Commission</td>
<td>99.11</td>
<td>12.49</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of the Private Education Commission</td>
<td>101.06</td>
<td>13.11</td>
<td>1.394</td>
<td>.249</td>
</tr>
<tr>
<td>Bangkok Metropolitan Administration</td>
<td>101.57</td>
<td>12.25</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 6 shows that means of intellectual ability measured by DAP in primary school students were not different in each administration.
Table 7  Comparisons of means of intellectual ability measured by CPM in primary school students divided by administration of the school

<table>
<thead>
<tr>
<th>Administration</th>
<th>Intellectual ability measured by CPM</th>
<th>Mean</th>
<th>S.D.</th>
<th>F</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office of National Primary Education Commission</td>
<td></td>
<td>93.08</td>
<td>11.64</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Office of the Private Education Commission</td>
<td></td>
<td>95.94</td>
<td>9.73</td>
<td>7.043</td>
<td>.001</td>
</tr>
<tr>
<td>Bangkok Metropolitan Administration</td>
<td></td>
<td>90.99</td>
<td>10.93</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7 shows that mean of intellectual ability measured by CPM in primary school students were different in each administration.

Table 8  Post-Hoc of means of intellectual ability measured by CPM in primary school students in Bangkok by administration of school

<table>
<thead>
<tr>
<th>Administration</th>
<th>Office of the Private Education Commission</th>
<th>Office of National Primary Education Commission</th>
<th>Bangkok Metropolitan Administration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office of the Private Education Commission</td>
<td>2.86</td>
<td></td>
<td>4.95*</td>
</tr>
<tr>
<td>Office of National Primary Education Commission</td>
<td>2.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bangkok Metropolitan Administration</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P<.05

Table 8 shows that means of intellectual ability measured by CPM in primary school students were different between Office of the Private Education Commission schools and Bangkok Metropolitan Administration schools.
Part III

Table 9  Correlation of intellectual ability measured between DAP and CPM in primary school students

<table>
<thead>
<tr>
<th>Test</th>
<th>Mean</th>
<th>S.D.</th>
<th>R</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAP</td>
<td>100.63</td>
<td>12.61</td>
<td>.173</td>
<td>.001</td>
</tr>
<tr>
<td>CPM</td>
<td>93.21</td>
<td>10.97</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 9 shows that intellectual ability measured by DAP and CPM was correlated with statistical significance at .001 level.
CHAPTER 5
CONCLUSION, DISCUSSION AND RECOMMENDATION

The research conducted in primary school students in Bangkok with the objective was to study the correlation of intellectual ability measured between Draw A Person Test and The Coloured Progressive Matrices Test. Sample group in this study was 396 students from grade 1 to 6 of primary schools, ranged by age 6 to 11 and 11 months. The students were studying in Semester 1, academic year 2003 from June 2003 – September 2003 at schools under the Office of the National Primary Education Commission, Office of the Private Education Commission, and Bangkok Metropolitan Administration.

Conclusion

1. Intellectual ability measured by DAP and CPM were correlated with statistical significance at .001 level.

2. Means of intellectual ability from Draw A Person Test (DAP) and means of intellectual ability from The Coloured Progressive Matrices Test (CPM) in primary school students were different at the age 6 to 9 and 11 months, but they were not different at 10 years to 11 years 11 months.

3. Means of intellectual ability measured by CPM in primary school students were different at each age range while means that measured by CPM in primary school students were not different at age 6 to 6 and 11 months and 7 to 7 and 11 months, the age ranged at 9 years to 9 years 11 months were not different from the ones at 10 years to 10 years 11 months and at 11 years to 11 years 11 months. While means that
measured by CPM at age 8 to 8 and 11 months have significant from others age ranges.

4. Means of intellectual ability measured by DAP in primary school students were not different in each administration. While means of intellectual ability measured by CPM in primary school students were different in each administration. Namely, means of intellectual ability measured by CPM in primary school students were different between Office of the Private Education Commission schools and Bangkok Metropolitan Administration schools.

Discussion

The research was to study the correlation of intellectual ability measured between DAP test and CPM test in age variable. Sample group in this study was 396 primary school students studied at schools under the Office of the National Primary Education Commission, Office of the Private Education Commission, and Bangkok Metropolitan Administration (BMA).

According to family backgrounds of students under Office of the Private Education Commission schools, they primarily lived with their parents whose economic status were in high-income group and also they were well educated. Hence, the children could be derived and more support in learning new things and also they could obtain lots of care from parents. For the students under Office of the National Primary Education Commission schools and Bangkok Metropolitan Administration, they mostly lived in nearby school area with their parents or their relatives whose economic status as well as their education were in low – middle levels.

The research could be discussed according to two mentioned hypotheses as follows:
1. Intellectual ability of primary school students measured by Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM) were correlated with statistical significance at .001 level.

This finding leads to the implication of alternative use these tests when want to measure “g-factor” of children. However, the precaution is that they are different in the characteristic and test administration. Intellectual assessment with DAP, examinee who can incorporate details or concept formation and have ability of visual conceiving be able to do human figure drawing completely which brings high score from the test. In addition to the above several intellectual abilities for obtaining high scores in CPM test, other abilities such as accuracy in differentiating the like and the difference or the ability to form comparisons, understanding of rational relationship or reasoning by analogy, and organizing spatial perceptions into systematically related wholes including flexible in process of thinking are needed to be applied. Therefore, it seems that children have to show more complex abilities in General Intelligence while doing the CPM test than having DAP test. However, these mentioned abilities are gradually developed when children grow up.

The different nature of tests characteristic as mentioned above may bring to the relatively low (r = .173) correlation as found despite they measure the same factor of intelligence.

2. Means of intellectual ability from Draw A Person Test (DAP) and means of intellectual ability from The Coloured Progressive Matrices Test (CPM) in primary school students were different at the age 6 to 9 and 11 months, but they were not different at 10 years to 11 years 11 months.

This result can be in line with Piaget’s theory of cognition, which mentions about level of development through aging. Both tests are also different in what to measure, i.e. the DAP is to measure general intelligence in term of ability to incorporate details or concept formation and the ability in visual conceiving.
However, the CPM not only can measure the above several intellectual abilities, but it can also measure other abilities such as accuracy in differentiating the like and the difference or the ability to form comparisons, understanding of rational relationship or reasoning by analogy, and organizing spatial perceptions into systematically related wholes (Sattler, 2001 : 561).

Under Piaget’s theory of cognition, the development of children at 6-7 years is at the stage of intuitive thought when children understand things based on their external perception or visualization but cannot think rationally. Children in this ages range are usually able to conceive discrete objects as spatially related wholes, but apparently have difficulty analyzing them into their components (Raven, 1995 : 23). Consequently, the scores obtained from CPM test were lower. In contrast, drawing was more intellectual realism and more of what they know of an object rather than what they see or have seen of it (Luquet, cited by Piaget & Inhelder, 1973 : 94), as well as clothing and decorative detail will be appeared (Burt, 1921 cited by Harris, 1963 : 18) that means when compares between the nature of both tests, small children were more comfortable to take the DAP than CPM. As a result, scores from the DAP test were higher.

Contrastingly, at the age of 8-9 years, it was the concrete operation stage. Children start to be able to set up criteria for classifying their environments, which enables them to learn specific relationship. Thus, children could perceive relationship of pictures in the CPM test and result in higher scores than 6-7 year children. At the age of 10-11 years, children enter the formal operation stage and they have maximum development in thinking which enables them to think systematically. They can understand intangible issues and understand the like and difference by repeated thinking, as well as are able to compare relationship of pictures in the CPM test. As a result, these ages obtained highest scores compared to other ages. Besides, a more complex way of thinking is developed through ages so means of intellectual ability obtained from the CPM test also increased with the increased ages. However, the means of intellectual ability measured by the DAP at the age of 11 years to 11 years and 11 months was lower than other ages, which could be due to the transition phase.
into adolescence so children are more interested in adult’s activities resulted in slower drawing development or less interested in drawing. Consequently, children at 6 - 9 years had lower means of intellectual ability measured by the CPM than the means of intellectual ability measured by DAP test.

Apart from above, the following results are also found

3. Means of intellectual ability measured by CPM in primary school students were different at each age range while means that measured by CPM in primary school students were not different at age 6 to 6 and 11 months and 7 to 7 and 11 months, the age ranged at 9 years to 9 years 11 months were not different from the ones at 10 years to 10 years 11 months and at 11 years to 11 years 11 months. While means that measured by CPM at age 8 to 8 and 11 months have significant from others age ranges.

Presumably, children with ages ranged at 8 years to 8 years and 11 months are in between periods of the middle childhood (6 - 7 years) and late childhood (9 – 11 years). In considering the result, it was founded that children at 6 – 7 years, which belong to the stage of Intuitive thought, were not able to understand any command, and also their ability to do problem solving rationally was not maturely developed while in the age range of 8 to 8 and 11 months, children’s cognitive development reaches the stage of Concrete operations, so the ability in concrete thinking starts being developed. The children could initially understand relationship of things. They, thus, utilized that gained ability to solve those problems in CPM test better than those in first mentioned period and also in the period of 9 – 11 years that the ability to do problem solving rationally had already been developed for a while. Then, the children were able to compare the similarities and differences between two objects and understand relationship rationally. Eventually, they could understand the relationship of anything. As a result, high scores can be more seen in this age range than other ones.
4. Means of intellectual ability measured by DAP in primary school students, age 6 – 11 and 11 months were not different in each administration. It might be because in the age of 6 to 11 and 11 months, children’s cognition are developed in the same level as they can incorporate some details in unity or have concept formation as well as have ability in visual conceiving. As a result, self perception and surrounding perception are not different. If the examiner wants to assess the intellectual ability in term of non complicated concept formation in children age 6-11 years, DAP is recommended.

While means of intellectual ability measured by CPM in primary school students, age 6 – 11 years and 11 months were overall similar in each administration; but it was found that means of intellectual ability measured by CPM in the students in Office of the Private Education Commission schools was little higher than other administrations, especially it was significantly to the Bangkok Metropolitan Administration schools.

This result bring to consider about the personal backgrounds as status of parents and child rearing etc. These components may relate to the child's opportunity to develop skills of form comparisons, reasoning by analogy and organizing spatial perceptions into systematically related wholes.

**Recommendation**

1. Recommendation on applying the result

Since the result of the research was found that the Intellectual ability of primary school students in Bangkok measured by Draw A Person (DAP) test and the Coloured Progressive Matrices (CPM) are correlated, it brings to use in place on one another to measure General Intelligence of small children who have different age levels or take the test under different testing environments. Because each child may has one’s own ability and limitation in response to the test such as having physical
health problems and language problems or being impatient to take the test with fixed format or need to be rational in order to get the answers like in CPM test. Thus, DAP can be used in stead as it is drawing of human figure close to them and it is always a preferable activity for any children. Besides, test as drawing is a kind of familiar activity that children have no fears or worries in doing so. Nevertheless, in using in place on one another, the examiner should understand characteristic of the both tests consisting test administration which has different levels of difficulty, and different abilities in what is measured by focusing on appropriateness to examinee.

As the results of the research, it was found different between means from DAP and CPM at the age 6 to 9 and 11 months, but no different at 10 years to 11 years 11 months. It shows that different tests be suitable for children in different age ranges depending on levels of development and degrees of interest in surrounding according to their ages. In practical ways, if an examiner want to assess intellectual ability in middle childhood for normal case, human figure drawing is recommended. But in late childhood, CPM be more suitable to apply for assessment in intellectual.

Hence, in the report of intellectual assessment, it should be clearly explained that which test the obtained scores of intellectual ability belonged to and which abilities measured.

2. Recommendation on intelligence testing in children

2.1 In testing children’s intelligence, either DAP test or CPM test or both seem pretty easy to process as they do not need any specialist in intelligence testing, only need practicing in the right steps as indicated in testing manual. Nevertheless, examining and interpreting still need to be done by sophisticated person.

As said by Naglieri (1988 : 3) that interpretation of DAP standard scores is a task requiring proper training and experience in test theory and individual assessment. The person who follow the training program provided in the manual or a
similar training procedure, should be able to administer, score, and interpret the DAP appropriately. Only persons with appropriate training should administration and interpret the DAP. Furthermore, a major decision about a person’s overall level of ability should not be made on the basis of any one test. The DAP, like any test, should be used in conjunction with other measures to obtain a complete profile of the individual’s abilities. Moreover, The Psychological Corporation (1997) had defined the User Qualifications in using DAP and CPM that user must have a master’s-level degree in Psychology or Education or the equivalent in a related field with relevant training in assessment.

2.2 An examiner should also consider an examinee’s both mental and physical readiness, which affect examinee’s cooperation and attention. The actual ability can, therefore, be discovered and evaluated accurately.

2.3 An examiner should be interested in testing environments by choosing a quiet place as noise can annoy an examinee and may also cause a lower result than actual.

2.4 In group test, an examiner should set up an appropriate group size e.g. in 6-9 year children group, which they cannot understand any command well enough and may not be able to be calm either, should be sized into a small one consisting of 3-6 people. By this, the examiner and assistant one have to observe and help them but not with doing the test to keep all in order.

2.5 An examiner has to strictly process the test according to that content stated in the testing manual.

3. Recommendation for the future researches

In comparison between administrations of the studied schools, it was found that the features of schools do not affect average scores obtained by DAP
measurement, but the students under Office of the Private Education Commission schools received the little higher average scores on CPM test than the students under Bangkok Metropolitan Administration schools. Thus, studying more on other factors such as family background that students live in, such as parents’ education levels, parents’ economic status and teaching methods etc. can help consider how child thinking process and development are influenced by these factors.
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นนท์ศุกรีย์ คำทันเจริญ. (2523). การศึกษาวุฒิภาวะทางเชาวน์ปัญญาของเด็กไทยในระดับอนุบาล โดยใช้แบบสอบถามความคิดเห็นเกี่ยวกับปัญญาของเด็กไทย. วิทยานิพนธ์ปริญญาครุศาสตรมหาบัณฑิต, ภาควิชาวิจัยการศึกษา บัณฑิตวิทยาลัย จุฬาลงกรณมหาวิทยาลัย.


ทิพวัลย์ สุรินยา. (2524). การศึกษาความสัมพันธ์ระหว่างระดับเจาะจงปัญญาที่ได้จากแบบสอบถามโปรเกรสซีพแมทริซีสแบบสีกับขั้นพัฒนาการของความคิดตามทฤษฎีของปีอาร์ช ของเด็กวัย 5½-11 ปี. วิทยานิพนธ์ปริญญามหาบัณฑิต, บัณฑิตวิทยาลัยมหาวิทยาลัยมหิดล.


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English


APPENDIX A

The Ethical Committee on Research Involving Human Subject
Faculty of Medicine Siriraj Hospital, Mahidol University
<table>
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<th>Protocol Title</th>
<th>A Study of The Correlation of Intellectual Ability Measure Between Draw A Person Test and The Coloured Progressive Matrices Test in Primary School Students in Bangkok</th>
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<tr>
<td>Principal Investigator</td>
<td>Mr. Niyot Sangtongluan</td>
</tr>
<tr>
<td>Name of Department</td>
<td>Psychiatry</td>
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The aforementioned project and informed consent have been reviewed and approved by the Ethical Committee, Faculty of Medicine Siriraj Hospital, Mahidol University, based on the Declaration of Helsinki on April 24, 2003.

**Signature of Chairman**

(Prof. Sumalee Nimmannit)

**Signature of Dean**

(Clin. Prof. Piyasakol Sekolsatayadorn)
APPENDIX B

Consent form
หนังสือแสดงเจตนายินยอมให้นักเรียนเข้าร่วมโครงการวิจัยทางการแพทย์

วันที่……เดือน………………พ.ศ.……

ข้าพเจ้า……………………………… อายุ………ปี อาศัยอยู่บ้านเลขที่…………ถนน………………………………ต.บล……………………………… อ.………………………………จ.………………

จังหวัด……………………………… โทรศัพท์……………………………… ขอแสดงเจตนายินยอมให้เด็กนักเรียนที่ข้าพเจ้ายินยอมเข้าร่วมโครงการวิจัยเรื่อง การศึกษาความสามารถทางประชาชนปัญญาที่วัดจากแบบทดสอบวาดภาพคน ในนักเรียนระดับประถมศึกษาในกรุงเทพมหานคร โดยนายนิยตแสงทองลวน แสดงผลดังนี้

โดยข้าพเจ้ายินยอมให้ท่านเกิดกู้บการเปลี่ยนแปลงของโครงการดังกล่าวไปนี้

วัตถุประสงค์ของการวิจัย เพื่อศึกษาความสามารถทางประชาชนปัญญาของนักเรียนชั้นประถมศึกษาในกรุงเทพมหานครที่วัดได้จากแบบทดสอบวาดภาพคนและแบบทดสอบการคิดอย่างเป็นลำดับขั้น

ประโยชน์ที่คาดว่าจะได้รับจากการวิจัยในครั้งนี้ ทำให้ทราบถึงความสัมพันธ์ของระดับชำนาญปัญญาที่ได้จากแบบทดสอบวาดภาพคนและแบบทดสอบการคิดอย่างเป็นลำดับขั้น เพื่อจะนำไปประยุกต์ใช้แทนกันได้ในการประเมินความสามารถทางประชาชนปัญญาของนักเรียนชั้นประถมศึกษาในกรุงเทพมหานคร

วิธีการเก็บข้อมูลจากนักเรียน ผู้วิจัยทำการทดสอบเป็นกลุ่มด้วยแบบทดสอบวาดภาพ คนล่อน โดยให้นักเรียนวาดภาพคนผู้ชาย ภาพคนผู้หญิง และภาพตัวเอง ให้เวลาในการวาดภาพละ 5 นาที จากนั้นทำการทดสอบคัดตลาดแบบทดสอบการคิดอย่างเป็นลำดับขั้นโดยใช้ชีวิตทดสอบเป็นกลุ่มขนาดเล็ก ใช้เวลาประมาณ 30 นาที โดยในเด็กเล็กอายุ 6 ถึง 9 ปี ซึ่งความเข้าใจในคำสั่งอาจยังไม่เต็มที่ ท่านจะให้ความสามารถอาจทำให้การทดสอบเป็นกลุ่มขนาดเล็กโดยผู้วิจัยจะสังเกตการณ์และให้ความช่วยเหลือ หลังจากทำการทดสอบการคิดอย่างเป็นลำดับขั้นแล้ว จะได้เป็นการเสริมสร้างการทดสอบ จากนั้นจะรวบรวมผลการทดสอบเพื่อนำไปแปลผลต่อไป

กรณีที่นักเรียนปฏิเสธที่จะทำการทดสอบหรือปฏิเสธที่จะทำการทดสอบหลังจากทำการทดสอบไปได้ระยะเวลาแล้วไม่ได้เห็นสาเหตุใดก็ตาม ผู้วิจัยจะอนุญาตให้ผู้ดูแลการทดสอบท่านที่ไม่ได้เห็นใจใดๆ ทั้งสิ้น

หมายเลขโทรศัพท์ที่สามารถติดต่อได้กับผู้วิจัย 0-2221-2968

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อาการเจ้าได้รับทราบข้อมูลของโครงการข้างต้น ตลอดจนประโยชนที่ส่วนรวมจะได้รับจากการเข้าร่วมโครงการในครั้งนี้ และอาการเจ้ายินยอมให้นักเรียนในปกครองของอาการเจ้าเข้าร่วมโครงการดังกล่าว โดยขอให้ผู้วิจัยองค์การเปิดเผยชื่อ ประวัติ ตลอดจนข้อมูลเกี่ยวกับอาการเจ้า รวมทั้งนักเรียนในปกครองของอาการเจ้าแก่ผู้อื่นได้รับทราบ

ลงชื่อ……………………………………………………. ผู้ให้ความยินยอม

(……………………………………………………..) (ระบุความเกี่ยวข้อง)

วันที่………………………………………..

ลงชื่อ……………………………………………………. พยาน

(……………………………………………………..)

ลงชื่อ……………………………………………………. พยาน

(……………………………………………………..)
APPENDIX C

Sample of human figure drawing on the students in the same ages ranged for each administration of school
human figure drawing on the student at the age 9 years and 7 months under Office of the Private Education Commission school
human figure drawing on the student at the age 9 years and 7 months under Office of the National Primary Education Commission school
human figure drawing on the student at the age 9 years and 7 months under Bangkok Metropolitan Administration school
<table>
<thead>
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<th>NAME</th>
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