THE CHARACTERISTICS OF THE COLORED PROGRESSIVE MATRICES(CPM) AND THE ADVANCED PROGRESSIVE MATRICES (APM) IN THAI STUDENTS AGE 6 – 18 YEARS OLD : THE SOUTHERN REGION

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ABSTRACT

The purpose of this research was to study the quality and the construct of a normative scores table of intelligence by Colored Progressive Matrices (CPM) and Advanced Progressive Matrices (APM) in 6-18 years old students in the Southern part; Nakornsithammarat. Province was selected as representation. The 467 and 829 students' intelligence level was measured by CPM and APM. Statistical analysis used was Alpha, item analysis, factor analysis, standard statistic and compared means of variable difference by t-test and F-test, and constructed to normative table.

Results revealed that the quality of CPM has a high reliability (Alpha of .91), the range of an item discriminates from .01 to .68 , mean of discrimination (0.31) discriminating between high group and low group, the range of an items difficulty ranges from .37 to .98, and mean of difficulty (.76) being rather easy for students. Overall quality of CPM results showed an standard error of mean of .32, mean of 27.53, Standard deviation of 6.91.The research showed there was no difference in mean of CPM raw scores in gender, but there was a difference of age and level of education at .05 level of significance. Moreover, the quality of APM has a high reliability (Alpha of .88), the range of an item discriminates from .03 to .56, mean of discrimination (0.30) discriminating between high group and low group, the range of an items difficulty ranges from .06 to .99, and mean of difficulty (.54) being difficult in moderate level for students. Overall quality of APM results showed a standard error of mean of .235, and mean of 19.55, Standard deviation of 6.87.The research showed there was a difference of gender, age and level of education at .05 level of significance.

The results led to construct a specific normative score table of intelligence by CPM in 6-11 years old students in the southern region of Thailand. It was divided by age and level of education. In addition, the results also led to construct a table of intelligence by APM in 12-18 years old students in the southern region of Thailand divided by gender, age and level of education to be the standard in comparing intelligent competence from 2 tests for 6-18 year old students in the southern region of Thailand.

KEY WORDS: IQ / COLORED PROGRESSIVE MATRICES / ADVANCED PROGRESSIVE MATRICES / THAI STUDENTS AGE 6-18 YEARS OLD / THE SOUTHERN REGION

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การศึกษาคุณภาพของแบบทดสอบเชาวน์ปัญญาThe Colored Progressive Matrices (CPM) และ The Advanced Progressive Matrices (APM)ในนักเรียนไทยอายุ 6-18 ปี :ภาคใต้
(THE CHARACTERISTICS OF THE COLORED PROGRESSIVE MATRICES (CPM) AND THE ADVANCED PROGRESSIVE MATRICES (APM) IN THAI STUDENTS AGE 6 - 18 YEARS OLD : THE SOUTHERN REGION.)

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บทคัดย่อ

การวิจัยครั้งนี้ มีวัตถุประสงค์เพื่อศึกษาคุณภาพของแบบทดสอบ Colored Progressive Matrices(CPM) และAdvanced Progressive Matrices(APM) พร้อมทั้งสร้างเกณฑ์ปกติของคะแนนการทดสอบเชาวน์ปัญญา CPM และ APM ในกลุ่มนักเรียนไทยที่มีอายุ 6-18 ปี โดยใช้จังหวัดนครศรีธรรมราชเป็นกลุ่มตัวอย่าง ทำการวัดเชาวน์ปัญญาเป็นกลุ่มด้วย CPM จำนวนทั้งสิ้น 467 คน และ APM จำนวน 829 คน วิเคราะห์คุณภาพของแบบทดสอบทั้ง 2 ชุด โดยหาค่าความเที่ยงด้วย Alpha วิเคราะห์รายข้อ วิเคราะห์องค์ประกอบ ค่าสถิติพื้นฐานและเปรียบเทียบความแตกต่างของคะแนนเฉลี่ยตามตัวแปรด้วย t-test และ F-test และสร้างเป็นตารางเกณฑ์ปกติ

ผลการวิจัยพบว่า คุณภาพของแบบทดสอบ CPM มีค่าความเที่ยงอยู่ในระดับสูง Alpha มีค่า .91 ค่าอำนาจจำแนกรายข้ออยู่ในช่วง .01- .68 เฉลี่ยค่าอำนาจจำแนก .31 ซึ่งสามารถจำแนกกลุ่มที่ได้คะแนนสูงออกจากกลุ่มที่ได้คะแนนต่ำได้ ค่าความยากรายข้ออยู่ในช่วง .37 - .98 ค่าเฉลี่ยความยาก .76 ซึ่งอยู่ในเกณฑ์ค่อนข้างง่ายค่าความคลาดเคลื่อน (SEM) .32 คะแนนเฉลี่ย 27.53 ส่วนเบี่ยงเบนมาตรฐาน 6.91 ด้านเพศพบว่า ไม่มีความแตกต่างของค่าเฉลี่ยจากคะแนนดิบจากCPM แต่อายุและระดับชั้นเรียนต่างกันมีคะแนนเฉลี่ยของคะแนนดิบจาก CPM แตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ระดับ .05 ส่วนคุณภาพของแบบทดสอบ APM มีความเที่ยงอยู่ในระดับสูง Alpha มีค่า .88 ค่าอำนาจจำแนกรายข้ออยู่ในช่วง .03- .56 เฉลี่ยค่าอำนาจจำแนก .30 ซึ่งสามารถจำแนกกลุ่มที่ได้คะแนนสูงออกจากกลุ่มที่ได้คะแนนต่ำได้ ค่าความยากรายข้ออยู่ในช่วง.06 - .99 ค่าเฉลี่ยความยาก .54 ซึ่งมีค่าความยากอยู่ในระดับปานกลาง ค่าความคลาดเคลื่อน(SEM) .235 คะแนนเฉลี่ย 19.55 ส่วนเบี่ยงเบนมาตรฐาน 6.78 พบว่าเพศ อายุ และระดับชั้นเรียนที่ต่างกัน มีคะแนนเฉลี่ยของคะแนนดิบจาก APM แตกต่างกันอย่างมีนัยสำคัญทางสถิติที่ระดับ .05

จากผลการวิจัย ได้สร้างเกณฑ์ปกติของคะแนนการทดสอบเชาวน์ปัญญาCPM ในกลุ่มนักเรียนไทยที่มีอายุ 6-11 ปีในภาคใต้ โดยจำแนกตามความแตกต่างของอายุและระดับชั้นเรียน และ APM ในกลุ่มนักเรียนไทยที่มีอายุ12-18 ปีในภาคใต้ โดยจำแนกตามความแตกต่างของเพศ อายุและระดับชั้นเรียน เพื่อใช้เป็นมาตรฐานในการเทียบค่าความสามารถทางเชาวน์ปัญญาที่ได้จากแบบทดสอบทั้ง 2 ชุด สำหรับนักเรียนไทย ที่มีช่วงอายุ 6-18 ปี ในภาคใต้

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CHAPTER 1
INTRODUCTION

Background and Rationale

Intelligence is one of the most influence to human affects to life style such as education, career, self-adjustment, healthy, wealthy, event or self-solution etc. Therefore, intelligence is the most popular research both definition and measurement. The results were used in various fields, for example, it was used in classifying children and students to study appropriating with their intellectual function and their aptitude. Some was used to classify a person, to put a man in the right job. Brain ability or intelligence is an interesting issue of research for many centuries. People are different and easy to be noticed not only physical body but also brain ability and characteristic. To understand the individual different personality, it needs to be measured objectively. The most popular measurement of brain ability is intelligence test, that is a standardize test (1). In the fact that psychological assessment has a restricted standardized process and system. Although among psychologists have some conflicts about what the intelligence is, content of intelligence test is not updated, and parts of test's content is not fait, but intelligence test has been used until now and intelligence test is the research instrument of the psychologists who interested in study individual different.

Intelligence tests have both individual and group tests (2). The individual test that is well known is the test of David Wechsler that used both in children and in adult. The benefits of the individual test are to know the intelligence quotients and to know personality background of examinee (1). However, the effectiveness of test bases on skill and practicing in measurement and interpretation of examiner. In addition, long duration of testing make examinee lost their concentrate and corporation. This test is a verbal test, which depend on language, education, and culture in each country so it is appropriate for specific group. For overcomes cultural

and language bias, Raven create initially an IQ test in non-verbal test and it was high accepted in measurement. This test is Raven's Progressive Matrices Test. It is easy to administer and score and it has a short time. It is a Culture Fair Intelligence test (2) which is well known in psychologists around Europe and England. Structure of this test allowing a measurement of the Spearman's g-factor. This test correlated with Wechsler's verbal tests (r =. 58) and performance test (r = .70) (1). It shown those correlation values has quite reliability. Therefore Progressive Matrices Test of J.C. Raven overcomes cultural and language bias. Raven (3) revealed that Progressive Matrices is designed to assess intellectual ability and is presented in the form of a sequence of symbolic figures. Progressive Matrices is matrix figure which is form comparison and reason by analogy. The subject is required to understand the nature of the relationships within each sequence and select one figure which completes each sequence. There are 6-8 figures which subject has to choose. The examinees have to classify them accurately in answering. From the test's result, it will assess a person's intellectual and reasoning ability and the ability to make sense of complex data, to draw meaning out of ambiguity and to perceive and think clearly. The norm was used as percentile (4).

The Progressive Matrices Test of J.C. Raven (5) has three versions namely the Colored Progressive Matrices (CPM), the Standarded Progressive Matrices (SPM), and the Advanced Progressive Matrices (APM). Each version has different number of problems and purposes.

The Colored Progressive Matrices (CPM) consists of 3 sets (A, Ab, b) and each set contains 12 problems. It was designed for young children or people with decreased intellectual abilities and the elderly people.

The Standard Progressive Matrices (SPM) consists of 5 sets (A, B, C, D, E) and each set contains 12 problems. It is for people of average ability and it is to evaluate the intelligence potential in various age ranges. Intelligence score was calculated from all sets and presented to percentile rank.

The Advanced Progressive Matrices (APM) consists of 2 sets. Set I consists of 12 problems. It is for subject to be accustomed in the method of working. The scores of set I was not scored to assess the intellectual ability. Set II consists of 36 problems and was scored for assessing the intellectual efficiency. It is for people of high ability in adolescence, adult, educated student, and the person who have high score in SPM.

This research is to study the characteristics of the Colored Progressive Matrices (CPM) and the Advanced Progressive Matrices (APM). Although Progressive Matrices Test of J.C. Raven (5) consists of 3 sets but there are only 2 sets were used in this study. Because of limitation of SPM, the highest intelligence quotient assessed is 123 (IQ = 123). The difficulty of CPM in each item (p) was .43 to .99. The problems within each item become progressively more difficult. It start with the easiest (p= .99) and the most difficult items were in the last (p= .43) (2). In the other hand, the difficulty of APM in each item (p) was .12 to .99.The mean of difficulty was .60; it shown that APM have moderate difficulty (1). Both CPM and APM were high quality intelligence test but the researches of those in Thailand were studied in specific group and not updated. At present life style, sociality, and educational system were largely changed so CPM and APM should be verified in construction, reliability, and norms in Thai students. It will be standard value for Thais. Norms not only shows mean score but also shows relation of deviation levels (6). Besides that its utility is assessment and prediction. Normally, the person who invented firstly the test will construct normative score from his culture and environment. So it is not fair if the normative score from another country was used for interpretation in people who are from different culture (7). The research from Office of the Basic Education, Assessing of the Achievement in Elementary Students, revealed achievement of elementary students was different because of geography (8). The development will be rapid or slow, it depends on environment(8). It conforms to Bruner's research which revealed that environment was a part of development of intellectual capacity (8). From those reasons, the author interested in study intellectual capacity of Thai students' age 6-18 years old in southern region. They are students from primary school and secondary school who are under Office of the Basic Education, Ministry of Education. Population of this research lived in the south of

Thailand which has the same culture, society, geography, and environment. The southern region's environment is different from the others such as life styles that people live together amicably as if they are relative and they have specific language. The religion in the south is different from others because most people respect Buddhism and Islam. The villagers can live together very well under different culture. Beside that society in the south is different from other societies obviously in life style, that might effect to different development of intelligence.

Benefits from this study are to identify statistical characteristics of CPM and APM and to know the facet of the intelligence quotient of students in the south. In addition, to have the normative score of intelligence of students' age 6-18 years old in the south of Thailand.

Furthermore, there are colleague to study the characteristics of CPM and APM of Thai students' age group 6-18 in every part of the country as : Bangkok area, central region, northern region, eastern region, western region, and northeast region. The benefits of this research are to explicit the quality of Raven's Progressive Matrices Test in Thai students and to have specific normative score table of Thai students' intelligence.

Research Objective

1. To study the quality of CPM and APM in Thai students' age 6-18 years old in the southern region of Thailand from validity, reliability, discrimination, difficulty Index, and factor analysis.

2.To construct the norms of CPM and APM in Thai students' age 6-18 years old in the southern region.

Scope of the Study

Population and Sample

Population for this study is primary school and secondary school students aged between 6-18 years in the southern region of Thailand. In this study, the students from Nakhonsithammarat province are represented. It consists of 427 primary level and 829 secondary level students.

The Variables

Independent variables: gender, age, and level of education.

Dependent variable: scores of intelligence from Colored Progressive Matrices and Advanced Progressive Matrices.

Materials

The Culture Fair Intelligence Test of J.C. Raven, 2 set were studied: The Colored Progressive Matrices (CPM) and The Advanced Progressive Matrices (APM).

Benefit and Expected Outcome

1. To know the quality of CPM and APM in students' age 6-18 years old in the southern region of Thailand by consideration of validity reliability discrimination, level of difficulty, and factor analysis.

2. To obtain the normative score of CPM and APM in students' age 6-18 years old in the southern region of Thailand.

Definition of Terms

Intelligence refers to the ability of adaptation oneself to environment, solving a new problem, reason understanding, and symbol understanding. As this research means general factor obtaining from ability of visual perception, comparison, and reason by analogy.

Intelligence Tests refer to instruments used to study intellectual capacity in solving various problems when compared with the other people in the same age group. In this research composes of 2 intelligence tests, CPM and APM. The characteristics of the both were invented to measure g factor (General factor) according to Spearman's theory. The results of CPM and APM explain the ability of observation, clear thinking, visual perception, perceptual relationships, and reasoning by analogy. The criteria of answering were complete a pattern, complete an analogy, introduce systematic permutation, and systematically resolve figures into parts.

Norms refer to mean of population who were used to be standard in comparing the level of individual ability. In the study, norms were construct from gender, age, level of education, and geography by using raw score from CPM and APM transformed IQ score.

Student mean students studying in primary school and secondary school and being under Office of the Basic Education, Ministry of Education in the southern region of Thailand age 6-18 years old.

CHAPTER 2
LITERATURE REVIEWS

This research is the study of the statistical characteristic of intelligence tests, Colored Progressive Matrices (CPM) and Advance Progressive Matrices (APM) in Thai students' age 6 – 18 years old in the southern region of Thailand. The research also obtains the norm of intelligence quotient in this study group. The literature reviews as :

Intelligence concepts
Measurement of Intelligence and intelligence tests
The Raven's Progressive Matrices (RPM)
The Colored Progressive Matrices (CPM)
The Advanced Progressive Matrices (APM)

The Intelligence, it is difficult to define into concept or specific definition. Because of different society and culture, conceptual thinking of intelligence is difference. There are many facets of intelligence proposed by psychologists such as : Intelligence's concepts were defined into 3 major groups(9).

The First definition, it emphasizes to adjustment oneself to environment. The intelligence is general brain ability to resolve problems and to confront new environment effectively.

The Second definition, it emphasizes to learning ability. From this definition, it show that the more intelligent person, the more learnable person. They can use their learning ability to do various activities and experiences.

The Third definition, the intelligence is abstract thinking ability. It means the person can use their concepts and symbols thinking for problem solving concerning with symbolic language and arithmetic.

Therefore, the definition of three groups cannot be separated definitely. The partial concepts are overlapped. Learning ability is base of adaptation oneself to new situations. The person who can manage new circumstances effectively from their learning experience in the past is cleverer than the person who must have new learning with every situation.

Waxner and Sternberg defied the concept of intelligence into 3 groups(10):

1. Psychometric Perspective

In 1905, Binet and Simon (in France) studied and developed intelligence test firstly. In 1960, Terman and Colleague (in USA) developed it later. Binet and Terman believed that intelligence is ability of solving skill from past experience of each person to apply in solving complex problems in daily life. In 1927, Spearman uses factor analysis method for explaining variance and individual difference of intelligence. Sperman's theory based on analysis of scoring test by statistical method and the scores of all intelligence test have tendency to positive correlation. Spearman believes those intelligence tests have co-factored called "General Intelligence", so he presented the two-factor analysis.

1. General factor or "g-factor", is general ability that is a partial component of intellectual capacity of human. Everyone has g-factor in different level. Spearman believes that g-factor depends on heredity. Education level does not effect to g-factor.

2. Specific factor or "s-factor" is specific ability for doing specific activity. S-factor is an important component which show people are different. It is special ability which cannot be found in everyone such as the musical ability and mechanical ability. When g-factor is included with s-factor, it will predict the succession level of various activities. S-factor related to education level more than heredity.

In 1938, Thurstone revealed ability of primitive thinking which human uses for resolving problem consists of 7 components (11).

1. Verbal Comprehension or V-factor; it is ability to understand words, messages, poems, and stories. V-factor concerns with the reason understanding and the appropriate words choosing.

2. Number or N-factor; it is ability to rapid and accurate calculation.

3. Memory or M-factor; it is memory ability for precise recognition of both important and not important historicesor situations.

4. Word Fluency or W-factor: it is an ability of rapid and accurate using various vocabularies for conversation following grammar.

5. Reasoning or R-factor; it is ability of inductive, deductive, and general reason. For example, resolving problem ability, it can be easily measured by numeric logical test.

6. Spatial or Space or S- factor; it is ability of dimensional perception, fixed spatial, geometric relation, or the other visualizations changed positions or transformations.

7. Perceptual or perceptual speed or P-factor; it is ability to quick distinguish of visual details including similarities/differences among objects.

Thurstone believes that the problems solving of individual use many components together more than use only one component of primartive ability. This concept was called Secondary component. Guilford and colleague developed this concept and presented three-dimensional model of the structure of intellect (12).

Dimension 1: Content – it was fact information that human perceives. In 1967, Guilford divided the content into 4 categories; visual, symbolic, semantic, and behavior. The fifth category auditory was added in 1977.

Dimension 2: Product – it was classified into units, classes, relations, systems, transformations, and implications. The correlation of dimension of content and dimension of product was called “Psychoepistemology” by Guilford.

Dimension 3: Operation – it was the procedure of brain for operation or responsion to information. The procedure composes of cognition, memory, divergent production, convergent production, and evaluation. In 1988, memory was divided into 2 types; memory recording and memory retention. From correlation of

three dimensions, the components of intelligence according to concept's Guilford comprised of 180 components.

Vernon has presented "Vernon's hierarchical model". He defined that intelligence was arranged into hierarchical three levels as: the first level was g factor, the second level was major group factors, which were consisted of verbal-education and practical-mechanical spatial, and the third level was minor group factors, which were consisted of verbal, number, mechanical information, spatial, and psychomotor. Vernon arranged the problem solving in detail of work into the last level of intelligence (13).

In 1971, Reymond Cattell has divided the intelligence into two aspects (12).

Fluid ability is ability that is outcome from only heredity. People who have high fluid ability can do the job coffectively. This ability is concerned with brain activity about thinking and solving problem. It is ability to understand relationships, as in analogies and letter and number series; fluid intelligence deals with reasoning ability primarily.

Crystallized ability is ability that depends on learning and experience relating to culture and environment. It is ability to understand language, number, and competency of assessment.

2. Piagetian Perspective

Piaget started studying the development of thinking since he had worked in laboratory with Binet. He was interested in wrong answer of children in Binet's test when he observed their behavior in re-test he found that it was reasonable false. Piaget concluded that thinking procedure of children has structural reason of reason differencing from adults. So Piaget tried to study cognitive structure and to explain different cognitive structure in each level of their development level. He believed that intelligence was consisted of two components; function and structure. Because he has primitive education of biology, he believed that intelligence is not different from biological work or activity. His concept, intelligence was adaptation comprising with assimilation and accommodation. Assimilation is mixing new situation with old experience together. Accommodation is adaptation of old

experience into new situation. The outcome of effective adaptation will develop to higher cognitive structure. Piaget classified development of children's thinking into concrete thinking and abstract thinking. Their cognitive structure will be equilibrium when they grow up.

3. Information Processing Model

Intelligence is the information processing. This concept was developed at the same time with computer era so intelligence was compared with some qualifications of computer. Main concept of this model was how the information processing is. Basis of information processing was development of computer including theories of communication and linguistics. Theorist believed both human and computer storage their data into symbolic type. This theory has been widely accepted in 1970. Present this concept becomes the part of cognitive psychology (14).

Figgerath(13) were classified into information processing including interpretation, action on, and store information. Information processing were divided into many types and they were found in animal, plant, and computer. Type of information processing in cell of animal and plant was genetic code. These cells can be transformed biologic stimuli to data. Information processing of human is complex and different from animal, plant, and machinery because human manage their information by active adaptation (14).

Information processing is number of component operations that are outcome various those processes following two components theory;

1.Structural components are details of each process e.g. the storage of knowledge receiving from sensory organ, short-term memory, and long-term memory.

2.Functional components are actions follow the various processes depending on interesting of their intelligence to finish their target of job.

Sternberg (10) avowed the information processing composes of different three dimensions.

1.Componential Dimension concerns with intelligence in internal process of human thinking. This process is information processing of brain for interpreting the

stimuli got from sensory organ to response it into motor organ that comprises of three components.

1.1 Meta Component is the highest process for rapid and appropriate decision planning about problem solving, management, and interpretation.

1.2 Performance component is the process of planning e.g. problem gathering, conclusion, and selection methods for solving problem. This component depends on individual skill.

1.3 Knowledge Acquisition Component is the process of new learning process by using old experience to compare with new experience. To select the which fact data concerning with old knowledge.

2. Experimental Dimension is an intelligence concerning with internal and external individual factor. Intelligence is an antecedent and autonomic process of brain. When human have much experience, management of new learning will be reduced. Their skill is autonomic action.

3. Contextual Dimension is an intelligence to learn new things for adapting oneself to environment or adapting environment to oneself. Adaptation ability to environment will be different in each culture but it can be measured by content measurement. When you cannot adapt yourself to environment, you can change method by adapting environment to yourself instead.

Concept of this group, the information processing, was a new concept trying to understand the intelligence functioning precisely. The concept was verified more than other concepts in the past. They are basic information processing of brain ability to be main process to measure and explain the brain procedure. Psychological measurement uses component that is outcome from learning experiences or complicated brain processing to explain brain function.

Prichard 1986, Stewart 1988, and Satler 1992 mentioned to the influential factors of intelligence. The main factors effecting to intelligence was divided into four factors (7):

1. Heredity factor

It was widely accepted because there are many researchers study and their results supported this factor clearly. There are studying in twin, family-tree, and

adopted child. They found that intelligence and developmental intelligence ability such as understanding, word fluency, reason ability, and memory related to heredity factor. These conclusions came from studying in many years ago.

2. Environment factor

Environment factors include pregnancy, delivery, illness, nutrition, education, occupation, income, environment in their house, family size, an order of bearing, and a period of pregnancy. The researchers found that those environment factors effect to children in their learning and development of intelligence level. Appropriate encouragement of their parent to support and motivate development of children is factor supporting their intelligence. Wanngam Rungpisutpong (15) has studied correlation among intelligence and democratic and strict bringing up, financial status, education level, and occupation of their parent. She found democratic bringing up, financial status, education level, and occupation of parent were positive correlation with intelligence level significantly at .05. Strict bringing up was negative correlation with intelligence level significantly at .05. Rushton and Skuy (16) studied 309 South African University students and found that the more the items from the SPM measured g (estimated by item-total correlation), the more they were related to standardized African-White differences. Rushton (17) analyzed data published on 154 high-school students in South Africa and found African-White differences on 10 subtests of the WISC-R were mainly on g. Rushton (18) analyzed item data from 4000 high-school students in South Africa on SPM and found the four-way African-Colored-East Indian-White mean differences were all on g. In 1979, British Standardization was conducted by Raven and found that the SPM variance was accounted for by region and socioeconomic status (19) similar to Miao and Huang's studied in Taiwan, they found young people from different geographical areas have different norms (20). Rower's research, intelligence quotient from CPM of Raven, revealed intelligence quotient from CPM of the students who were low financial status (black children) and the students who were medium financial status (white children) were different. The research from Office of the Basic Education, Assessment of the Achievement of Elementary Students, revealed achievement of elementary students was different because of geography (8). It conformed to Bruner's

research that environment support development of intelligence. That development of intelligence will be slow, fast, or paused depend on environment (8).

In this study, the researcher studied in the sample living in the south because the south's society is living together as if they are relative. The most villagers are helpful. They have specific culture and custom which they've inherited since ancient times including their specific language. The province that is representation was Nakhonsithammarat which is the territory which the ancestor have settled down since pre-historical period and it was developed orderly. It was center of spread of the Buddhism, center of administration various provinces in the south. From these reasons, it is the place that has accumulated knowledge from the past continuously until the present. The characteristic of geography of Nakhonsithammarat being country is different from the city clearly in life style, it effects to unequaled development of intelligence. With all reasons, the researcher interested in sample group of the south to study the intelligence level of the students living in specific environment.

3. Gender factor

Brody Levton and Walwetne (21) concluded their research congruously. They found the sexuality difference in some aspects of capacity or skill. Female have higher the verbal capacity than male and male have higher ability of dimension, machinery, and calculation than female. But general capacity of intelligence is not different in male and female. It liked Wechsler's research (2) that male have higher score than female in the general information, the calculation, the cubic figure, and figuration. Female have higher score than male in resemble picture, number recognition, and picture order but intelligence quotient of male and female are not different. In 1978, Anderson et al. (22) studies 229 persons from the population 70 years old in Gothenburg by CPM, they found that men has a better score. Amongst the women, those who had received a longer education had a better score compared with those who had had less education. Sudanee Wutthiprom (23) studied normative intelligence of CPM in student aging 5-11 years old in the east north of Thailand and she found mean of intelligence quotient of male and female were not different significantly at .01. This result and the research studying APM in Thai population

were concluded accordingly that intelligence level of male and female in under graduate group are not different significantly at.05 (1,7).

4. **Age factor**

Anatasy and Goodman's research (6) revealed that intelligence of infants was changed highly. It agrees with Baylay's study that raw score of IQ of the children to adolescence increase rapidly until they are early adolescence and it increases slowly in middle adolescence. Raw score of IQ will be static in adolescence. IQ of children is not always equal in addition IQ of each child will point to level of capacity when they were compared with others in the same age range. There is only one person from fifty persons in Baylay's study (14) who got static IQ score in the ninth year firstly. The scores of some children changed inconsistently which is an outcome of temporary emotional and healthy changing. Although they are in the same age range, different development and environment of each child effect to different intellect. The researchers studied difference of age and intelligence quotient and they found that intelligence quotient decrease when age increase because verbal and motor capacity was limited by time (7). Bab (24) studied difference of aging effect to Advanced Progressive Matrices in sample group aging rang 21-83 years old and number of sample is 165 persons. Bab found different age effect to intelligence level. This result relates Wechsler's study (6) that the score of Wechsler Adult Intelligence Scale will increase until at the end of 20 years old to at the beginning of 30 years old. The score will decrease slowly when they are 60 years old. When they age 60 and above, the score will decrease rapidly in subtest of coding because scores of coding depends on speed and visual perception. When the person get older, capacity of speed and visual perception will decrease. Raven (3) studied the norm of APM and he found the same percentile range in the people age 11 years 6 months years old ($\bar{x}$ =16), 12 years 6 months ($\bar{x}$ =17), 13 years old ($\bar{x}$ =18), 13 years old ($\bar{x}$ =19), 13 years 6 months ($\bar{x}$ =20), and 14 years old ($\bar{x}$ =21). Moreover, the people aging 20 years old ($\bar{x}$ =24), 30 years old ($\bar{x}$ =23), and 40 years old ($\bar{x}$ =21) are in the same percentile range too.

About the effect of educational level to intelligence quotient, from the researches, intelligence tests have high correlation with achievement tests (25). The students promoted to a higher grade are outcome from achievement tests having

different content and difficulty. So intelligence of each grade will be different too(7). Program of study of non-vocational education in Thailand was separated in two main parts, sciences and arts program. The faculties of university were divided into sciences and arts too. The students can choose it appropriately with their skill. The differences of sciences and arts program are result of brain ability, right or left hemisphere, heredity factor, and environment factor. Therefore program of study is a factor which effect to intelligence. This study relates to Chalita Kaiyanone's research (7) studying in undergraduate group in Thailand by APM and she found that the scores of APM in undergraduates of science faculty and in undergraduate of arts faculty are different significantly at .01.

The psychological tests were constructed following the various concepts of intelligence for assessment the intellectual function. They base on many concepts such as intelligence is the general ability used to do all intellectual activity. Another concept is intelligence was composed of many abilities or aptitude. Intelligence tests were developed and adapted continuously. Until now intelligence tests were constructed and developed following different concepts and it has high reliability and validity (26).

The opinions of psychologists about intelligence were changed continuously. Vernon concluded the opinion of English psychologists in 1928 to 1933 into three aspects (27).

1. Intelligence is an individual intellect of child and adult and it is an important factor making people are different in learning, reason ability, and problem solving ability. Intelligence is an energetic brain so it can change in quantity, growth level, and deterioration. However, psychologists of this group believe intelligence is a specific and static character of human's life span.

2. Although we cannot measure the intelligence obviously like measurement of body, appropriate randomize method in work sample, using standardized method, and construction of norms with appropriate sample group effect to index score of intelligence. These index scores will be accepted to be quality index of individual measurement intelligence level.

3. Intelligence is something that we get since we were born and it was determined by genes. The children get it from their ancestor. Environment and bringing up do not effect to determined genes. Development of intelligence depends on age and it was developed orderly. It can be developed to the highest growth until age 15 years old and it will be static for a long time until an old age, it will deteriorate.

The three concepts effect to our life very much. That is using the reliable intelligence tests for assessment intelligent quotient since they was young to be index of determining the education level and occupation of children in the future.

Many researchers inspected components of brain ability and instrument used to measure various components by testing in sample group with different race, culture, and age range. Objective of the study is to study an appropriate way for assessment the level of brain ability in individual. The researchers try to construct the instrument for appropriate measuring of the brain ability in various social groups. Because learning of people depend on social group with that they are member. Components of brain ability of people in distinct societies were different, so using the instrument created for specific social group in another social group cause to bias and incorrect assessment. Some psychologists tried to overcome cultural and language bias therefore they created a culture fair test. The result of brain ability measurement by culture fair tests, Culture-Fair Test of Cattle and Progressive Matrices of Raven, was used to predict success of working. It was an effective predictor more than other verbal tests especially people group getting low score from verbal test (26).

Meanings of intelligence are various but intelligence measurement is an important thing in psychology and education. Because the result of intelligence measurement was used in many activities such as to select students to continuous studies, to help mentally retarded persons or superior persons, to resolve adaptation of someone, to select the persons in the right job being appropriate with their intelligence, and to create program for developing the intelligence to higher function.

Intelligence is outcome from correlation of three factors: heredity, learning, and environment factor. Intelligence tests were constructed in various types depending on objective of measurement and people group. The famous academes try

to create intelligence tests seriously for many decades until now there are many intelligence tests. Some tests were developed to standardized test being high reliability (28).

Psychologists invented various intelligence tests and divided them into two groups as following (7).

1. **Individual Testing**

It is examination between a psychologist and an examinee. Individual testing is the most popular test such as the Stanford-Binet Scales, Wechsler Adult Intelligence Scale (WAIS) for 16-75 years old, Wechsler Intelligence Scale for Children (WISC) for 5 years old-15 years 11 months, and Wechsler Preschool and Primary Scale of Intelligence (WPPSI) for 4 years old – 6 years 6 months. Those tests are always developed and updated continuously.

2. **Group Testing**

It is administered to large numbers of examinees. The sample tests are the Lorge-Thorndike Testing, the Army Alpha & Army Beta Test, and the Raven's Progressive Matrices Test (RPM).

Paiboon Taewarux classifical the intelligence tests into 2 types as (29);

1. **Verbal Test**

It is to measure general verbal ability and some skills by question-answer test. The examinee has to use verbal skill both writing and speaking. The sample tests are Stanford-Binet intelligence Scale and Wechsler Intelligence Scale. Those tests have restriction in difference of verbal, cultural, social, domiciliary, and skilled variable.

2. **Non-Verbal Test**

It is the test presenting the figured problem or activities that do not use verbal for response such as Progressive Matrices Test, the Pintner-Paterson Scale, the Cornell-Coxe Scale, and the Kohs Block Design Test. The constructors tried to get rid of difference of verbal, cultural, and skilled variable of individual. Non-verbal tests,

especially Progressive Matrices Tests, were widely used because of control of those variables. Many countries use Progressive Matrices Tests overcoming cultural and verbal bias for studying the intelligence level.

All type of test needs to have norms for effective diagnostication or prediction. If they do not have norms, it cannot interpret the meaning of score. Norms indicate not only mean of test but also relativity frequency of various deviation levels which are upper or lower than mean score. Examiner will know the rank of examinee from comparison the score of examinee with the score of same group or the score of other tests by using norms (7). Raven (3) created the norms from undergraduate students of University in Australia. It was studied by Yett and Forb(3); they calculated the score to percentile rank and shows rank of result of individual compared with people in the same age group. Age range of norms was divided to six month in each interval of age 8-14 years old and five years in each interval of age 20-65 years old.

The sorts of norms were divided according to the criteria following (30);

1. Criterion of geographical representation

1.1 Classroom Norms

It is constructed by teachers and the raw score was changed into standard score for comparing with only the students studying in the same level.

1.2 External Norms

1.2.1 Local Norms

It is constructed from local sample group so interpretation and using were limited and compared between within specific local group.

1.2.2 Regional Norms

It is created from regional sample group, and was used for comparing between within specific regional group.

1.2.3 National Norms

It is constructed from sample group around the country so it was used for comparing between within specific national group.

1.3 Group Norms

1.3.1 Age Norms

It is constructed from different age range and was used for comparing the people in the same age range. Intelligence tests or tests measuring various ability use age norms.

1.3.2 Grade Norms

It is constructed from grade, and was used for comparing between within specific grade.

2. Criterion of changed scores

2.1 Percentile Norms

It is created by changing the raw scores to standard score which is ordinal scales to Percentile rank. It shows how many data from a hundred portions which has less value than one's percentile rank.

2.2 Standard Score Norms

It is transformation from raw scores to standard score as;

2.2.1 Z-Score

It is transformation from raw scores to standard score to know standard deviation values which raw score is higher of lower than mean score.

2.2.2 T-Score

It is the standard score transformed from Z-Score because Z-Score is a positive and negative value and make confusion in interpretation value. T-Score is a positive value, and mean of T-Score is 50 and standard deviation value is 10.

The Evolution of Intelligence Testing

Psychological tests play a prominent role in our society, but this wasn't always so. The first psychological tests were invented only a little over a hundred years ago. Since then, the reliance on psychological tests has grown gradually. When the ancient Chinese administered oral tests to determine a candidate's fitness for carrying out the tasks of civil administration, the modern intelligence test has its origins in the nineteenth century (31). Sir Francis Galton in the later part of the 9th century studied family trees and found that success and eminence appeared consistently in some

families over generations by using an objective measure of intelligence. Although Galton's mental test were a failure, his work created an interest in the measurement of mental ability, setting the stage for a subsequent breakthrough by Alfred Binet, a prominent French psychologist (32). In 1904, a commission on education in France asked Alfred Binet to devise a test to identify mentally subnormal children. Binet and a colleague, Theodore Simon, published the first useful test of general mental ability in 1905. Their scale was a success because it was inexpensive, easy to administer, objective, and capable of predicting children's performance in school fairly well. The Binet-Simon scale expressed a child's score in terms of mental level or mental age. A child's mental age indicated that he or she displayed the mental ability typical of a child of that chronological age (32).

In America, Lewis Terman and his colleagues went to work on a major expansion and revision of Binet's test. Their work led to the 1916 publication of the Stanford-Binet Intelligence Scale. Although this revision was quite loyal to Binet's original conception, it incorporated a new scoring scheme based on the intelligence quotient. Since its publication in 1916, the Stanford-Binet has been updated periodically in 1937, 1960, 1973, and 1986. Although the most recent (1986) revision introduced some major changes in the organizational structure of the test, the modern Stanford-Binet remains loyal to the conception of intelligence originally formulated by Binet and Terman (32).

David Wechsler found the Stanford-Binet somewhat unsatisfactory for this purpose. Thus, Wechsler set out to improve on the measurement of intelligence in adults. In 1939 he published the first high quality IQ test (the Wechsler-Belleveue Intelligence Scale) designed specifically for adults, which came to be known as the Wechsler Adult Intelligence Scale (WAIS). Ironically, Wechsler eventually devised downward extensions of his scale for children in 1949 and was revised in 1974. In 1991, another revision was introduced. Subsequent modifications also led to a test suitable for preschool children, the Wechsler Preschool and Primary Scale of Intelligence (WPPSI) of 1967 (21).

Culture Fair Tests

The term culture fair test refers to tests that are not biased toward a particular cultural group. While it is technically impossible to develop a test that is completely free from cultural bias. While most test publishers make a conscious effort to reduce cultural bias in the items of a test, instructions, and interpretation of results, there have also been many attempts to develop culture fair tests specially designed to give equal score distributions for different subgroups. Most of these tests measure general nonverbal aptitude skills. One of the first systematic, large scale attempts to construct a culture fair test was the Davis-Eells Test of General Intelligence (1953). The Davis-Eells test assesses general reasoning ability by using cartoon pictures of persons in familiar situations, rather than relying on highly verbal or abstract content. The test was designed for ages 5-12. The examinees look at each picture and choose from three possible explanations of the situation read by the test examiner. However, research has shown that the test possesses questionable reliability and validity, and that it does not reduce the differences among subgroup performance on other intelligence test. A different approach to culture fair testing was developed by Lionel Penrose and J. C. Raven, who published the Raven Matrices Tests (1936). These tests were devised to assess Charles E. Spearman's notion of a single general factor of intelligence common to all cognitive tests. There are three forms of the Raven Matrices Test (31).

Raymond B. Cattell developed another type of culture fair test, based on his theory of fluid and crystallized intelligence. The Cattell Culture Fair Intelligence Tests (1949) are mostly nonpictorial and nonverbal. The tests are available in three levels that cover ages four through adult. Research with the Cattell tests shows that different cultural subgroups do not attain the same mean scores. These results, with other studies, indicate that subgroup differences are not attained primarily because of verbal content in the tests (31).

The Raven's Progressive Matrices (RPM)

J.C. Raven (1,2,3,5) invented initial the Raven's Progressive Matrices (RPM) in 1938 in England and developed it continuously until 1978. RPM was designed to measure g-factor from Raven's belief that the nature of intelligence has characteristic according to Spearman' s theory. Raven discussed that intelligence is behavior got from heredity more than is ability from environment. To inspect this concept, Spearman stuck geometric figure, which is a chart on the wall, and then examinee used conceptual thinking for description relationship among figures. Raven's test measured perception of correlation and congruence of geometric figure. The problems were determined in matrices being various patterns and arranged orderly from easy problems to hard problems. Matrix in each problem has some important parts missing so examinee has to select the missing portion from six to eight response options to complete matrix. Criteria of choosing are complete a pattern, complete an analogy, introduce systematic permutations, and systematically resolve figures into parts. Standard test of Raven aims to measure general ability, Colored and advanced test are used for assessment the ability of perception and clear thinking. The problems are presented to assess individual working method while he/she is doing; otherwise, the test does not pay attention to old experience or verbal ability to communication in present of individual. The Raven's Progressive Matrices can be described as tests of observation and clear thinking. Each problem in the test is really the mother of system of though while the order in which the problems are presented provides training in the working method. Hence the name "Progressive Matrices". It means the form of a sequence of symbolic figures and the problems within each of the test variants become progressively more difficult. These tests were designed to three types as follow:

1. The Colored Progressive Matrices (CPM) is designed for young children (5-11 years old), mentally retarded persons and older adults. It is a utilized test for the study of anthropology, and psychiatry and its results are satisfied in the people who do not use English language or the people who are dumb or deaf. The coloured backgrounds on which all the problem are printed attract attention. The test composes

of 3 sets, set A, Ab and B, and each set consists of 12 matrices, starting with the easiest. Each set is different in difficulty of problem. Set A is easier than set Ab and set Ab is easier than Set B.

2. The Standard Progressive Matrices (SPM) is designed for people of average ability in all age ranges, all education levels, and all races. It consists of 60 problems divided into five sets, set A, B, C, D, and E, and each set consists of 12 matrices. The problems were presented to black and white matrices. Set A and B are like set A and B in CPM; otherwise, set C, D, and E become progressively more difficult and complex. The limitation of test is content appropriate with average intelligence and it cannot separate the people who are superior.

3. The Advanced Progressive Matrices (APM) is designed in 1943 to recruit the soldiers into England army during World War II. In 1947, it was developed for general persons who are above average ability or superior intellectual ability. Foul's study indicated that APM measure ability level of perception and systematic thinking precisely. Some items and item arrangement were revised later on, and it was republished in 1962. It was divided into two sets.

1. Set I consists of only 12 problems split of APM in 1947 edition, but it cannot separate superior intelligence from average intelligence obviously. Content of matrices, both APM and SPM, cover thinking process of intelligence. Set I is easy to familiarize people with test and allay anxiety and to practice, and it was finished under 10 minutes. The persons who are low intellectual ability will obtain score lower than 6 scores, and the persons who are average intellectual ability will do it wrong in No.5, 10, 11, and 12. The persons who superior intellectual ability will learn principles of solving problem rapidly and they can solve all problems truly. The score of set I is not assessed to index score of intelligence level but the result can show that 10 percent of people are dullest, 80 percent of people are average, and 10 percent of people are brightest.

Set II consists of 36 problems, arranged in ascending order of difficulty. It was more difficult and complex than set I. The examinees have to use rule, reason, and

through thinking to solve the problem correctly and speedily. It was a speed test, so it can separate the persons who are superior from general persons.

All three tests, CPM, SPM, and APM, were scored 1 point in each item when the examinee answer correctly. Each test has specific norms table (percentile norms) for comparing examinee's scores with the same age range of examinee. Assessment of examinee's intelligence is assessment from percentile norms that provided five levels as follow:

Level 1 Percentile rank is above 95 and it was grouped of "superior".

Level 2 Percentile rank is above 75 percentiles and it was grouped of "high normal". The person who gets percentile rank higher 90 but lower 95 is level 2 plus.

Level 3 Percentile rank is between 25-75 percentiles and it was grouped of "normal". The person who gets percentile rank higher 50 is level 3 plus but the person who gets percentile rank lower 50 is level 3 minus.

Level 4 Percentile rank is between 10-25 percentiles and it was grouped of "lower normal". The person who gets percentile rank 5-10 percentiles is level 4 minus.

Level 5 Percentile rank is lower than 5 percentiles and it was grouped of "mental retardation".

Raven (5) discussed that the qualitatively different items of which the test is composed form part of a common continuum and are absolutely dependent on the abilities required to solve the easier items. It has been suggested that the core abilities tapped by the Raven's Progressive Matrices include an incremental, reiterative strategy for encoding and inducing the regularities in each problem, the ability to induce abstract relations, and the ability to dynamically manage a large set of problem solving goals in working memory (33). Raven scores show a significant increase with in creasing years of education and socioeconomic status (34). Concurrent validity studies show a modest correlation (about.7) between Raven and conventional tests of intelligence such as the Wechsler and Stanford-Binet scales (34,35,36). Moreover when the Wechsler subtests are considered, the strongest relationship is found with

Block Design, which involves visuospatial skills and is considered a good measure of fluid intelligence (37).

The Raven's Progressive Matrices by J.C. Raven is an intelligence test that does not use verbal ability. It was widely accepted because of various features as follow (1,2):

1. Easy to administer and score and may performed by non-psychologists.
2. Can administration in both group and individual test.
3. A shorter testing time.
4. Overcomes cultural and language bias.
5. Indicates perception, think clearly, and opposite reason ability.
6. Reliable result when paralleled with David Wechsler's test. (Correlation of performance tests is .70).

The Colored Progressive Matrices (CPM) is designed for young children (5-11 years old), mentally retarded persons and older adults. It is a utilized test for the study of anthropology, and psychiatry and its results are satisfied in the people who do not use English language or the people who are dumb or deaf. The sum score can be explained about individual ability in observation and clear thinking. Individual ability is assessed in perceptual relationships and reason by analogy that are important abilities of individual learning. Each problem of CPM is basic thinking. The problems were presented orderly to familiarize and to practice the method of problem solving (2,5).

All problems of 3 sets in CPM were used for assessment of thinking process and perception of children who age lower 11 years old and they should do it correctly. All three sets were used at the same time for people develop their thinking process consistently. Thirty-six problems of 3 sets are used for assessment of accuracy of brain capacity that is matured intelligence.

Three sets of CPM were created to assess the development of brain capacity increasing when the children grow up. They can use reason by analogy for development to summarized thinking or implying later on.

In Nigeria, Fahrmeier (38) collected data 375 people who are 6-13 years old in studying of the effect of schooling on cognitive development. The children's mean score on CPM was 12 out of 36, giving them an IQ equivalent of <70. In 1981, Carlson and Jensen (39) studied the reliability of CPM by using CPM in sample group which composed of different age and race (black, white, and Latin-America). The number of sample group was 783 persons and they divided age range into 3 levels: 5 years 6 months - 6 years 6 months, 6 years 6 months - 7 years 6 months, and 7 years 6 months - 8years 6 months. Reliability of CPM calculated from all items was .20-.80. The reliability of each age range was not equivalent. The reliability of sample group being low age was lower than sample group being high age. The reliability of sample group which was different races was almost equivalent. The discriminative power of item being low or high effect to reliability just a little. Reddington and Jackson (40) used seven midpoints to distinguish age groups (5.5, 6.5, 7.5, 8.5, 9.5, 10.5, 11.5 years of age). The CPM was found to have good reliability as determined by Cronbach's alpha, with estimates ranging from .79 for 7 year olds up to .90 for 11 year olds. Valencia(41) studied reliability of Raven's CPM in sample group which was Anglo and Maxican American children studying in grade 3. The number of sample group was 96 persons and they were low financial status and low society level. The result found that reliability of CPM in different races was high. Yeudall et al.(42) tested 225 normal Canadian men and women, ages 15-40, with the CPM. At each age-group interval (e.g., 15-20, 21-25, etc.), there were few if and errors. The mean number correct for the combined group (ages 15-40) was 34.9 (SD =1.25). In Ghana, Glewwe and Jacoby (43) reported on a World Bank that studied the tested in representative sample of 1736 people who were 11-20 years old form the entire country. Their mean score on the CPM was 19 out of 36, which gives an IQ equivalent of <70. Marcopulos et al. (44) reported a mean of 17.5 (SD =6.0) for 110 community-dwelling older adults (mean age = 76.48, SD = 7.87) with an average educational level of 6.65 years (SD = 2.14). In Kenya, Sternberg et al. (45) administered the CPM to 85 12-15 years old who scored 23.5 out of 36, an IQ equivalent of about 70. In 2004, Cotton et al. (46) studies 618 children from Victoria Australia ranging in age from 6.00 to 11.92 years old and they found split-half reliability with values ranging .91 and internal consistency estimates ranged .89.

In Thailand, Sucheera Phattharayuttawat et al. (2) studied validity, quality, and norms of CPM in Thai population. The number of sample group was 900 persons and they were divided into male and female equally. The sample group was divided into 5 age ranges; 5 years old, 5-6 years old, 7-8 years old, 9-10 years old, and 11 years old. The result found that internal consistency of KR-20 was .91 and the mean score was 29.67. The score of intelligence in different gender was not different significantly. The difficulty value range of items was .43 - .99 and difficulty value was easy level (p=.77). The test was started from easy item (p=.99) and it was more difficult at the last (p=.43). The result of factor analysis found that CPM is an intelligence test measuring only one component that is g-factor according to Spearman's theory.

The Advanced Progressive Matrices (APM) was initially published at War Office Officer Selection Boards in 1943 to recruit the soldiers into England army during World War II. In 1947, it was developed for general persons who are above average ability or superior intellectual ability to assess brain capacity. While examinee is doing test, they have to think of comparison with among figures and develop thinking method of reason by logic. The non-verbal test is better than the verbal test because it can measure thinking method of individual ability clearly. The figure that is stimuli is independent from different learning experience. The benefits of test in practice are a shorter testing time and accurate result.

APM is an intelligence test used in persons who are higher than 11 years old and are average ability and above. It was used to be an untimed test or a timed test to assess speed of accurate intellectual function. Set I consists of 12 items was presented to provide training in the method of working. The problems of set II consists of 36 items was presented like set C, D, and E of SPM. The accurate sum score does not depend on the effort of person to complete all items in that set. Although everyone can finish set I within 2-3 minutes but individual has different intelligence level (dull, average, and superior). If someone ability is average or above, he/she has to do set II continuously to assume brain ability accurately. Set II is a timed test to assess effectiveness of brain in solving problem. The examinees have to solve them as much as they can do. It assesses effectiveness of quality and quantity of their answering.

The limited time was variance to objective of scattering of score. APM discriminates the superior persons from the average person obviously. It was used in adolescences, adults, undergraduates, superior persons, and the persons who have high score in SPM. It should not be used in the persons who have lower score than 50 points in SPM(1).

The research to develop norms and quality of APM by Raven (3) was studied in undergraduates in universities of England. The number of sample group was 170 persons. The results found that mean score was 21 and standard deviation was 4. Yett and Forb (3) studied APM in freshman student in university who age between 17 and 20 years old in Australia. The number of sample group was 960 persons. Mean raw score of male was 23.67 and standard deviation was 5.02. Mean raw score of female was 23.45 and standard deviation was 4.94. Besides the study in undergraduates of New Zealand of 730 persons has mean score was 22.55 and standard deviation was 4.49. The Gibson's study (47) in student of Hitpill polytechnique of 281 persons found that mean score of 24.28 and standard deviation was 4.67. In Thailand, Sucheera Phattharayuttawat and et al.'s study(1) in student in university who was students in sciences and society program of 491 students. It found that the mean score of male was 24.44 and standard deviation was 8.20. The mean score of female was 23.43 and standard deviation was 6.35. The mean score of male and female was 23.34 and standard deviation was 7.30. Mean score of male was higher than mean score of female significant differently. It conformed to Paiboon Taewalux's research (29) studying in undergraduates of Chulalongkorn University. The number of sample group was 1,000 persons. The mean score was 22.73 and standard deviation was 4.87. Chalita Kaiyanone (7) researched in students who study in a higher education at Bangkok. The number of sample group was 960 persons. The mean score was 23.59 and standard deviation was 4.60. It found that mean score of different age of male and female students was not different significantly. The mean score of students who studied in sciences and arts program were different significantly at .01. The students who studied in governmental university had higher mean score than the students who studied in private university significant differently at .01.

Fawn (7) studied of APM's consistency in 1947; he found that consistency in the children age group 10 years 6 months was 0.76. It shown APM was not appropriate with the children who are age under 11 years old. APM is difficult intelligence test. The consistency in the children age group 12 years 6 months was 0.86 and in adults was 0.91. It was high consistency level. Test-retest method was used in Fawn's study to find consistency value. In Thailand, Sucheera Phattharayuttawat and et al. researched internal consistency by Kuder – Richardson 20 formula in undergraduates group in university of Thailand, and she found consistency was 0.90(1).

Fawn (7) studied of APM's validity in children age group 12 years 6 months in 1947. He revealed that APM was high construct validation because it discriminated among children who had different achievement prominently. The children who got grade A were higher intelligence ability than the children who got grade F. It shown APM can measure perception and systematic thinking ability effectively. It assesses intelligence level of individual according to concept of intelligence. After that it was rearranged items by divided into two sets and it was used until now. It was arranged items in only right page and it was added administration to explain to examinee before they do it. APM will be consistent more than in the past to assess intelligence level. Rushton (48) et al. tested in 294 persons who were 17-23 years old in the Faculties of Engineering and the Built Environment at the University of the Witwatersrand (187 African, 40 East Indians, 67 Whites; 70 women, 224 men). The mean score of the African students was 22, the mean score of the East Indian students was 25, and the mean score of White students was 29 ($P< .001$), placed them at the 57^{th}, 64^{th}, and 86^{th} percentiles, respectively, and yielding IQ equivalents of 103, 106, and 177 on the 1993 US norms. The mean r is .30 and P's < .05.

In Thailand, Manus Jintanadilokkul (4) studied factor analysis of each item. His research was in line with Sucheera Phattharayuttawat et al. study finding APM was the test measuring only one component. It was implied to g-factor according to Spearman's theory (1). Sucheera Phattharayuttawat et al. (1) studied discriminance power of each item (r) and they found discriminance power was between .10 and .59

and t value was between 2.01 and 2.30 (P< .05). The result showned each item can discriminate the person who gets high score from the person who gets low score significantly at .05. Raven studied the level of difficulty in each item of APM. That research revealed characteristic of item behavior become progressively more difficult. Raven's research conformed to Sucheera Phattharayuttawat et al.'s which found the difficulty value of each item was between .12 and .99. The mean difficulty value was .60, it shown APM was moderate difficulty (1). Therefore, APM used in this research was high effective to measure intelligence.

This research aims to construct norms of intelligence in students' age range 6-18 years old in the southern region of Thailand from raw score of CPM and APM modified into IQ scores . After that the researcher took the result to construct the norms of intelligence in students' age range 6-18 years old in the southern region of Thailand.

CHAPTER 3
MATERIALS AND METHOD

This study was a descriptive research. The objectives were to study the statistical characteristics of CPM and APM in students' age 6-18 years old in the southern region of Thailand and to construct the normative scores of intelligence. The procedures are as follow:

Population and Sample

Population

The population in this study was student studying in primary school and secondary school in age range 6-18 years old who are under Office of the Basic Education, Ministry of Education in the southern region of Thailand. It comprised of 14 provinces (the data from National Statistic Office) as Krabi, Chumphon, Trang, Nakhonsithammarat, Narathiwat, Pattani, Phang-nga, Phuket, Yala, Ranong, Satun, Suratthani, and Songkhla. The population was divided into 2 groups: 6-11 years old and 12-18 years old.

Size of sample group

The size of sample group was calculated at confidence interval at 95% and allow error of selection (E) for primary school student at 0.69 and 0.44 for secondary school student. The size of sample group was calculated by formula:

$$n_{\mu} = \frac{(NZ^2)\sigma_x^2}{NE^2 + Z^2\sigma_x^2}$$

n_{μ} = Size of sample group for estimated.

N = Total number of target population.

Z = Value of normal curve at area under the normal curve range $\alpha/2$.

This research determine $(1-\alpha)$.

σ_x^2= Variance of population in each variable, which already studied in the previous research.

E = value of error this research determine = 0.05.

Sample size of the sample group for CPM was 450 students and sample size of the sample group for APM was 620 students.

Sample group

The sample group was selected by using the multi-stage sampling method as follow:

1. Random one province (from 14 provinces) to be the representative from the southern region. The random sample was Nakhonsithammarat which had located in the middle of the south. The total number of population was 1,530,882 (762,825 were men and 768,057 were female). The denseness of population was 154 people a square kilometer (the data from National Statistic Office). The administrative limit was bordered into 21 districts and 2 sub-districts. The total aggregate production was 76.149 million baht and it was the second of the south. The average income of person a year was 45,598 baht and it was the tenth of the south. The principle income came from agriculture (the data from National Economic and Social Development Board). The most people observe Buddhism (90.83%), Islam (8.72%), and Christianity (0.45%).

2. The schools being under Office of the Basic Education were divided in two levels: primary school and secondary school

3. The schools being under Office of the Basic Education were divided in three sizes:

3.1 Small size have 1-499 students.

3.2 Medium size have 500-1499 students.

3.2 Large size have 1500 and up students.

The school in the small and large size were choose in the research. Because the medium size were flooded along the time of data collection.

4. Random the primary schools according to size of school. Each size will be selected only one school, so a total number of schools were two schools. Random samples were Pakpraya School from small schools and Watpramahatath School from large schools.

5. Random the secondary schools according to size of school. Each size will be selected only one school so a total number of schools were two schools. Random samples were Pakpoon School from small schools and Benjamarachutij School from large schools.

6. Each random sample school was selected classroom of each level to be representation. The criterion of selection was the students should be unsorted. There were excellent students, good students, and poor students in the same group.

Material of the study

The Culture Fair Intelligence Test of J.C. Raven, 2 set were studied: The Colored Progressive Matrices (CPM) and The Advanced Progressive Matrices (APM).

1. Colored Progressive Matrices (CPM) by J.C. Raven in 1962 edition(2), The 36 problems are presented in 3 sets (A, Ab, and B) of 12 each, starting with the easiest. The test represents a perceptual analogy in the form of a matrix which part of figure lost of. Therefore the subjects have to select the correct figure in which. One point for correct answer and zero point for wrong answer.

2. Advanced Progressive Matrices (APM) by J.C. Raven in 1962 edition(3), consists of 36 matrices. A working period is about 40 minutes. APM was divided into 2 sets. Set 1 is a screening test used to train in the method of working and to show whether or not a person is capable to do set 2. The scores of set 1 were not included with the scores of set 2 (1). The test represents a perceptual analogy in the form of a matrix and has multiple-choices for selecting the appropriate answer. One point for correct answer and zero point for wrong answer.

The process of data collecting and data analysis

1. Data collecting was done by the researcher and co-researcher. The subjects were administered for group test in their classroom. Each group consisted of students in one classroom. In young children age between 6-8 years old were done in small groups of 4-5 students because they are young and have never been tested before so they may need more monitor. The researcher administered them to fill out the personal data as gender, age, and level of their education. After that the person in charge clearly explains that the upper part is a pattern with a bit missing. Each of theses bits below is the right shape to fit the space, but they do not all complete the pattern. There is only one correct answer. The test was standardise managed both of time and administration.

2. Verifying the answer sheets after testing.

3. Scoring to prepare data analyzing.

4. Data analyzed by program SPSS as the follow procedures:

4.1 Statistical analysis for instruments' quality:

- Reliability (internal consistency) by Cronbach's Alpha.
- Level of difficulty and calculate of ratio formula.
- Power of discrimination and calculate of ratio formula.
- Factor analysis by correlation coefficient between items score and total score.

4.2 Descriptive statistic

- Percentage
- Mean, Medium, Mode.
- Standard Deviation, Standard Error of Mean, Skewness, Maximum and Minimum.

4.3 Statistical analysis for variables and norms

- Compared means of gender, age and level of education by t-test and F-test.
- Calculated of IQ score from raw score of CPM and APM to compare with Intelligence Quotient, and constructed the IQ norm scores table.

CHAPTER 4
RESULTS

Results

This research was to study the quality of the CPM and APM in students' age 6-18 years old in the southern region of Thailand. It was to construct the normative score of students' intelligence in age group 6-18 years old in the south by CPM and APM. In this study, the students from Nakhonsithammarat province are represented. The number of sample group of CPM was 467. They were age ranges 6-11 years old studying pratomsuksa 1-6 at Pakpraya School (231 persons) and at Wat Pramahathaj School (236 persons). The number of sample group of APM was 829. They were age ranges 12-18 years old studying Pratomsuksa 3-6 (age12 years old) at Pakpraya School (45 persons) and at Wat Pramahathaj School (40 persons). There are students who studying in Mathayomsuksa 1-6 at Benjamarachotij School (564 persons) and at Pakpoon School (180 persons). The results of this research are divided into 2 tests and each test is reported into 3 parts:

I. The Colored Progressive Matrices.

Part 1 The quality of CPM in students'age 6-11 years old.

Part 2 The comparison among gender, age, and level of education.

Part 3 The construction of normative score from CPM of 6-11 years old by using CPM raw scores converted into IQ scores and classified by age and level of education.

II. The Advanced Progressive Matrices.

Part 1 The quality of APM in students'age 12-18 years old.

Part 2 The comparison among gender, age, and level of education.

Part 3 The construction of normative score from APM of 12-18 years old by using APM raw scores converted into IQ scores and classified by gender, age and level of education.

I. The Colored Progressive Matrices

Part 1 The quality of CPM in student' age 6-11 years old. (n = 467)

- The quality of CPM, it was found that the level of reliability (Alpha) was .91, the level of discrimination (r) was .31, the level of difficulty (p) was .76 and the level of standard error of mean (SEM) was .32.

Table 1 Mean, Standard Deviation (S.D.), Difficulty (p), Discrimination (r) of CPM

Items	Mean	S.D.	p	r	Items	Mean	S.D.	p	r
1A.	.99	.04	.98	.01	**7Ab.**	.83	.37	.82	.30
2A.	.98	.12	.98	.03	**8Ab.**	.77	.42	.76	.35
3A.	.98	.15	.97	.03	**9Ab.**	.67	.47	.66	.39
4A.	.98	.14	.97	.04	**10Ab.**	.65	.47	.65	.45
5A.	.96	.20	.95	.05	**11Ab.**	.58	.49	.57	.40
6A.	.94	.23	.94	.06	**12Ab.**	.44	.49	.43	.55
7A.	.79	.40	.78	.36	**1B.**	.97	.17	.96	.05
8A.	.87	.33	.87	.18	**2B.**	.95	.22	.94	.08
9A.	.86	.35	.85	.24	**3B.**	.93	.26	.92	.15
10A.	.77	.42	.76	.35	**4B.**	.88	.33	.87	.21
11A.	.61	.48	.61	.55	**5B.**	.74	.43	.74	.42
12A.	.39	.48	.39	.39	**6B.**	.65	.47	.64	.48
1Ab.	.97	.17	.96	.06	**7B.**	.56	.49	.56	.51
2Ab.	.97	.17	.96	.06	**8B.**	.47	.49	.46	.62
3Ab.	.97	.18	.96	.07	**9B.**	.56	.49	.55	.65
4Ab.	.84	.36	.83	.30	**10B.**	.62	.48	.61	.57
5Ab.	.77	.42	.76	.35	**11B.**	.53	.50	.53	.68
6Ab.	.74	.43	.74	.46	**12B.**	.38	.48	.37	.51

Table 1 showed the difficulty items values range from (p) .37 to .98, the discrimination range from (r) .01 to .68, the mean ranges from .38 to .99 and the standard deviation ranges from .04 to .50.

Table 2 Eigenvalue and Total Variance Explained of the 7 factors

Factor	Eigenvalue > 1	% of Variance	Comulative%
1	10.63	28.74	28.74
2	3.90	10.55	39.29
3	1.79	4.84	44.13
4	1.36	3.68	47.80
5	1.22	3.29	51.10
6	1.12	3.03	54.12
7	1.08	2.93	57.05

Table 2 illustrated factor analysis of CPM in students'age 6-11 years old. It found the eigenvalue of the 7 factors and factor loading was factor one. The total variance of CPM's score was 28.74.

Table 3 Factor loading over 0.40 before rotation the axis

	factor						
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**
1A	.705						
4Ab	.673						
7Ab	.654						
11A	.643						
11B	.640						
3B	.632						
8Ab	.627						
9B	.611	-.406					
5B	.606						
7A	.606						
10A	.598						
10B	.595						
9A	.574						
10Ab	.570						
4B	.553						
5Ab	.552						
7B	.552						
8B	.550	-.423	.416				
9Ab	.535						
6B	.530						
12B	.482						
12Ab	.479	-.413					
2B	.443						
12A	.414						
2Ab	.466	.610					
2A		.583					
1B		.568					
1Ab	.407	.564					
3A		.544					
3Ab	.416	.519					
4A		.517		.402			
5A		.417					
6A					-.447		
1A						.630	
8A						-.446	
11Ab	.410					.459	-.478

Table 2 and 3 revealed the result of item analysis by principal component analysis method that there were 7 factors which had Eigenvalue more than 1.00. The first factor explained variance 28.74 percent and total factors explained variance 57.05 percent. If the extracted weight of the first factors has upper than .4 and positive correlation coefficient value, each item of the CPM can measure common factor of

intelligence structure and uniqueness of intelligence. To confirm the result of item analysis we rotated the axis by varimax with Kaiser Normalization method on simple structure and positive manifold principle and showed in table 4.

Table 4 Factor loading over 0.40 after rotation the axis

	factor						
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4B	.683						
7Ab	.671						
6Ab	.620						
8Ab	.614						
5B	.598						
3B	.585						
4Ab	.582						
9Ab	.559						
5Ab	.546						
6B	.512						
11A	.452						
7B	.443						
10Ab	.424						
2B	.407		.405				
8B		.787					
11B		.777					
10B		.772					
9B		.761					
12B		.704					
12Ab		.656					
2Ab			.804				
1Ab			.793				
3Ab			.746				
1B			.674				.777
3A				.718			
4A				.699			
5A				.668			
6A				.639			
2A			.471	.558			
8A					.732		
9A					.567		
7A	.450				.494		
10A					.401		
11Ab						.725	
12A						.538	
1A				.441			

Table 5 The items of the 7 factors

Factor	Item	Factor's name
1	4B,7Ab,6Ab,8Ab,5B,3B,4Ab,9Ab,5Ab,6B, 11A,7B,10Ab,2B,7A	Balance
2	8B,11B,10B,9B,12B,12Ab	Creation
3	2B,2Ab,1Ab,3Ab,1B,2A	Category
4	3A,4A,5A,6A,2A,1A	Distinguish
5	8A,9A,7A,10A	Assembly
6	11Ab,12A	Conection
7	1B	Similarity

Table 5 showed the items consisted in each factor of the all 7 factors.

The descriptive statistic of CPM in students' age 6-11 years old. (n = 467)

The value of descriptive statistic of CPM which had mean 27.53, median 29, mode 34, standard deviation 6.91, maximum score 36, minimum score 5 and skewness -.90.

Table 6 Comparing mean score and standard deviation of all set of CPM in Bangkok, Nakhonsrithammarat, Chantaburi, Udonthani, Lumpang, Nakorn - Sawan and Kanchanaburi

Province	Mean	S.D
Bangkok	29.44	6.003
Nakhonsrithammarat	27.53	6.92
Chantaburi	27.021	7.170
Udonthani	27.01	7.03
Lumpang	26.86	7.119
Nakorn Sawan	26.73	7.102
Kanchanaburi	26.38	7.52

Table 6 showed the comparing mean score and standard deviation of all set of CPM test, it showed mean score from the highest to lowest scores; 29.44 of Bangkok mean score, 27.53 of Nakornsrithammarat mean score, 27.021 of Chantaburi mean score, 27.01 of Udonthani, 26.86 of Lumpang mean score, 26.73 of Nakorn Sawan mean score and 26.38 of Kanchanaburi mean score.

Table 7 Mean and standard deviation of the CPM that divided into seven provinces and age group

Age	Province	Bang kok	Nakorn Sritam marat	Chanta buri	Udorn tanee	Lam pang	Nakorn sawan	Kancha naburi	Total
6	Mean	24.79	21.75	15.44	18.00	17.98	17.26	18.83	18.71
	S.D.	6.53	8.89	5.96	4.58	6.01	6.12	6.20	6.92
7	Mean	24.75	22.88	21.44	19.72	21.59	22.48	20.08	21.85
	S.D.	7.13	7.26	6.38	6.36	6.35	6.39	6.97	6.85
8	Mean	27.50	23.71	25.86	25.25	25.33	24.73	25.49	25.56
	S.D	5.70	7.54	6.70	6.96	6.15	6.30	6.78	6.55
9	Mean	30.39	27.02	28.60	27.41	27.94	27.62	28.25	28.30
	S.D.	4.60	5.40	4.95	5.76	5.81	5.78	5.88	5.52
10	Mean	31.12	30.96	30.74	29.51	30.81	30.89	30	30.66
	S.D.	4.67	4.36	4.44	5.50	4.91	4.02	5.35	4.79
11	Mean	33.16	31.41	31.25	31.48	32.11	31.71	35	31.93
	S.D.	3.50	4.82	4.72	4.56	3.72	5.32	3.33	4.36

Table 7 revealed mean of the CPM in age 8 years old in Nakhonsithammarat province was lower than mean in all. Nevertheless, mean of the CPM in age 6, 7 and 10 years old had 21.75, 22.88 and 30.96 which were lower than Bangkok but upper than mean in all. Namely, mean on raw score of the CPM in students' age 6 - 11 years old from Nakhonsithammarat province were the second rank.

Part 2 The comparison among gender, age, and level of education

Table 8 The comparison of mean and standard deviations among gender

Sex	n	Mean	S.D.	S.E.	t	Sig (2-tailed)
Boy	227	27.83	6.84	.454	1.928	.16
Girl	240	27.24	6.98	.451		

Table 8 showed that the raw score of CPM in the students' age 6-11 years old in both boy and girl were not different significantly at .05.

Table 9 The comparison of mean and standard deviations among age groups

Age (year)	n	Mean	S.D.	S.E.	F	Sig
6	16	21.75	8.89	2.22	33.88	.000
7	68	22.88	7.26	0.88		
8	80	23.71	7.54	0.84		
9	95	27.02	5.40	0.55		
10	103	30.96	4.36	0.43		
11	105	31.41	4.82	0.47		
Total	467	27.53	6.92	0.32		

Table 9 showed that when compared mean score of CPM in six age groups by ANOVA it revealed that there were significant differences at .05.

Table 10 Multiple comparison of age groups

Age (year)	6	7	8	9	10	11
6	-	1.13	1.96	5.27	9.21*	9.66*
7		-	.83	4.14*	8.08*	8.53*
8			-	3.31*	7.25*	7.70*
9				-	3.94*	4.39*
10					-	.45
11						-

* P < .05

Table 10 showed that when Multiple comparison of age groups by Scheffe's Method it revealed ten couples that there were significant differences at .05.

Table 11 The comparison of mean and standard deviation among level of education

Level of education	n	Mean	S.D.	S.E.	F	Sig
Pratomsuksa: 1	66	20.92	7.28	0.89	42.11	.00
Pratomsuksa: 2	92	24.29	7.18	0.75		
Pratomsuksa: 3	91	26.89	5.35	0.56		
Pratomsuksa: 4	102	30.38	5.45	0.54		
Pratomsuksa: 5	93	31.32	3.95	0.41		
Pratomsuksa: 6	24	33.91	2.70	0.56		
Total	467	27.53	6.92	0.32		

Table 11 showed that when compared mean score of CPM in six level by ANOVA it revealed that there were significant difference at .05.

Table 12 Multiple comparison of level of education

Level of education	Pratom-suksa: 1	Pratom-suksa: 2	Pratom-suksa: 3	Pratom-suksa: 4	Pratom-suksa: 5	Pratom-suksa: 6
Pratomsuksa: 1	-	3.37*	5.97*	9.46*	10.40*	12.99*
Pratomsuksa: 2		-	2.60	6.09*	7.03*	9.62*
Pratomsuksa: 3			-	3.49*	4.43*	7.02*
Pratomsuksa: 4				-	.94	3.53
Pratomsuksa: 5					-	2.59
Pratomsuksa: 6						-

* P < .05

Table 12 showed that when Multiple comparison of class by Scheffe's Method it revealed eleven couples that there were significant difference at .05.

Part 3 The Construction of normative score from CPM of 6- 11 years old by using CPM raw scores converted into IQ scores and classified by age and level of education

Table13 The table of raw scores of CPM of 6-11 years old in Southern region converted into IQ scores and classified by age

	Age 6-8 years old.	Age 9-11years old.
Raw score	**IQ. score**	**IQ. score**
36	135	125
35	132	125
34	126	116
33	122	111
32	117	105
31	114	102
30	112	100
29	110	98
28	108	96
27	106	93
26	104	91
25	102	89
24	100	87
23	99	85
22	97	83
21	96	81
20	94	79
19	92	76
18	91	73
17	89	70
16	88	67
15	87	66
14	85	65
13	83	64
12	81	63
11	78	62
10	74	61
9	73	60
8	72	58
7	69	56
6	67	55
5	65	52
4	63	48
3	61	45
2	60	43
1	58	42

Table 14 The table of raw scores of CPM of 6-11years old in Southern region converted into IQ scores and classified by level of education

	Pratomsuksa: 1	Pratomsuksa: 2-3	Pratomsuksa: 4-6
Raw score	**IQ. score**	**IQ. score**	**IQ. score**
36	135	135	122
35	135	128	114
34	127	122	108
33	126	119	102
32	121	115	98
31	119	112	95
30	117	110	93
29	115	107	91
28	114	104	88
27	112	101	86
26	111	99	85
25	108	97	83
24	107	95	80
23	106	93	77
22	103	91	76
21	101	89	75
20	99	87	72
19	97	85	70
18	95	83	69
17	93	82	68
16	90	81	67
15	88	79	67
14	86	77	66
13	83	76	65
12	81	75	65
11	80	74	64
10	79	72	63
9	77	71	62
8	76	69	60
7	74	67	58
6	70	66	57
5	68	65	55
4	66	63	53
3	64	62	51
2	62	61	50
1	60	60	48

II. The Advanced Progressive Matrices

Part 1 The quality of APM in student'age 12-18 years old (n = 829)

-The quality of APM in the range, it was found that the level of difficulty range (p) was .06-.99 and the level of discrimination range (r) was .01-.56. The level of mean range was .28-.99 and the level of standard deviation was .09 -.50.

Table 15 Mean, Standard Deviation (S.D.), Difficulty (p), Discrimination (r) of APM

Items	Mean	S.D.	p	r	Items	Mean	S.D.	p	r
1.	.96	.18	.99	.01	**19.**	.83	.37	.66	.34
2.	.98	.12	.86	.22	**20.**	.81	.38	.69	.36
3.	.99	.09	.87	.20	**21.**	.80	.39	.51	.56
4.	.98	.13	.81	.31	**22.**	.77	.41	.42	.56
5.	.98	.12	.85	.21	**23.**	.79	.40	.46	.46
6.	.98	.11	.85	.21	**24.**	.56	.49	.31	.30
7.	.93	.24	.75	.37	**25.**	.66	.47	.42	.33
8.	.92	.26	.72	.44	**26.**	.54	.49	.38	.31
9.	.98	.11	.85	.28	**27.**	.58	.49	.24	.27
10.	.97	.16	.74	.40	**28.**	.42	.49	.20	.11
11.	.97	.14	.80	.36	**29.**	.33	.47	.16	.12
12.	.91	.27	.74	.40	**30.**	.57	.49	.21	.20
13.	.73	.44	.48	.33	**31.**	.59	.49	.22	.24
14.	.94	.23	.78	.34	**32.**	.51	.49	.18	.16
15.	.89	.31	.59	.47	**33.**	.53	.49	.28	.20
16.	.94	.22	.63	.53	**34.**	.51	.50	.18	.17
17.	.84	.35	.69	.36	**35.**	.64	.47	.23	.24
18.	.77	.41	.54	.42	**36.**	.28	.45	.06	.05

Table 15 showed the difficulty items values range from (p) .06 to .99, the discrimination range from (r) .01 to .56, the mean ranges from .28 to .99 and the standard deviation ranges from .09 to .50.

Table 16 Eigenvalue and Total Variance Explained of the 8 factors

Factor	Eigenvalue > 1	% of Variance	Comulative%
1	8.79	21.70	21.70
2	1.84	5.05	26.75
3	1.20	3.32	30.07
4	1.17	3.24	33.31
5	1.13	3.12	36.44
6	1.10	3.04	39.48
7	1.06	2.93	42.41
8	1.01	2.81	45.23

Table 16 and figure 2 illustrated factor analysis of APM in students'age 12-18 years old. It found the eigenvalue of the 8 factors and factor loading was factor one. The total variance of APM's score was 21.70.

Table 17 Factor loading over 0.40 before rotation the axis

	Factor							
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
11	.666							
10	.649							
4	.627							
14	.624							
16	.607							
21	.598							
9	.596							
15	.581							
12	.578							
8	.570							
7	.565							
22	.565							
6	.547							
2	.547							
3	.543							
5	.540							
20	.531							
17	.487							
19	.478							.423
23	.465							
18	.462							
25			.666					
26			.598					
24			.572					
30		.429						
35			.580					
33			.581					
1				.744				
36		.432				.527		
28						.459		
29								
13							.484	
34							.478	
31								.420
27					.451			
32					.450			

Table 16 and 17 evealed the result of item analysis by principal component analysis method that there were 8 factors which had Eigenvalue more than 1.00. The first factor explained variance 21.70 percent and total factors explained variance 45.23 percent. If the extracted weight of the first factors has upper than .4 and positive correlation coefficient value, each item of the APM can measure common factor of

intelligence structure and uniqueness of intelligence. To confirm the result of item analysis we rotated the axis by varimax with Kaiser Normalization method on simple structure and positive manifold principle and showed in table 18.

Table 18 Factor loading over 0.40 after rotation the axis

	Factor							
Item	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
3	.666							
2	.663							
5	.648							
6	.630							
4	.615							
14	.600							
11	.572							
9	.548							
10	.529							
7	.498							
8	.401							
20		.656						
22		.655						
16		.591						
23		.582						
21		.508						
25		.449						
15		.443						
12		.402						
19			.575					
17			.528					
18			.505					
31				.620				
30				.587				
27				.513				
13					.636			
26					.471			
36						.598		
33						.590		
35						.437		
24						.409		
29							.747	
34							.615	
28								.799
32								.514
1	.401							

Table 19 The items of the 8 factors

Factor	Item	Factor's name
1	3,2,5,6,4,14,11,9,10,7,8,1	Organization
2	20,22,16,23,21,25,15,12	Subtraction
3	19,17,18	Combination
4	31,30,27	Relation
5	13,26	Direction
6	36,33,35,24	Creation
7	29,34	Transformation
8	28,32	Summation

Table 19 showed the items consisted in each factor of the 8 factors.

The descriptive statistic of APM in students'age 12-18 years old

The value of descriptive statistic of APM which had mean 19.55, median 21, mode 23, standard deviation 6.78, maximum score 34, minimum score 2 and skewness -.47.

Table 20 Comparing mean score and standard deviation of all set of APM in Nakornsrithammarat, Chantaburi, Kanchanaburi, Lumpang, Bangkok, Nakorn Sawan and Udonthani

Province	Mean	S.D
Nakornsrithammarat	19.55	6.78
Chantaburi	18.71	6.608
Kanchanaburi	17.87	6.75
Lumpang	17.76	7.003
Bangkok	17.03	6.214
Nakorn Sawan	16.64	7.90
Udonthani	14.86	7.07

Table 20 showed the comparing mean score and standard deviation of all set of APM, it showed mean score from the highest to lowest scores; 19.55 of Nakornsrithammarat, 18.71 of Chantaburi, 17.87 of Kanchanaburi, 17.76 of Lumpang, 17.03 of Bangkok, 16.64 of Nakorn Sawan and 14.86 of Udonthani.

Table 21 Mean and standard deviation of the APM that divided into seven provinces and age group

Age	Province	Bang kok	Nakorn Sritam marat	Chanta buri	Udorn tanee	Lam pang	Nakorn sawan	Kancha naburi	Total
12	Mean	17.57	14.31	15.14	12.01	13.76	13.60	13.72	14.44
	S.D.	6.51	6.07	6.21	5.70	6.61	7.06	6.56	6.59
13	Mean	16.98	18.47	16.43	11.36	14.65	13.85	16.91	15.49
	S.D.	6.16	6.08	5.90	6.04	6.54	6.72	6.69	6.66
14	Mean	16.16	18.91	18.77	13.82	16.14	15.58	17.34	16.78
	S.D	6.36	6.48	7.17	6.48	6.55	7.45	6.64	6.95
15	Mean	17.45	20.17	18.45	16.79	17.98	16.99	18.65	18.19
	S.D.	6.32	6.27	6.62	7.14	6.40	8.11	5.74	6.68
16	Mean	17.58	21.15	20.29	18.07	21.96	18.95	20.12	19.83
	S.D.	5.61	7.03	5.84	7.09	5.82	7.42	5.66	6.44
17	Mean	17.39	22.84	21.28	18.56	21.29	19.31	19.14	20.16
	S.D.	6.62	5.93	5.73	6.92	6.71	8.32	6.89	6.86
18	Mean	15.87	21.15	21.41	17.02	20.99	20.98	21.06	20.24
	S.D.	5.64	6.48	6.16	6.36	5.71	7.71	7.20	6.65

Table 21 revealed Nakhonsithammarat province had mean of the APM of all age groups were upper than mean in all. The finding of study might summarize mean on raw score of the APM in students' age 12 - 18 years old from Nakhonsithammarat province were the first rank.

Part 2 The comparison among gender, age, and level of education

Table 22 The comparison of mean and standard deviations among gender

gender	n	Mean	S.D.	S.E.	t	Sig (2-tailed)
Male	343	19.25	7.266	.392	7.69	.006
Female	486	19.77	6.414	.291		

Table 22 showed that the raw scores of APM in the students' age 12-18 years old in male and female were different significantly at .05.

Table 23 The comparison of mean and standard deviations among age groups

Age (year)	n	Mean	S.D.	S.E.	t	Sig (2-tailed)
12	108	14.31	6.07	.58	18.184	.00
13	127	18.47	6.08	.54		
14	138	18.91	6.48	.55		
15	130	20.17	6.27	.55		
16	110	21.15	7.03	.67		
17	126	22.84	5.93	.53		
18	90	21.15	6.48	.70		
Total	829	19.55	6.78	.235		

Table 23 showed that when compared mean score of APM in seven age groups by ANOVA it revealed that there were significant difference at .05

Table 24 Multiple comparison of age groups

Age (year)	12	13	14	15	16	17	18
12	-	4.16*	4.60*	5.85*	6.83*	8.53*	6.84*
13		-	.44	1.70	2.67	4.37*	2.68
14			-	1.26	2.23	3.93*	2.24
15				-	.98	2.67	.98
16					-	1.70	.01
17						-	1.69
18							-

* P < .05

Table 24 showed that when Multiple comparison of age groups by Scheffe's Method it revealed eight couples were significant difference at .05.

Table 25 The comparison of mean and standard deviation among level of education

Level of education	n	Mean	S.D.	S.E.	F	Sig
Mathayomsuksa: 1	130	18.05	6.29	.55	20.9	.00
Mathayomsuksa: 2	131	18.66	6.69	.58		
Mathayomsuksa: 3	129	19.48	5.8	.51		
Mathayomsuksa: 4	120	21.32	6.6	.60		
Mathayomsuksa: 5	122	21.94	6.72	.60		
Mathayomsuksa: 6	112	22.85	5.42	.51		
Pratomsuksa: 3	2	5.00	1.41	1.00		
Pratomsuksa: 5	2	7.00	4.24	3.00		
Pratomsuksa: 6	81	13.44	5.51	.61		
Total	829	19.55	6.78	.235		

Table 25 showed that when compared mean score of APM in nine level of education by ANOVA it revealed that there were significant difference at .05.

Table 26 Multiple comparison of level of education

Level of educa-tion	M:1	M:2	M:3	M:4	M:5	M:6	P:3	P:5	P:6
M:1	-	.62	1.43	3.27*	3.90*	4.80*	13.05	11.05	4.60*
M:2		-	.82	2.65	3.28*	4.18*	13.66	11.66	5.22*
M:3			-	1.84	2.46	3.37*	14.48	12.48	6.04*
M:4				-	.63	1.53	16.32	14.32	7.87*
M:5					-	.91	16.64	14.94	8.50*
M:6						-	17.85*	15.85	9.40*
P:3							-	2.00	8.44
P:5								-	6.44
P:6									-

* P < .05

Table 26 showed that when Multiple comparison of level of education by Scheffe's Method it revealed thirteen couples significant differences at .05.

Part 3 The Construction of normative score from APM of 12-18 years old by using APM raw scores converted into IQ scores and classified by gender, age and level of education

Table 27 The table of raw scores of APM of 12-18 years old in Southern region converted into IQ scores and classified by gender and age

Raw score	Age 12 years old		Age 13-16 years old		Age 17-18 years old	
	IQ. score		IQ. score		IQ. score	
	Male	Female	Male	Female	Male	Female
36	143	148	140	143	137	138
35	141	145	139	140	136	136
34	140	143	137	138	135	135
33	139	142	135	136	129	132
32	137	139	135	135	125	131
31	136	138	134	131	123	129
30	135	137	129	130	120	124
29	134	136	126	126	116	121
28	132	135	123	124	111	119
27	131	135	119	121	106	116
26	125	131	115	117	104	112
25	124	130	112	113	101	108
24	121	125	109	110	99	105
23	122	123	106	106	97	101
22	118	121	104	102	96	99
21	113	117	102	100	96	96
20	110	114	100	98	94	94
19	108	112	98	96	91	91
18	107	111	96	93	89	89
17	104	110	94	92	87	87
16	102	107	92	90	85	86
15	99	105	91	88	85	84
14	98	102	89	86	84	83
13	96	100	88	85	83	82
12	94	99	87	83	82	81
11	91	97	86	81	81	78
10	88	95	85	79	79	74
9	83	92	83	77	77	71
8	82	88	81	75	77	67
7	80	85	80	72	74	66
6	79	83	78	70	73	66
5	78	79	75	66	68	65
4	72	75	69	65	67	61
3	70	74	66	63	65	58
2	67	73	65	60	62	56
1	65	71	63	59	60	54

Table 28 The table of raw scores of APM of 12-18 years old in Southern region converted into IQ scores and classified by age and level of education

Raw score	Pratomsuksa: 3,5,6		Mathayomsuksa: 1-3		Mathayomsuksa: 4-6	
	IQ. score		IQ. score		IQ. score	
	Male	Female	Male	Female	Male	Female
36	150	149	147	140	136	137
35	148	147	146	139	135	136
34	146	145	144	138	135	135
33	145	143	143	137	131	135
32	143	141	140	135	127	134
31	142	140	138	135	124	130
30	141	138	135	133	119	125
29	138	137	134	129	116	121
28	135	135	129	127	111	119
27	134	134	124	126	108	115
26	132	131	118	122	106	111
25	129	129	114	118	102	107
24	127	128	112	114	100	104
23	125	125	109	109	98	100
22	124	124	106	105	97	98
21	116	122	103	103	96	96
20	116	119	101	101	94	93
19	112	116	99	99	92	90
18	110	115	97	96	90	89
17	109	114	95	94	88	87
16	106	111	93	92	87	85
15	103	108	91	90	85	84
14	101	105	90	88	85	83
13	100	103	88	86	84	82
12	97	101	87	85	84	80
11	94	99	86	83	83	77
10	91	96	84	82	82	74
9	86	93	82	80	80	71
8	85	88	81	77	77	69
7	83	85	79	74	75	68
6	82	82	78	72	75	66
5	80	79	74	67	71	65
4	76	77	69	63	65	65
3	72	70	67	61	63	64
2	70	69	65	59	61	61
1	67	67	62	57	60	58

CHAPTER 5
CONCLUSION, DISCUSSION AND RECOMMENDATION

Conclusion

The objective of this research were to study the statistical characteristic of CPM and APM intelligence test using with 6 to 18 years old students in the southern region of Thailand. The study also found about the normative scores of intelligence by using CPM test with 467 sampling students and APM test with 829 students. The findings were as follows;

CPM intelligence test

Part 1 The conclusion of quality analysis of CPM, the study revealed the test had high quality as follows;

1. The quality of CPM in the range, it was found that the level of difficulty (p) was .37- .98 and the level of discrimination (r) was .01-.68. The level of mean was .38-.99 and the level of standard deviation was .04-.50.

2. For the quality of all set of CPM, it was found that the level of reliability (α) was .91, the level of discrimination (r) was .31, the level of difficulty (p) was .76 and the level of standard error of mean (SEM) was .32.

3. For the factor analysis, it was found that eigenvalue with more than 1 level had 7 factors and the first factor explained variance 28.74 percent and total factors explained variance 57.05 percent. If the extracted weight of the first factors has upper than .4 and positive correlation coefficient value, each item of the CPM can measure common factor of intelligence structure and uniqueness of intelligence. The study showed the first factor eigenvalue was 10.63 while other factors were 3.90,1.79,1.36,1.22,1.12 and 1.08 in chronological order. Considering factor loading with more than .40 level, it was found that the first factor had 15 questions, which contained the question number 4B,7Ab,6Ab,8Ab,5B,3B,4Ab,9Ab,5Ab,6B,11A,7B,

10Ab, 2B, and 7A.To confirm the result of item analysis we rotated the axis by varimax with Kaiser Normalization method on simple structure and positive manifold principle and found that the second factor had 6 questions, which were the question number 8B,11B,10B,9B,12B, and12Ab with variability level at 10.55 percent. The third factor had 6 questions, which were the question number 2B, 2Ab, 1Ab, 3Ab, 1B, and 2A with variability level at 4.84 percent. The forth factor had 6 questions, which were the question number 3A, 4A, 5A, 6A, 2A, and1A, with variability level at 4.84 percent. The fifth factor had 4 questions, which were the question number 8A,9A,7A, and 10A,with variability level at 3.29 percent. The sixth factor had 2 questions, which were the question number 11Ab and 12A,with variability level at 3.03 percent and the seventh factor had 1 question, which was the question number 1B,with variability. level at 2.93 percent

Part 2 The conclusion of descriptive statistic and difference of mean score from CPM intelligence test, the study showed as below;

1.Conclusions of descriptive statistic analysis were ;

1.1 All set of standard statistic level of CPM intelligence test showed that the mean score was 27.53, median was 29, mode was 34, standard deviation was 6.91, maximum score was 36,minimum score was 5 and skewedness score was -.90.

1.2 Comparing mean score and standard deviation of all set of CPM in Bangkok by Chantanee Mungkhetklang (49), it was found that the mean score was 29.44 and standard deviation was 6.003. The mean score of the central part (Nakorn Sawan province) by Sudarat Sirisakpanit (50) was 26.73 and standard deviation was 7.102. The mean score of the northern part (Lumpang province) by Siree Udomphol (51) was 26.86 and standard deviation was 7.119. The mean score of the easthern part (Chantaburi province) by Wararat Intumtim (52) was 27.021 and standard deviation was 7.170. The mean score of the westhern part (Kanchanaburi province) by Sureerat Palakas (53) was 26.38, standard deviation was 7.52 and the mean score of the northeastern part (Udonthani province) by Witchaya Moreechatwas (54) 27.01 and standard deviation was 7.03.

2. The conclusions of inferential statistic which were analyzed the mean diference from raw scores of CPM classified with individual factors

2.1 Gender - It was found that there was the statistical different significantly of CPM at the .05 level of significance in boy and girl students.

2.2 Age – It was found that different age group of students had statistical different significantly of CPM at the .05 level of significance. The 11 years old students had highest mean scores (31.41) and the 6 years old students had lowest mean scores (21.75).

2.3 Level of education- It was found that the students in different level of study had statistical different significantly of CPM at the .05 level of significance.

Part 3 The conclusion of normative score of the CPM was separated into 2 tables;

1. The table of raw scores of the CPM of 6-11 years old students in the south of Thailand converted into IQ scores and classified by age.

2. The table of raw scores of the CPM of 6-11 years old students in the south of Thailand converted into IQ scores and classified by level of education.

APM intelligence test

Part 1 The conclusion of quality analysis of APM, the study revealed the test had high quality as follows;

1. The quality of APM in the range, it was found that the level of difficulty (p) was .06-.99 and the level of discrimination (r) was .01-.56. The level of mean was .28-.99 and the level of standard deviation was .09 -.50.

2.For the quality of all set of APM, it was found that the level of reliability (α)was .88, the level of discrimination (r) was .30, the level of difficulty (p) was .54 and the level of standard error of mean (SEM) was .235.

3. For the factor analysis, it was found that eigenvalue with more than 1 had 8 factors and the first factor explained variance 21.70 percent and total factors explained variance 45.23 percent. If the extracted weight of the first factors has upper than .4 and positive correlation coefficient value, each item of the CPM can measure common factor of intelligence structure and uniqueness of intelligence.The study

showed the first factor was 8.79 eigenvalue while other factors were 1.84,1.20,1.17,1.13,1.10,1.06 and 1.01 in chronological order. Considering factor loading with more than .40 level, it was found that the first factor consisted of 11questions, which were the question number 3,2,5,6,4,14,11,9,10,7,8 and 1. To confirm the result of item analysis we rotated the axis by varimax with Kaiser Normalization method on simple structure and positive manifold principle and found that the second factor had 8 questions, which were the question number 20,22,16,23,21,25,15 and 12, with variability level at 5.05 percent. The third factor had 3 questions, which were the question number 19,17 and 18, with variability level at 3.32 percent. The forth factor had 3 questions, which were the question number 31,30 and 27,with variability level at 3.24 percent. The fifth factor had 2 questions, which were the question number 13 and 26,with variability level at 3.12 percent. The sixth factor had 4 questions, which were the question number 36,33,35 and 24,with variability level at 3.04 percent. The seventh factor had 2 questions, which were the question number 29 and 34,with variability level at 2.93 percent and the eighth factor had 2 questions, which were the question number 28 and 32,with variability level at 2.81 percent.

Part 2 The conclusion of descriptive statistic and difference of mean score from APM, the study showed as below;

1.Conclusions of descriptive statistic analysis were;

1.1 All set of standard statistic level of APM showed that the mean score was 19.55, median was 21, mode was 23, standard deviation was 6.78, maximum score was 34,minimum score was 2 and skewedness score was -.47.

1.2 Comparing mean score and standard deviation of all set of APM in Bangkok by Chantanee Mungkhetklang (49), it was found that the mean score was 17.03 and standard deviation was 6.214. The mean score of the central part (Nakorn Sawan province) by Sudarat Sirisakpanit (50) was 16.64 and standard deviation was 7.90. The mean score of the northern part (Lumpang province) by Siree Udomphol (51) was 17.76 and standard deviation was 7.003. The mean score of the easthern part (Chantaburi province) by Wararat Intumtim (52) was 218.71 and standard deviation was 6.608. The mean score of the westhern part (Kanchanaburi province) by Sureerat

Palakas (53) was 17.87, standard deviation was 6.75 and the mean score of the northeastern part (Udonthani province) by Witchaya Moreechat (54) was 14.86 and standard deviation was 7.07.

2. The conclusions of inferential statistic which were analyzed diference the mean from raw scores of APM classified with individual factors;

2.1 Gender - It was found that there was the statistical different significantly of CPM at the .05 level of significance in male and female students and the female groups had mean scores more than male.

2.2 Age – It was found that different age group of students had statistical different significantly of APM at the .05 level of significance. The 17 years old students had highest mean scores (22.84) and the 12 years old students had lowest mean scores (14.31).

2.3 Level of education- It was found that the students in different grade had statistical different significantly of APM at the .05 level of significance.

Part 3 The conclusion of normative score of the APM was separated into 2 tables;

1. The table of raw scores of APM of 12-18 years old students in the south of Thailand converted into IQ scores and classified by gender and age.

2. The table of raw scores of APM of 12-18 years old students in the south of Thailand converted into IQ scores and classified by gender and level of education.

Discussion

CPM intelligence test

1. Results of the quality study of CPM, it was found that

1.1 Reliability analyzed by Alpha method had value at .91, which was high reliability (2). This result was similar to the study of CPM in Thai people by Sucheera Phattharayuttawat et al. (2) which found internal reliability value was .91. It showed that CPM intelligence test had high effectiveness for testing with this sampling group. This result was higher than Carlson and Jensen's (39) studied the reliability of CPM

by using CPM in sample group which composed of different age and race (black, white, and Latin-America), they found Reliability of CPM calculated from all items was .20-.80. This result conform with Reddington and Jackson's (40) study, they used seven midpoints to distinguish age groups (5.5, 6.5, 7.5, 8.5, 9.5, 10.5, 11.5 years of age). The CPM was found to have good reliability as determined by Cronbach's alpha, with estimates ranging from .79 for 7 year olds up to .90 for 11 year olds and Valencia(41) studied reliability of Raven's CPM in sample group which was Anglo and Maxican American children studying in grade 3. The result found that reliability of CPM in different races was high. Similar to Cotton et al. (46) studies 618 children from Victoria Australia ranging in age from 6.00 to 11.92 years old and they found split-half reliability with values ranging .91 and internal consistency estimates ranged .89.

1.2 The level of discrimination, from the research it was found that the item discrimination analysis had positive direction (r = .01- .68). It was also found that the item discrimination which was less than .20 (13 questions) had low discrimination scores and 23 questions had good discrimination scores. The average level of discrimination on total CPM score was .32, it showed that all set of CPM level of discrimination in this study could discriminate students with high scores in CPM test from low scores group. This result was similar to the study of CPM in Thai people by Sucheera Phattharayuttawat et al. which found the level of discrimination range was .10-.36 (2). So the CPM test could discriminate high score students from low score students effectively.

1.3 The difficulty of CPM in each item (p) was .37-.98 being in the form of item behavior starting from the easy items accordance with Raven's study (5). This research showed that item 2 was the easiest item (p). = 98, the most difficult item was the Item 36 (p) =.37. It showed that CPM test of 6-11 years old students was fair when compared with difficulty (.20-.80) (2,27). The difficulty of this research was similar the study of CPM in Thai people (2) which the level of difficulty was .43-.99 in the form of item behavior starting from easy (P=.99) to difficult items (P=.43). The difficult level of all set of CPM was .77, nearly with this study (.76). So the researcher concluded that the test had easy level of difficulty.

1.4 Standard error of mean (SEM) was .32, it showed that in this research, the 6-11 year old students had done CPM and got the raw score with error at .32. In other words, raw score together with SEM gave the real score of these students.

1.5 For factor analysis, it was found that eigenvalue with more than 1 level had 7 factors and could measure intelligence factors at 28.74 percent. The study showed the first factor had 10.63 of eigenvalue while other factors were .3.90,1.79,1.36,1.22,1.12 and 1.08 in chronological order. Considering factor loading with more than .40, it was found that the first factor had 15 questions, which were the question number 4B,7Ab,6Ab,8Ab,5B,3B,4Ab,9Ab,5Ab,6B,11A,7B, 10Ab, 2B, and 7A.Considering in each item, it showed that the first factor had the principle in choosing answers by using complete a pattern by symmetry and orientation of missing part method. So this factor was named Balance. To confirm the result of item analysis we rotated the axis by varimax with Kaiser Normalization method on simple structure and positive manifold principle and found that the second factor had 6 questions, which were the question number 8B,11B,10B,9B,12B, and12Ab, with variability level at 10.55 percent. Considering in each item, it showed that the second factor had the principle in choosing answers by using complete an analogy by modify figure method. So this factor was named Creation. The third factor had 6 questions, which were the question number2B, 2Ab, 1Ab, 3Ab, 1B, and 2A with variability level at 4.84 percent. Considering in each item, it showed that the third factor had the principle in choosing answers by using complete a pattern by difference and similarity identity method. So this factor was named Category. The forth factor had 6 questions, which were the question number3A, 4A, 5A, 6A, 2A, and 1A,with variability level at 3.68 percent. Considering in each item, it showed that the forth factor had the principle in choosing answers by using complete a pattern by identity of pattern method. So this factor was named Distinguish. The fifth factor had 5 questions, which were the question number 8A, 9A,7A, and 10A ,with variability level at 3.29 percent. Considering in each item, it showed that the fifth factor had the principle in choosing answers by using complete a pattern by similarity and difference completion of pattern method. So this factor was named Assembly. The sixth factor had 2 questions, which were the question number 11Ab and 12A,with variability level at 3.03 percent.

Considering in each item, it showed that the sixth factor had the principle in choosing answers by using complete a pattern by identity and continuous pattern method. So this factor was named Connection. The seventh factor had 1 questions, which was the question number 1B,with variability level at 2.93 percent Considering in each item, it showed that the seventh factor had the principle in choosing answers by using complete a pattern by grouping similarity of pattern. So this factor was named Similarity.

2. From the study of descriptive statistic, it was found that 6-11 year old of 467 students done CPM and got mean score of 27.53, median of 29, mode of 34, standard deviation of 6.91, maximum score of 36, minimum score of 5 and skewed score of -.90. The descriptive statistic showed mean, standard deviation and minimum score were lower than score of Thai people studied by Sucheera Phattharayuttawat et al. (2) which mean score of male was 29.02, standard deviation was 7.82, mean score of female was 28.90, standard deviation was 7.11, minimum score was 11, maximum score was 36 and skewed score was –1.96 with wide score range. Considering with all set of CPM mean score and standard deviation, it showed mean score from high to low scores ; 29.44 of Bangkok (49)mean score, 27.53 of Nakornsrithammarat mean score, 27.021 of Chantaburi (52) mean score, 27.01 of Udonthani (54), 26.86 of Lumpang (51) mean score, 26.73 of Nakorn Sawan (50) mean score and 26.38 of Kanchanaburi (53) mean score. Revealed Nakhonsithammarat province of mean of the CPM in age 8 years old was lower than mean in all. Moreover mean of the CPM in age 6, 7 and 10 years old had 21.75, 22.88 and 30.96 which were lower than Bangkok but upper than mean in all. The summarized mean on raw score of the CPM in students' age 6 - 11 years old from Nakhonsithammarat province were second rank.The different mean scores was similar to the study of Department of Committee's National Primary Study which reported that the study achievement of primary students was different by geography condition (8) and relevant to Bruner's studies found the environment is the support factor for intelligence development, it can make brain developing slowly and also make brain developing rapidly(8). Similar to Miao and Huang's studied in Taiwan, they found young people from different geographical areas have different norms (20).

3. From the study of comparing between the mean score of CPM of gender it was found that there was no significant difference at 0.5 level, according to the Sudanee Wuttiphrom's study (23), Brody Levton Walwetnet (21) and Wechsler (2) which were mostly found the differences between boy and girl in some skills but there are no difference in generally intelligence level.

4. From the study of comparing between the mean score of CPM of age it was found significant difference at .05 level. The 6 years old had 21.75 of mean scores, 8.89 of standard deviation. The 7 years old had 22.88 of mean scores, 7.26 of standard deviation. The 8 years old had 23.71 of mean scores, 7.54 of standard deviation. The 9 years old had 27.02 of mean scores, 5.40 of standard deviation. The 10 years old had 30.06 of mean scores and the 11 years old had 31.41 of mean scores, 4.82 of standard deviation. When Multiple Comparisons with Scheffe's Method, it was found 10 couples of difference at .05 level of significance which were; the 6 years old student's group with the 11 years old student's group, the 7 years old student's group with the 9,10 and 11 years old student's group, the 9 years old student's group with the 10 and 11 years old student's group. This study was similar to Bab (24) which found that the different age had effects on intelligence level, as well Raven's (5) study showed the 6.5 year old student got 15 points, 8.5 year old student got 21 points and 10.5 year old one got 27 points.

5. From the study of difference of level of education and mean of raw scores of CPM, the result showed that students in different level of education had mean of raw scores of CPM at .05 of significance, the Pratom One students had 20.92 of mean scores, 7.28 of standard deviation, the Pratom Two students had 24.29 of mean scores, 7.18 of standard deviation, the Pratom Three students had 26.89 of mean scores, 5.35 of standard deviation, the Pratom Four students had 30.38 of mean scores, 5.45 of standard deviation, the Pratom Five students had 31.32 of mean scores, 3.95 of standard deviation and the Pratom Six students had 33.91 of mean scores and 2.70 of standard deviation. When multiple Comparisons with Scheffe's Method it was found 11 couples of difference at .05 level of significance which were; the Pratom One student's group with the Pratom Two, Three, Four, Five and Six student's group, the

Pratom Two student's group with the Pratom Four, Five and Six student's group, the Pratom Three student's group with the Pratom Four, Five and Six student's group. This study was similar to Sax (25), which found that the intelligence test had high relation with achivement test and the shift of student's study level. This was result of acheivement test which had different difficulty depending on study level, so the intelligence level in each class had some differences.

6. The Construction of normative score from CPM of 6-11 years old students in the southern region of Thailand by using CPM test raw scores converted into IQ scores and classified by age and level of education.

6.1 The table of raw scores of CPM of 6-11 years old students in the southern region of Thailand converted into IQ scores and classified by age.

The table shown that intelligence score has positive correlation with age. When age increase, the intelligence score will increase too. In each raw score range the IQ score increase 1-3 score. In score table in age group 6-8 years old assessed the highest IQ score to 135 while age group 9-11 years old assessed the highest IQ score to 125. It shown that CPM appropriate with age group 6-8 years old more than age group 9-11 years old because it can separate the children who were get high score from the children who get low score effectively. This result found CPM was easy for children age group 9-11 years old.

6.2 The table of raw scores of CPM of 6-11year old students in the southern region of Thailand converted into IQ scores and classified by gender and level of education.

The table shown that intelligence score has positive correlation with age. When age increase, the intelligence score also increase. In each raw score range the IQ score increase 1-3 score. In score table in Pratomsuksa 1-3 assessed the highest IQ score to 135 and Pratomsuksa 4-6 assessed the highest IQ score to 122. It shown that CPM appropriate with Pratomsuksa 1-3 more than Pratomsuksa 4-6. This result found CPM was suitable Pratomsuksa 1-3. It confirms the concept that IQ scores classified by age. Therefore, both of age and level of education were related with stage of cognitive development of normal child, so the comparison of IQ score that are measured should compare by the same range of age or level of education.

APM intelligence test

1.Results of the quality study of APM test, it was found that

1.1 Reliability analyzed by Alpha method had value at .88 which was high reliability (2). This result was similar to the study of reliability of Foul (7) revealed reliability value of 12.5 year old student was .86 and adult was .91, as well the study of Sucheera Phattharayuttawat (1) which found reliability value of Thai university student at .90. It showed that APM intelligence test had high effectiveness for testing with this sampling group.

1.2 The level of discrimination, from the research it was found that the item discrimination analysis had positive direction (r = .01- .56). It was also found that the item discrimination which was less than .20 (6 questions) had low discrimination scores and 30 questions had good discrimination scores. The average level of discrimination on total APM score was .30, it showed that all set of APM level of discrimination in this study could discriminate students with high scores in APM test from low scores group. This result was similar to the study of Sucheera Phattharayuttawat et al. (1) which found the level of discrimination range was .10-.59. So the APM test could discriminate high score students from low score students effectively.

1.3 The difficulty of APM in each item (p) was .06-.99 being in the form of item behavior starting from the easy items. This research showed that easiest item (p) = .99, the most difficult Item (p) =.06. The mean of difficulty of all set of APM was .54, according to Raven' s study (3) which found that APM test had several quizs starting from easy to difficult ones, as well the study of Sucheera Phattharayuttawat et al. (1) which revealed the difficulty of each item was .12 - .99 and the mean of difficulty was .60. It showed that APM intelligence test had difficulty in average and had enough effectiveness for testing intelligence.

1.4 Standard error of mean (SEM) was .235, it showed that in this research, the 12-18 year old students had done APM and got the raw scores with error at .235. In other words, raw score together with SEM gave the real score of these students.

1.5 For factor analysis, it was found that eigenvalue with more than 1

level had 8 factors and could measure intelligence factors at 21.70 percent. The study showed the first factor had 8.79 of eigenvalue while other factors were 1.84, 1.20, 1.17, 1.13, 1.10,1.06 and 1.01 in chronological order. Considering factor loading with more than .40, it was found that the first factor had 11 questions, which were the question number 3,2,5,6,4,14,11,9,10,7,8 and 1. Considering in each item, it showed that the first factor had the principle in choosing answers by using complete an analogy by mergence, split, shitting and grouping method. So this factor was named space Organization. To confirm the result of item analysis we rotated the axis by varimax with Kaiser Normalization method on simple structure and positive manifold principle and found that the second factor had 8 questions, which were the question number 20,22,16,23, 21, 25,15 and 12, with variability level at 5.05 percent. Considering in each item, it showed that the second factor had the principle in choosing answers by using introduce systematic permutation by reduce identity for modify pattern method. So this factor was named Subtraction. The third factor had 3 questions, which were the question number 19,17 and 18, with variability level at 3.32 percent. Considering in each item, it showed that the third factor had the principle in choosing answers by using complete an analogy by mergence of pattern method. So this factor was named Combination. The forth factor had 3 questions, which were the question number 31,30 and 27,with variability level at 3.24 percent. Considering in each item, it showed that the forth factor had the principle in choosing answers by using systematically resolve figures into part by correlation method. So this factor was named Relation. The fifth factor had 2 questions, which were the question number 13 and 26, with variability level at 3.12 percent. Considering in each item, it showed that the fifth factor had the principle in choosing answers by using complete an analogy by change position method. So this factor was named Direction. The sixth factor had 4 questions, which were the question number 36,33,35 and 24, with variability level at 3.04 percent. Considering in each item, it showed that the sixth factor had the principle in choosing answers by using systematically resolve figures into part by overlap to modify identity method. So this factor was named Creation. The seventh factor had 2 questions, which was the question number 29 and 34,with variability level at 2.93 percent Considering in each item, it showed that the seventh factor had the principle in choosing answers by using introduce systematic

permutation by change identity method, so this factor was named Transformation and the eighth factor had 2 questions, which was the question number 28 and 32,with variability level at 2.81 percent Considering in each item, it showed that the eighth factor had the principle in choosing answers by using systematically resolve figures into part by perception of summarize identity to pattern method. So this factor was named perception.

2. From the study of descriptive statistic, it was found that 12-18 years old of 829 students done APM test and got mean score of 19.55, median of 21, mode of 23, standard deviation of 6.78, maximum score of 34, minimum score of 2 and skewed score of -.47. The descriptive statistic showed mean, standard deviation and minimum score were lower than score of the study of Raven (3) that showed university students in England had 21 of mean score, and 4 of standard deviation. Yatt and Forb (3) studied about sophomores in Australia and found they had 23.45 of mean scores, 4.94 of standard deviation, and students in New Zealand got 22.55 of mean scores, 4.49 of standard deviation, while Gibson (47) Hitpill Polytechnic students had 24.28 of mean scores and 4.67 of standard deviation. The Thai university students' study of Sucheera Phattharayuttawat et al. (1) show 23.34 of mean scores and 7.30 of standard deviation. Moreover, Paiboon Taewalux (29) studied Chulalonkorn University bachelor's degree students and found 22.73 of mean scores and 4.87 of standard deviation. In additions, Chalitta Kaiyanone (7) studied university students in Bangkok and found that they got 23.59 of mean scores and 4.60 of standard deviation. Comparing mean score and standard deviation of all APM test, the study showed the mean scores in chronological order; 19.55 of Nakornsrithammarat, 18.71 of Chantaburi (52), 17.87 of Kanchanaburi (53), 17.76 of Lumpang (51), 17.03 of Bangkok, 16.64 of Nakorn Sawan (50) and 14.86 of Udonthani (54). Revealed Nakhonsithammarat province had mean of the APM of all age groups were upper than mean in all. The finding of study might summarize mean on raw score of the APM in students' age 12 - 18 years old from Nakhonsithammarat province were first rank.The different mean scores was similar to the study of Department of Committee's National Primary Study which reported that the study achievement of primary students was different by geography condition (8) Similar to Miao and Huang's studied in Taiwan,

they found young people from different geographical areas have different norms (20). and relevant to Bruner's studies found the environment is the support factor for intelligence development, it can make brain developing slowly and also make brain developing rapidly(8).

3. From the study of comparing between the mean score of APM of gender it was found that there was significant difference at 0.5 level, female students' mean scores was 19.77 and male was 19.25.It showed that in creating normative scores of APM intelligence test, the researcher must classify gender.

4. From the study comparing between the mean score of APM of age it was found significant difference at .05 level. The 12 years old had 14.31 of mean scores, 6.07 of standard deviation. The 13 years old had 18.47 of mean scores, 6.08 of standard deviation. The 14 years old had 18.91 of mean scores, 6.48 of standard deviation. The 15 years old had 20.17 of mean scores, 6.27 of standard deviation. The 16 years old had 21.15 of mean scores, 7.03 of standard deviation. The 17 years old had 22.84 of mean scores, 5.93 of standard deviation and the 18 years old had 21.15 of mean scores, 6.48 of standard deviation. When Multiple Comparisons with Scheffe's Method, it was found 8 couples of difference at .05 level of significance which were; the 12 years old student's group with the 13,14,15,16, 17 and 18 years old student's group, the 13 years old student's group with the 17 years old student's group, the 14 year old student's group with the 17 year old student's group. This study was similar to Bab (24) which found that the different age had effects on intelligence level, as well Raven 's (3) study compared younger than 14 years old students at the same percentile level and found that intelligence level was different when older than half year in steps. Then the degree of difference inclined to increase in accordance with the age.

5. From the study of difference of level of education and mean of raw scores of APM test, the research showed that students in different level of education had mean of raw scores of APM at .05 of significance, the Pratom Three students had 5 of mean scores, 1.41 of standard deviation, the Pratom Five students had 7 of mean

scores, 4.24 of standard deviation, the Pratom Six students had 13.44 of mean scores, 5.51 of standard deviation, the Mattayom One students had 18.05 of mean scores, 6.29 of standard deviation, the Mattayom Two students had 18.66 of mean scores, 6.69 of standard deviation.The Mattayom Three students had 19.48 of mean scores and 5.8 of standard deviation. The Mattayom Four students had 21.32 of mean scores and 6.6 of standard deviation. The Mattayom Five students had 21.94 of mean scores and 6.72 of standard deviation and the Mattayom Six students had 22.85 of mean scores and 5.42 of standard deviation. When multiple comparisons with Scheffe's Method it was found 13 couples of difference at .05 level of significance which were; the Mattayom One student's group with the Mattayom Four, Five, Six and Pratom Six student's group, the Mattayom Two student's group with the Mattayom Five, Six and Pratom Six student's group, the Mattayom Three student's group with the Mattayom Six and Pratom Six student's group, the Mattayom Four student's group with the Pratom Six student's group, the Mattayom Five student's group with Pratom Six student's group and the Mattayom Six student's group with the Pratom Three and Six student's group. The study showed the Pratom Three, Five and Six had low mean scores and this study was similar to Sax (25), which found the intelligence level in each class had some differences.

6. The Construction of normative score from APM of 12-18 years old students in the southern region of Thailand by using APM test raw scores converted into IQ scores and classified by gender, age and level of education.

6.1 The table of raw scores of APM of 12-18 years old students in the southern region of Thailand converted into IQ scores and classified by gender and age.

This result found IQ score was different between female and male. In the same raw score female have IQ score level higher than IQ score level of male. In each raw score range the IQ score increase 1-3 score. So APM was appropriate with this sample group because it can classify the children who get low score from the children who get high score and it can assess the intellectual ability to high IQ score.

6.2 The table of raw scores of APM of 12-18 year old students in the southern region of Thailand converted into IQ scores and classified by age and level of education.

From the table, it found the highest score of APM is between 136 to 150. It also shown the same as in the CPM that score varies by age and level of education consistent to the concept that age and level of education were related with cognitive development. Therefore, IQ score have to compare within the same age range or level of education.

Recommendation

1.Recommendation for research application

1.1 This research showed that there was no difference between gender in CPM but there were difference in age and level of education, these factors effected the interpretation of IQ score that measured. Therefore, the normative scores had to classify by age and level of education. Likewise APM that found the different in gender, age and level of education. Therefore, normative score tables had to classified by gender, age and level of education.

1.2 For formal education students can use normative score tables classified by age or level of education.

1.3 As the geographical variable, the sample group in this research was students in the south of Thailand, so this normative score tables might more appropriate use for southern region students.

2.Recommendation for test administration

2.1 The CPM and APM should be administer restrictly and cleary both method and process of test. The examinee should understand it throughly. Beside that the examiner should consider physical and mental readiness, motivation, intention of examinee to perform it potentilly.

2.2 Be careful intervening variable that exist during the test, for example, nuisance or heat that having effect on the concentration and intention of the examinee.

2.3 CPM administer in 6-8 years old students should be done with carefully. The researcher should explain slowly and clearly because students may not understand and no enough concentration. Moreover it should have done and observing closely in a small group, at least 1 examiner for 5-6 students.

3.Recommendation for the further research

The study should be done with students studying in non-formal education and vocational study to create national norm for student in the whole system of study.

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