### CHAPTER IV
#### PLAN AND PROCEDURE

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CHAPTER IV

PLAN AND PROCEDURE

4.1 INTRODUCTION

Design is an essential step in the process of test construction. It is often at this stage of planning that the decisions taken will differentiate a sound study from a faulty study. The factor that most often differentiates between good and poor research is not the funds available, the size of sample, or sophistication of the statistics, it is the care and thought that goes into the research plan. As Burroughs puts it: "The hypotheses formulated act as a guide to what one is proposing to test. The purpose of the design is to show how to do it. We need to collect data in such a way that we may validly draw conclusions from them. There are many elements to be taken into consideration at this stage not all of which are compatible. In this the stage is probable that all others, experience and where technical advise should be sought"¹.

Thus, a reliable test cannot just happen. It is not the fruit of a few hours or days. It encompasses number of operations, carried out with patience, zeal, accuracy and industriousness for months and years. For such a long process, planning demands utmost care and insight. The design of a test involves the preparation of an outline of specification of the ability to be measured, the content through which the ability could be measured, types of test items to be framed to measure the ability, arrangement of the test items, selection of type of test, assigning weightage to the items, deciding length of

the test, preparation of directions for administration of the test, the testing material that is to take shape, so on and forth.

4.2 STUDY OF DIFFERENT TESTS OF INTELLIGENCE

Before preparing a design for the present test some of the existing tests, both in foreign countries and in Thailand, were reviewed with a view to selecting the base of the type of items to be included in the present test. The lists of the tests reviewed for the purpose have been given in the previous chapter.

From the review of various tests, it was observed that they contain some of the sub-tests with the ability components. It could conclude ability components and types of item of intelligence tests as follows:

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Ability</th>
<th>Component</th>
<th>Type of Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Verbal Test</td>
<td>Verbal - Comprehension</td>
<td>1. Abilities to select of words, antonyms, synonyms, vocabularies, arranged letters and meaning.</td>
</tr>
<tr>
<td>2</td>
<td>Numerical</td>
<td>Number, numerical reasoning, number facility and solve problems.</td>
<td>2. Abilities to select of number series, arithmetic reasoning and solve problems.</td>
</tr>
<tr>
<td>3</td>
<td>Reasoning</td>
<td>Verbal reasoning</td>
<td>3. Abilities to select of words analogies, words letter matrix, verbal classification, inference and logical selection.</td>
</tr>
</tbody>
</table>
4. Information etc.
- Memory

5. Non-Verbal Test

<table>
<thead>
<tr>
<th>5.</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>- General information i.e. home, community, science, social science, nature and recreation.</td>
<td></td>
</tr>
<tr>
<td>5. Abilities to select to pictures that were required by characteristics, concepts, principles, symbols and idea etc..</td>
<td></td>
</tr>
</tbody>
</table>

6. Figural Reasoning
- Figural analysis, figural series, pattern matrix.

| 6. | Abilities to select to figures or pictures that were required by analysis relationship, involvement and distractor. |

7. Spatial Relations
- Dimension relation of figures or pictures.

| 7. | Abilities to select of figures or pictures that were changed by cutting, adding, decreasing and moving etc. |

8. Picture Assemble etc.
- Conception

| 8. | Abilities to assemble a piece of picture to be the requisite picture. |

From the study of different tests it was observed that different parts test specific function of intelligence and types of items are also various. It was useful for investigator to consider the ability components and types of items to decide the present test.

4.3 DECIDING THE TYPE OF THE PRESENT TEST

After reviewing the tests of intelligence, the investigator decided to construct present test which is a verbal and non-verbal group test of intelligence that includes items measuring comprehension, reasoning,
number, information (cultural-fair) and reasoning (cultural-free). This test are divided into two sections i.e. (1) Section I (Verbal Test) and (2) Section II (Non-verbal Test).

4.3.1 Section I (Verbal Test)

It has three parts i.e. (1) verbal ability part, (2) reasoning ability part and (3) numerical ability part. The concept in verbal test is adopted from test of "Otis-Lennon Mental Ability Test (OLMAT)" by R.T. Lennon, being prepared on the same line. It includes items that measure verbal comprehension, verbal reasoning and numerical reasoning in the test.

The verbal ability part includes the test items which measure comprehension i.e. synonym words, antonym words and arranged letters that students learned in schools. This ability is a kind of general knowledge acquired from learning and around them.

The reasoning ability part includes the items of word-letter matrix, verbal analogies, verbal reasoning, word matching and inference. This test measures understanding, reasoning ability in language which is very important to analyse and solve problems of their life.

The numerical ability part includes the items of number series, arithmetic reasoning and solve problems. It measures ability about number and quantitative aspect that could find the reason from series number and solve arithmetic problems. This part has several arithmetic skills, so that students may know about number from learning.

4.3.2 Section II (Non-Verbal Test)

It has two parts, which include items measuring information ability (cultural-fair) and reasoning ability (cultural-free). The concept in this part was
adopted from Tests of General Ability (TOGA) by J.C. Flanagan, being prepared on the same lines were more critically studied. J.C. Flanagan has included items that measure information ability (cultural) and reasoning ability (non-cultural) in the test of intelligence by giving two reasons, "(1) It appeared that two abilities are dominated in most definitions of general ability, and (2) A review of the literature indicated that these two abilities usually provide the best predictions of school success".  

The information ability part of the tests of intelligence includes the test items from various fields of culture viz. home, community, science, social sciences, nature and recreation. Flanagan states that it tests student's familiarity with the world around him through his experiences in the school, at home and in the community.

The reasoning ability part includes the test items of student's powers of abstract reasoning from figures.

After fixing the ability components of the test to be designed, the next step was to select the type of the test. There are two openings to this problem:

1. To adopt the test of Otis-Lennon Mental Ability Test (OLMAT) and the Test of General Ability (TOGA), and standardize it on the population of Southern part of Thailand, or

2. To adopt the principle of Otis-Lennon Mental Ability Test (OLMAT) and Test of General Ability (TOGA) in toto, and to construct an original test on the same lines.

The most items in OLMAT and TOGA are comprehension and culture fair items, based on knowledge and cultural background of U.S.A. Especially; there are verbal comprehension, verbal reasoning and information,

---

which are different for Thai's students. Moreover, in TOGA's reasoning ability part too, the items are too difficult to be included in the present test. Hence, it was very difficult to adopt the OLMAT and TOGA. But the second idea was worth considering. As there was no test developed for students belonging to age group 14-17 in Thailand, it was decided to construct an original test of intelligence on the same principle of "OLMAT" for Verbal Test and "TOGA" for Non-Verbal Test, and to standardize it on the population of Southern part of Thailand.

The characteristics of the test were designed as under:

1. The test should be a verbal and non-verbal group test.
2. The items of verbal test should be in Thai language, and for non-verbal test it should be pictorial in form.
3. The test has two sections, the first section is verbal test which has three parts i.e. (1) verbal ability part, (2) reasoning ability part, and (3) numerical ability part. The second section is non-verbal test that has two parts i.e. (1) information ability part, and (2) reasoning ability part.
4. Items included in the verbal test should be pertaining to comprehension, verbal reasoning and numerical reasoning, and for non-verbal test should be pertaining to information (cultural-fair) and reasoning (cultural-free).
5. The test should be power cum speed test.

4.4 AGE AND GRADE

After deciding the type of the test, it was essential to decide age range and grade for the standardization for the test. According to Compulsory Education Act, 1960 of Thailand, the lower compulsory age is 6 years. It is compulsory to get the child admitted at the age of 6th years. Moreover, some
children who have completed 5 years are only allowed to admit in primary schools. Thus, if a child enters primary school at the age of 6 years, he will reach Grade X at 15 years and to the class XII at the age of 17 years. But, there might be variations in the age on account of acceleration in years because of ambitious parents. There might be cases of early or late entry in the school and of detention for one or more years in the same classes. Hence, it is obvious that in every class there are children of different age groups. So that students are in Grade X to XII have age between 14-18 years old. Looking to this fact, it was decided to administer the test class-wise and standardize it on the population of students of higher secondary schools classes X to XII.

In Thailand, the stages can safely be recognized as:

(1) Primary school stage (Grades I to VI).
(2) Secondary school stage (Grades VII to IX). and
(3) Higher secondary school stage (Grades X to XII).

For the present investigation, it was decided to construct and standardize Intelligence Test for students belonging to age group 14-17 of higher secondary schools of Southern part of Thailand.

4.5 PROCEDURE

4.5.1 Population & Sample

John W. Best pointed out that “A population is any group of individuals that have one or more characteristics in common that are of interest to the investigator. The population may be all the individual of a particular type or a more restricted part of the group. A sample is a small proportion of a population selected for observation and analysis. By observing the characteristics of the sample, one can make certain inferences about the characteristics of the population from which it is drawn. Contrary to some popular opinion, samples are not selected haphazardly. They are chosen
randomly in a systematic way, so that chance or the operation of probability can be utilized."\(^3\)

The primary purpose of research is to discover principles that have universal application, but to study a whole population in order to arrive at generalizations would be impracticable if not impossible. Some population is so large that their characteristics could not be measured; before the measurement had been completed the population would have changed.

The process of sampling makes it possible to draw valid inferences or generalizations on the basis of careful observation of variables within a relatively small proportion of the population. A measured value base upon sample data is a statistic. A population value inferred from a statistic is parameter.

It is important to note that a random sample is not necessarily an identical representation of the population. Characteristics of successive random samples drawn from the same population may differ to some degree, but it is possible to estimate their variation from population characteristics and from each other. The variation known, as sample error does not suggest that mistake has been made in the process, but that with randomization, certain predictable chance variations are observed.

The present study, the population and sample were students belonging to age group 14-17 in Southern part of Thailand, which were studying in higher secondary schools Grade X to XII in academic year 2001-2002.

4.5.2 Norms

In the process of standardizing test, it is administered to a large, representative sample of the type of subjects. This group known as the standardization sample serves to establish the norms. The norms indicate the average performance and the relative frequency of varying degrees. In the present study the norms would be established as follows:

1) Age Norms
2) Grade Norms
3) Percentile Ranks
4) Deviation IQs.
5) Classification of students according to IQs.

4.5.3 Reliability & Validity

It is very essential to obtain final evidence of the reliability and validity of the test no matter how carefully the test was planned and prepared. Its merits should be established. It is therefore necessary that be performed to check and its results be reported to users of the test to enable them to evaluate better.

1. Reliability

In the present test, investigator will estimate reliability by various methods. They are:

1) Test-Retest Method
   a. Retest Method (Short Interval)
   b. Retest Method (Long Interval)
2) Split- Half Method
3) Method of Rational Equivalence using
   a. K-R 20 Formula
4.5.4 Statistics & Analysis

The data yielded by the test will be analysed according to norms, standardization and hypotheses. The following techniques of analysis of data and statistical calculations were employed.

1) The percentage was used to calculate the number of sample.

2) In order to determine the average scores of student belonging to different groups of sex, age, grade, area, mean (\( \bar{x} \)) and standard deviation (S.D.) were calculated.

3) The Chi-Square (\( \chi^2 \)) was determined for significant of item analysis.

4) The t-test was used to test significant of difference between mean scores of intelligence test to students belonging to different groups of sex and area of schools.
5) ANOVA (F-test) was used to test significant difference between mean scores of intelligence test to students belonging to different groups of age and grade level.

6) The correlation Coefficient (r) was used to test reliability of intelligence test.

7) K-R 20, K-R 21 and Tucker's Formula were used to test reliability of the test.

8) Percentile Rank was used to indicate the percentages of student in the norms group.

4.6 SELECTION OF TEST MATERIAL

To decide the components of intelligence as basis for the selection of different types of items for the test is the crux of the problem. After a critical study and careful observation of the ability components that contribute to measure intelligence, selection of ability components of intelligence and types of items that can best measure the intelligence was to be done. It is advised by most of psychologists to measure only the most important abilities that contribute to general factor ("g"). It is here that several points require due consideration. The first point is how many abilities is to be measure. The second is whether psychologists have an exhaustive list of separate abilities, and if so, does all agree upon it. The third point is whether it is necessary to include maximum number of abilities in the test or to include minimum required abilities of intelligence.

Looking to the existing tests, the minimum number of ability of intelligence components vary from two to ten. Freeman's opining on the point stage, "The new technique is to reduce the number of sub-tests and to
improve them, so that the smaller number has as much predictive value as the large.".4

1) Section I (Verbal Test)

For selection of ability contents in section I (verbal test) the views of R.T. Lennon believes that specific school learning should not be included in the mental ability test because it is the individual’s potential ability to learn. The OLMAT’s items of verbal test were designed to measure intelligence i.e. acquisition of comprehension, vocabulary, number, reasoning, concept and skill from school learning and their experiences. The OLMAT is a group test that included four types of item; they are (1) verbal comprehension which was designed to measure the comprehension that involved synonyms, antonyms and complete sentence. It has weightage of 25-31% of all items. (2) verbal reasoning which was designed to measure vocabulary, reasoning and skill that involved verbal analogy, classification, inference and logic selection. It has weightage of 31-40% of all item’s. (3) Quantitative reasoning which was designed to measure ability of calculation and solving problem that involved number series and arithmetic reasoning. It has weightage of 16-19% of all items. And (4) Figural reasoning, which is designed to measure the reasoning ability that involves figural analogy, figural series and pattern matrix. It has weightage of 19% of all items5. For verbal test in the present test, investigator adopted OLMAT’s ability in three types of item i.e. (1) verbal ability, (2) reasoning ability and (3) numerical ability.


2) **Section II (Non-Verbal Test)**

For the selection of ability components of section II (non-verbal test), the following views of Flanagan\(^6\) were considered: "All tests of intelligence include items which measure general ability developed through the influence of the following factors; (1) Heredity refers to the genetic constitutional difference in general ability which are inherited and affect the individual's performance throughout. (2) Acculturation refers broadly to general (or out of school) learning experiences. This includes learning for which the family, early time environment, and other general cultural factors are largely responsible. and (3) Specific school learning includes the development of natural capacities of the individual through reading and other formal school learning experiences". Flanagan believed that specific school learning should not be included in the tests of general intelligence because they are meant to measure individual's potential ability to learn. So that TOGA included two types of items i.e. (1) The other type of items measures the student's acquisition of information, vocabulary and concepts, which they acquired from home, family or community environment rather from academic knowledge. (2) Reasoning ability, the items designed to measure intelligence with as little influence from acculturation as possible which intended to measure the developing concepts from series of drawings. A series of figures will be relatively independent of both school learned skills and acculturation factors.

So the investigator has decided to follow the principle of Otis-Lennon and Flanagan to measure intelligence and select ability components and types of items as shown in the following Table No.4.1. The content of validity and construct validity were established by constructing reputed psychologists.

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Table 4.1
Ability Components and Type of Items Included
in the Test to Measure each Ability.

<table>
<thead>
<tr>
<th>Test Part</th>
<th>Ability Component</th>
<th>Type of Item</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Verbal Test One</td>
<td>Verbal</td>
<td>1. Selection of word having synonym when words are given.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Selection of word having antonym when words are given.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Ability to spell out the word by arranging the letters as means when the letters are given.</td>
</tr>
<tr>
<td>Two</td>
<td>Reasoning</td>
<td>1. Ability to select an analogous word by comparing the relationship of a given pair and then find the word that relates with given word.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Ability to select the odd man out word when the words are given.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. Ability to summarize given sentence.</td>
</tr>
<tr>
<td>Three</td>
<td>Numerical</td>
<td>1. Ability to select a missing number from numbers series which is given.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Ability to solve mathematical problems.</td>
</tr>
<tr>
<td>2. Non-Verbal Test One</td>
<td>Information</td>
<td>1. Recognition of a pictured object when its name is given.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Recognition of a pictured object when a classifying characteristic is given or implied.</td>
</tr>
</tbody>
</table>

contd.
<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Selection of a pictured object, person or action that represents a given quality or symbol.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Selection of a picture that is an example of given abstract concept.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5. Selection of a pictured object, the use of which involves a given principle or abstract concept.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>6. Selection of a pictured object that illustrates the same implied principle as a given principle.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7. Selection of a picture that depicts an element essential to an idea or social institution.</td>
</tr>
<tr>
<td>Two Reasoning</td>
<td></td>
<td></td>
<td></td>
<td>1. Concepts involving characteristics of Simple lines or figures.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2. Concepts involving simple relations between lines and figures with one distracting factor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3. Concepts involving simple relations between lines and figures with two or more distracting factor.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4. Concepts relating to artistic effects and assembly of lines and figures.</td>
</tr>
</tbody>
</table>
4.7 GUIDING PRINCIPLES FOR PREPARATION OF TEST ITEMS

This test has two sections, as follows:

4.7.1 Section I. (Verbal Test)

Section I of this test is a verbal type, which has three parts and

1.) Verbal Ability Part

(1.) The items should test individual's ability to grasp meanings and
to understand vocabularies, means and underlying principle of
language for synonym, antonym and spelling words.

(2.) The verbal ability items should include simple language,
absorbed from learning in school.

(3.) The items should test ability of meanings, vocabularies,
spelling and summary.

(4.) Items based on Thai culture should be included in the verbal
ability part of test.

(5.) All the items in this part should be of multiple-choice items i.e.
to select any one out of five choices.

2.) Reasoning Ability Part

(1.) The items should test individual's ability to grasp meanings,
and recognize relationships and reasoning principle of
comprehension i.e. analogies, series and logical selection.

(2.) The reasoning ability items should include simple types
of comprehension, absorbed from learning in school.

(3.) The items should test ability to comprehend vocabulary and
then find the word which have relationship.

(4.) The test items should include knowledge and experiences
that received from television, news, Internet, radio, periodical
or the other.
(5.) Items based on Thai culture should be included in this part of the test.

(6.) All the items in this part should be of multiple-choice items i.e. to select any one out of five choices.

3.) Numerical Ability Part

(1.) The items should test individual’s ability to grasp calculation, and numerical relationship and underlying principle of arithmetic i.e. number series and mathematic reasoning.

(2.) The numerical ability items should include simple types of number, absorbed from learning in school.

(3.) The items should test ability to systematize and relate, number series and calculation.

(4.) All the items in this part should be of multiple-choice items i.e. to select any one out of five choices.

4.7.2 Section II (Non-Verbal Test)

Section II of this test is a pictorial and figure type. It has two parts and guiding principle for preparation of test items are as follows:

1.) Information Ability Part

(1.) The items should test individual’s ability to grasp meanings, and to recognize relationships and underlying principles of natural and social environment.

(2.) The information items should include simple factual types of information, absorbed from surroundings.

(3.) The items should test ability to systematize and relate new information, recently acquired to knowledge that the testee already possesses.
(4.) The test items should include as far as possible, general (out of school) experiences.

(5.) The information items should be based on various environments like home, community, nature and recreation, science and social science.

(6.) Items based on Thai culture should be included in the information part of the test.

(7.) All the items in this part should be multiple-choice items, pictorial in form, involving recognition or selection of a picture out of a row of five pictures in an item.

(8.) Clarity in language of the problem to be read before the class should be carefully considered.

2.) Reasoning Ability Part

(1.) The items included should measure the testee’s ability to develop concepts from series of line drawings.

(2.) The items should include series of figures that will be relatively independent of school learned skills and acculturation factors.

(3.) The items should include student’s ability to understand relationships from line drawings and figures.

(4.) All the items should be multiple-choice items. In each item, four figures should be constructed on the basis of a specific rule and the remaining fifth figure should be different, to which rule should not apply.

3.) For both the Sections

(1.) The items should be constructed keeping in mind the different types shown in the Table No.4.1
(2.) Span of experience of students and level of different class should be kept in mind while framing the items.

(3.) While framing multiple-choice test items, care should be taken to employ random occurrence of correct responds in the items.

4.8 ASSIGNING WEIGHTAGE

The next essential point that was to be considered, was regarding weightage to be assigned to: (1) each part of the test and (2) each type of the items in every part of test.

For that, the opinions were taken from various expert teachers of psychology, experts in test construction and psychologists. They opined that equal weightage to both the sections i.e. Section I (verbal test) & Section II (non-verbal test) should be given. The weightage given to each of the sections and parts is shown in Table No.4.2.

Table 4.2
Weightage Given by Experts to Different Sections and Ability Components

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Section</th>
<th>Part</th>
<th>Weightage in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Section I (Verbal Test)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td>Verbal Ability</td>
<td>11 %</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Reasoning Ability</td>
<td>25 %</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Numerical Ability</td>
<td>14 %</td>
</tr>
<tr>
<td></td>
<td><strong>Section II (Non-Verbal Test)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td></td>
<td>Information Ability</td>
<td>25 %</td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td>Reasoning Ability</td>
<td>25 %</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td></td>
<td>100 %</td>
</tr>
</tbody>
</table>
They opined that looking to the age and grade level of the students to be tested, there should be variation in weightage to be given to each type of items in every part of each section of the test.

The following Tables No.4.3 to 4.7 show the weightage determined by various expert consultants.

**Table 4.3**

*Weightage Given by Experts to Different Types of Items of Verbal Ability Part in Section I (Verbal Test)*

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Type of Verbal Ability Item</th>
<th>Weightage in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Selection of word having synonym when words are given.</td>
<td>33 %</td>
</tr>
<tr>
<td>2.</td>
<td>Selection of word having antonym when words are given.</td>
<td>40 %</td>
</tr>
<tr>
<td>3.</td>
<td>Ability to spell words when the letters are given.</td>
<td>27 %</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>

**Table 4.4**

*Weightage Given by Experts to Different Types of Items of Reasoning Ability- Part in Section I (Verbal Test)*

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Type of Reasoning Ability Item</th>
<th>Weightage in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ability to select an analogous word by comparing the relationship of a given pair and then find the word that relates with given word.</td>
<td>45 %</td>
</tr>
<tr>
<td>2.</td>
<td>Ability to select the odd man out word when the words are given</td>
<td>42 %</td>
</tr>
<tr>
<td>3.</td>
<td>Ability to summarize given sentence.</td>
<td>13 %</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>
### Table 4.5
Weightage Given by Experts to Different Types of Items of Numerical Ability - Part in Section I (Verbal Test)

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Type of Numerical Ability Item</th>
<th>Weightage in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ability to select a missing number from number series which is given</td>
<td>65 %</td>
</tr>
<tr>
<td>2.</td>
<td>Ability to solve mathematical problem that is given.</td>
<td>35 %</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>

### Table 4.6
Weightage Given by Experts to Different Types of Items of Information Ability Part in Section II (Non-Verbal Test)

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Type of Information Ability Item</th>
<th>Weightage in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Ability to recognize a pictured object when its name is given</td>
<td>4 %</td>
</tr>
<tr>
<td>2.</td>
<td>Ability to recognize a pictured object when a classifying characteristic is given or implied.</td>
<td>34 %</td>
</tr>
<tr>
<td>3.</td>
<td>Ability to select a pictured object, person, action or interaction situation that represents a given quality or symbol</td>
<td>14 %</td>
</tr>
<tr>
<td>4.</td>
<td>Ability to select a picture that is an example of a given abstract concept.</td>
<td>4 %</td>
</tr>
<tr>
<td>5.</td>
<td>Ability to select a pictured object the use of which involves a given principle or abstract concept.</td>
<td>14 %</td>
</tr>
<tr>
<td>6.</td>
<td>Ability to select a pictured object that illustrates the same principle implied as a given principle.</td>
<td>20 %</td>
</tr>
<tr>
<td>7.</td>
<td>Ability to select a picture that depicts an element essential to an idea or social instruction.</td>
<td>10 %</td>
</tr>
<tr>
<td></td>
<td><strong>Total</strong></td>
<td><strong>100 %</strong></td>
</tr>
</tbody>
</table>
Table 4.7
Weightage Given by Experts to Different Types of Items of Reasoning Ability- Part in Section II (Non-Verbal Test)

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Type of Reasoning Ability Item</th>
<th>Weightage in Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Concepts involving characteristics of simple lines and figures</td>
<td>12%</td>
</tr>
<tr>
<td>2.</td>
<td>Concepts involving simple relations between lines and figures with one distracting factor.</td>
<td>46%</td>
</tr>
<tr>
<td>3.</td>
<td>Concepts involving simple relations between lines and figures with two or more distracting factors.</td>
<td>40%</td>
</tr>
<tr>
<td>4.</td>
<td>Concepts relating to artistic effects and assembly of lines and figures.</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

4.9 DESCRIPTION OF TEST PARTS AND TYPES

In the present test, the Intelligence Test consists of mainly two sections and five parts viz.,

1.) Section I (Verbal Test), it has three parts. There are:

   (1) Verbal Ability Part.
   (2) Reasoning Ability Part. and
   (3) Numerical Ability Part.

2.) Section II (Non-verbal Test), it has two parts. There are:

   (1) Information Ability Part. and
   (2) Reasoning Ability Part.

4.9.1 Section I (Verbal Test)

(1) Verbal Ability Part

The verbal ability part of the test consists of items measuring ability to grasp meaning of words, vocabulary which underlying principles of
verbal structure. It provides an index of the student's knowledge and understanding from his learning.

The verbal ability items are classified into three types.

The examples of the three types of items are as follows:

**Type 1**: Selection of word having synonym when the words are given.

**Problem**: Find the synonym of “line”

a. small  
b. long  
c. column  
d. lean  
e. straight

**Type 2**: Selection of word having antonym when the words are given.

**Problem**: Find the antonym of “black”

a. white  
b. purple  
c. green  
d. pink  
e. yellow

**Type 3**: To spell out the word by arranging the letters as meanings when the letters are given.

**Problem**: If you arrange the letters "BARBIT" you would have the name of a:

a. ocean  
b. country  
c. bird
The reasoning ability part of the test consists of items measuring ability to grasp meanings, recognize relationship and summarize the statement and underlying principles of comprehension. It provides an index of the student's intellectual verbal comprehension, his concept and analyze by reasonable considering. It also measures his knowledge and understanding of verbal comprehension that was learnt.

The reasoning ability items are classified into three types.

The examples of the three types of items are as follows:

Type 1: Selection of analogous word by comparing the relationship of a given pair, and then find the word that relates with given word.

**Problem**: Find the one that makes the best comparison.

Bird : Net $\rightarrow$ Man : ?

- a. room
- b. house
- c. bed
- d. car
- e. office

Type 2: To classify or group the words by using concept formation and comparison that it match or unmatched.

**Problem**: Find the one that does not characteristic with other.

d. city
e. animal
a. stoop
b. turn
c. incline
d. relate
e. glance

Type 3: Summarize the given sentence by reasoning and logic.

Problem: Jack is taller than Peter, and Bill is shorter than Jack.

Which of the following statements would be most accurate?

a. Bill is taller than Peter.
b. Bill is shorter than Peter.
c. Bill is as short as Peter.
d. Can't summarise.
e. It is impossible to tell whether Bill or Peter is taller.

(3.) Numerical Ability Part

The numerical ability part of the test consists of items measuring ability to grasp number, quantitative analysis and relationship underlying mathematical principles. In number series and arithmetic reasoning, it provides index of the student's intellectual knowledge and understanding of mathematic that he learns in school.

The numerical ability items are classified into two types.

The examples of the two types of items are as follows:

Type 1: Selection of an analogous number, which miss from the given set of a number.

Problem: Find the missing number.

2 4 6 8 ?
Type 2: Calculation to find out the result of the given mathematical problem.

**Problem:** John who is 12 years old, is 3 times as old as his brother. How old will John be when he is twice as old as his brother?

- a. 15
- b. 16
- c. 18
- d. 20
- e. 21

The numerical items emphasize on process, principles, interpretation, reasoning, comparing, creating concept for mathematic, proving and evaluation. Thus the student's language comprehension should be of high standard. Otherwise the probability for them to answer the problem correctly is little, if they don't understand the problem.

**4.9.2 Section II (Non-verbal Test)**

This section is a pictorial items type, which has two parts:

1. information ability part and (2) reasoning ability part.

(1.) **The Information Part**

The information ability part of the test consist of items measuring ability to grasp meaning, recognize relationships and understand basic
concepts underlying principles of natural and social environment. It provides an index of the student's intellectual curiosity and inquisitiveness by sampling his understanding of general phenomena and the sampling factual types or information he has acquired from his surrounding environment. It also measures his ability to systematize and relate new information he has required to knowledge with that he already possesses.

The information ability items are classified into seven types.

The examples of the seven types of items are as follows:

**Type 1:** Recognition of a pictured object when its name is given.

**Problem:** Find the one that is national animal of Thailand

A B C D E

**Type 2:** Recognition of a pictured object when a classifying characteristic is given or implied such as function, source, form, appearance etc.

**Problem:** Find the picture that shows checkup action.

a b c d e
Type 3: Select a pictured object, person, action or interaction situation that represents a given quality or symbol.

Problem: Find the picture that shows the symbol of ruling.

![Options A, B, C, D, E]

Type 4: Selection of a picture that is an example of a given abstract concept.

Problem: Find the one in which consumption of power is less.

![Options A, B, C, D, E]

Type 5: Selection of a pictured object, the use of which involves a given principles or concept.

Problem: Find the one that shows the principle of gravity.

![Options A, B, C, D, E]
Type 6: Selection of a pictured object that illustrates the same implied principle as a given principle.

Problem: Find the one that shows capillary action.

Type 7: Selection of a picture that depicts an element essential to an idea or institution.

Problem: Find the one that is most important for the man be good.

The information ability items have also been classified under five broad areas relating to content, which include home, community, nature and recreation, science and social science.

(2.) Reasoning Ability Part

The reasoning ability part consists of items testing the ability to understand relationships and to form concepts. In each item, four figures are constructed on the basis of some specific rule. The remaining figure is different to which the rule does not apply. These items test the ability to derive concepts of various types, which involve a wide range of difficulty. The concepts the students required to understand in these items may be classified into four principal types:
Type 1: Concepts involving characteristics of simple lines or figures.

This include concepts of curvilinearity, number of sides and elements, shading, shape, area, length, type of lines, size of angles.

In this example, the concept of size of angles is crucial.

```
A
B
C
D
E
```

Type 2: Concept involving simple relations between lines and figures with one distracting factor. This include concepts of shape, parallelness, similarity, perpendicularity, symmetry, position, orientation, interaction etc.

In the following example the concept of shape, similarity and orientation is involved. The smaller and bigger figures are the same in all but one of the figure is not.

```
a
b
c
d
e
```

Type 3: Concepts involving simple relations between lines and figures with two or more distracting factors.

In the following example, the position of the figure is crucial. The direction and repetition of big and small cycles are contracted the line.
both, but one figure is contracted one cycle.

Type 4: Concepts relating to artistic effects and assembly of lines and figures. This include concepts of shading, shape perspective etc.

In the example, shading and shapes are distractors. Count of shading is crucial.

4.10 JUDGES AGREEMENT

After selected test material and test items, the test was constructed. For the step of judges agreement of the preparation from the test, the list of judges consists of members from different walks of life like, educational officer, senior teachers, schools administer, psychologists, psychiatrists and sociologist. The judges were requested to tick mark (/) against the appropriate column whether they “agree” or “uncertain” or “disagree” with is problem and answer, keeping in mind the statement of problem and answer should measure the intelligence of students belonging to age group 14-17. Beside this, the judges agreement was carried out under the objectives which is given below:

1.) To see whether the statements of the test can be measured the intelligence of students.
2.) To see whether there was the consistency between statement and the intelligence of students.

3.) To see whether the instruction of the test was self-explanatory.

4.) To see whether the illustration in the test was perfect.

In obtaining responses from the judges, the “agree” response was given +1 mark, the “uncertain” response was given 0 mark and the ‘disagree” response was given −1 mark.

In all 80 judges were selected and booklets were sent to them. Out of 80 booklets, 71 booklets were received back. Out of 71 booklets, only 65 booklets were found carefully filled in. hence, the investigator eliminated 6 booklets which were filled in carefully and retained only 65 booklets for further analysis. The list of judges whose booklets were accepted is present in Table No.4.8.

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>List of Judges</th>
<th>Number of Accepted Booklets</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Educational Officer</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Senior Teacher</td>
<td>11</td>
</tr>
<tr>
<td>3</td>
<td>School Administrator</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>Psychiatrist</td>
<td>10</td>
</tr>
<tr>
<td>5</td>
<td>Sociologists</td>
<td>6</td>
</tr>
<tr>
<td>6</td>
<td>Psychologist</td>
<td>16</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>65</td>
</tr>
</tbody>
</table>

From Table No.4.8, it can be seen that there are 65 judges who response the agreement over each item of the test to measure the abilities of
students of Grade X-XII of higher secondary schools of age group 14-17, of Southern part of Thailand.

Finding the general degree of agreement among the judges over each problem of item, the index of consistency (IOC) was applied. The method of index consistency (IOC) was calculated under the following formula which suggested by Phonrat Thaveerat.

\[
IOC = \frac{\sum R}{N}
\]

Whereas \( IOC \) = The consistency between the problems of item and ability of student.
\( \sum R \) = The total scores of the agreement of judges in each item.
\( N \) = The total number of judges.

After the IOC method was applied to the response of the judges agreement, the obtained scores were compared with the criteria. According to Phongrat Thaveerat the item, which could be accepted to be the included in try-out form of the test should obtained IOC value greater than .05.

According to the foregoing calculation with IOC, the investigator go further for the preparation of try-out form of the test to measure intelligence of students Grade X-XII belong to age group 14-17 in Southern part of Thailand.

According to the judges agreement, the obtained IOC value in each item indicated the accepted, rejected and some item was modified.

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8 Ibid., 117.
absolutely by judge's opinions and suggestions. In this way, out of 200 items, 175 items were selected to be concluded for try-out form of the test.

4.11 DIRECTION FOR TEST ADMINISTRATION

Along with the selection of test material, test items and judges' agreement, special attention was given for preparing directions for the administration of the test to maintain its objectivity.

This being a Verbal and Non-Verbal Test, directions to testers for administering the test were prepared. The directions consist of general instructions and specific instructions for the teachers. In general instructions, methods of using test booklets and answer-sheets, method of reading specific instructions, technique of introducing practice items, etc., have been clearly explained.

In Verbal Test general instructions were given to which testers read clearly and loudly in the classroom while testees have to answer in the answer-sheet. So, that the problems would be checked clearly to correct. While in Non-Verbal Test specific instructions were given, the preliminary work of filling up personal particulars of the testees, the method of reading problem-statements of information ability part, explanation of the reasoning items, assigning time to administer the test part, etc., have been clearly stated. It is planned to prepare a manual of directions along with the standardized test for public use.

4.12 TESTING MATERIAL

The Intelligence Tests are to be constructed on design discussed in this chapter and to be standardized for measuring individual differences in intelligence of students belonging to age group 14-17 were studying in Grade X to XII of the higher secondary schools of Southern part of Thailand.
Each student to be tested will require one test booklet and one answer-sheet. The test administrator will need directions for giving the tests, scoring key and ready recknor for obtaining IQs.

Thus, the following testing material is planned to develop along with the construction and standardization of the test.

1. Test Booklets
2. Answer-Sheets
3. Scoring Key
   1) Directions for administering the test.
   2) Percentile Ranks & Norms.
   3) Deviation of IQs.