"The basic reason for planning and organizing is to facilitate the research. Any research project is made up of specifics. Specific hypotheses referring to the variables, conditions, factors, or subjects of the project are required. We may speak in terms of generalities in regard to a research project, but to complete the project, the generalities must be applied or translated into the specifics. These specifics will vary with the nature and complexity of the research study, but it is attention to the details of the specifics that brings a research project to a successful conclusion. Organization will avoid haphazard activities as the specifics are put together to produce the final product".

- WILLIAM WIERSMA
CONTENTS

4.0 Introduction
4.1 Specific Objectives
4.2 Planning for Test Construction
  4.2.1 Test Format
  4.2.2 Tryout
    4.2.2.1 Time
    4.2.2.2 Instruction
    4.2.2.3 Selection of the Sample
    4.2.2.4 Final Form of the Test
  4.2.3 Norms Established
  4.2.4 Test Reliability and Validity
4.3 Methodology of Study
  4.3.1 Tools Used
  4.3.2 Sample Selected
  4.3.3 Variables Under Study
  4.3.4 Hypotheses Built
  4.3.5 Statistical Technique
4.4 Resume
References
4.0 Introduction

No work can successfully be completed without being well planned even in our day-to-day life. Therefore, planning is a necessary aspect to arrive at the satisfactory result in any type of research work. What is considered well planned has to be systematic, scientific, economic, logical and orderly one. Hence the meticulous care has been taken in the planning and carrying out of various procedures for the construction of test in education and related studies.

In short, planning is a mapping strategy like the architect's plan. As McGrath\(^1\) puts it:

"An architect does his designing before construction, activities get underway, so should the researcher do his designing before he gets his project underway".

Here the reviews made in Chapter III give the insight to the investigator for his necessary planning and procedure in the study entitled:

"An investigation into the Creative Thinking Ability of Primary School Children".
For the purpose of the study, it was essential to develop a new Creative Ability Test for the primary school children, because there is no such test available in Gujarati for lower grades. Thus the present research study consists of the two parts as shown below:

Part I The Constructions of Creative Ability Test for Primary School Children

Part II The Studies of Creative Ability of the Primary School Children in relation to certain variables, viz: Stream K.G.-Non K.G., Birth Order, Grade, Sex.

The study in both the parts was carried on keeping in view the following specific objectives.

4.1 Specific Objectives

The specific objectives are as under:

1. To construct C.A.T. for the elementary school children.

2. To provide a creative ability test for measuring the creative ability of the primary school children.
To survey the creative inherit in the elementary school children.

To study the trends of creativity of the school children, studying in grade Std. IIInd to Vth.

To study the nature of creativity of the school children under study.

To find an easier way of scoring the C.A.T. in comparison to the previous scoring method.

To study the creative ability of the school children in context with past learning i.e. students coming from pre-primary schools.

To study the creativity of the school children in relation to their birth order.

To study whether there is any sex difference with regard to creative ability.

To fulfill the above mentioned objectives, the investigator thought of planning for the study both the parts separately. First, the planning for the test construction of measuring the creativity of primary school children was taken at hand. It is mentioned in the next caption.
4.2 Planning for Test Construction

The test needs much care, right from the planning to the work of complete standardisation for highly reliable and valid tool. Regarding the plan and procedure the following process was adopted. Before preparing a design of the test construction, some of the existing tests both in foreign countries and India were reviewed with a view to selecting base for the type of items to be included in the present test. The list of the test reviewed for the purpose has been given in the previous chapter. The review of the existing test was helpful to the investigator in selecting the format i.e. the test items. The investigator concentrated on the principles and procedure of Kogan and Wallach test of creativity.

4.2.1 Test Format

Kogan-Wallach has standardized his creative ability test in America. Mr. Parmesh and Husan adopted this type of test in India. The investigator preferred this format due to the following points:

1. The Torrance Test of Creativity was found to be lengthy one and was difficult to score.
2. Passi's Test consists of six sub-tests in which verbal and non-verbal sub-tests have different weightages.

3. Mehdi's Test of creativity has two formats. One is verbal and the other is non-verbal. Their weightages are equal. Though equal in weightage both these tests are time consuming so far as the scoring is concerned.

4. All the above tests do not test numerical ability.

Hence the investigator has adopted the Kogan-Wallach Creativity Ability Test including new sub-test pertaining to the numerical aspect. Thus, the test consists of three sub-tests.

(1) Verbal Creativity Test
(2) Figural Creativity Test
(3) Numerical Creativity Test

This format of this test was developed by J.Z. Patel, Reader, P.G. Department of Education, Sardar Patel University, Vallabh Vidyanagar in his research project work for the students of grade V to X and it was accepted thoroughly. Even though the essential steps of standardization process should be applied in every new test.
4.2.2 **Tryout**

The tryout process of the test items was divided into three phases viz.,

(a) Manuscript Tryout
(b) Pilot Tryout
(c) Final Form of the Test

4.2.2.(a) **Manuscript Tryout**

For tryout of a manuscript, some test items were selected from Kogan and Wallach test and some were constructed. When this was over necessary items were selected for the pilot tryout.

Nunnally\(^2\) has suggested to construct items three times more than required for the preliminary tryout in the field of mental ability test. Mehrotra\(^3\) has recommended to construct double the test items than required for the tryout of mental ability tests. In view of the above recommendation of Mehrotra, it was thought to include double the items for pilot tryout. Because this test is of divergent thinking type and there is no right or wrong response and hence it would be not impossible but would be difficult to score it. Hence for the manuscript prepared for tryout on a small group of children only 20 items were included so
that the final form of the test could include 10 items. The part-wise numbers of items to be included are shown in the following table.

Table 4.1

PART WISE NUMBER OF ITEMS IN MANUSCRIPT AND FINAL FORM

<table>
<thead>
<tr>
<th>Parts</th>
<th>Type of Test</th>
<th>Sub-parts</th>
<th>No. of Items</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Manuscripts</td>
<td>Final</td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Verbal</td>
<td>Instances</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Alternate uses</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Figural</td>
<td>Line meaning</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Pattern meaning</td>
<td>4</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Numerical</td>
<td>Number</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Sums of number</td>
<td>2</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Total</strong></td>
<td><strong>20</strong></td>
<td><strong>10</strong></td>
</tr>
</tbody>
</table>

The manuscript containing 20 items in all was given to a very group of 15 pupils for tryout. The main objective of this tryout was to confirm the applicability of the manuscript. Hence no statistical calculations were involved at that level. The specific objectives of this tryout were listed as under:

1. To see whether the pupils follow the instructions.
2. To confirm whether the pupils follow the language of the test items.

3. To check whether items work well with the students.

4. To find out, if there is any ambiguity in the items.

5. To determine the time limit for each of the item.

6. To fix-up the necessary time intervals for relaxation.

7. To find out the items which were responded in varied ways by the respondents.

8. To find out the items which is found to be effective in getting the uncommon responses.

On the basis of observations the investigator selected some items. The following criteria was kept in mind while selecting the items.

1. The difficulty level of the items could be judged from the number of responses or ideas given by the subject.

2. The number of categories of the ideas should be sufficient to measure the flexibility in scoring.

3. Goodness of creative items could be determined by the unique responses given by the subjects.

Thus the investigator arrived at the stage of pilot form of creative ability test.
4.2.2.(b) Pilot Tryout Work

From the observations of the varied responses obtained during the manuscript tryout, the investigator selected the necessary and sufficient number of items for each part of the test. On discussing the efficacy of the test items with the guide and experts the numbers of items included in the pilot form were as shown below.

Table 4.2

<table>
<thead>
<tr>
<th>Part Description</th>
<th>Sub-parts</th>
<th>Number of Item in a Pilot Form</th>
<th>Final Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Verbal</td>
<td>Instances</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Alternate uses</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>II Figural</td>
<td>Line meaning</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Pattern meaning</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>III Numerical</td>
<td>Number</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Sum</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>16</td>
<td>10</td>
</tr>
</tbody>
</table>

Generally, test constructor has to select the $1\frac{1}{2}$ times the number of items to be included in final form of the test. So the investigator kept 6 items in part I, 6 items in part II and 4 items in part III.
As the pilot tryout was at final stage of tryout, it required consciousness on the part test administrator. Main objective of this tryout was to analyse and to select the items for the final testing. Besides these main objectives, some specific objectives kept in mind during the pilot tryout as under:

1. Instructions for each of the parts were to be finalised.

2. To check the reactions of pupils to the Creative Ability Test, which was prepared after modifications and necessary corrections.

3. The utility of the revised answer booklet was to be checked up and finalised.

4. To get the general idea about the time required was finalised during the pre-pilot tryout.

5. To select the items for the final testing according to the response analysis.

During the course of application of the test construction, the following factors had to be reckoned with (i) Time limit, (ii) Instruction for the test construction, (iii) Selection of the sample and (iv) Mental readiness of the pupils.
4.2.2.1 Time Limit

This factor should be discussed in two ways i.e. time limit per item and time limit for the whole test. This test contains 16 items in all. Hence part one of the test was put on pilot testing. It contains 6 items of verbal form. The probable time limit for the general instruction was given 15 minutes and therefore the time for items to be responded was 30 minutes for 6 items (each would require 5 minutes). The second and the third parts were given together, the time limit given for these parts was 45 minutes as each of them included 10 items in all.

4.2.2.2 Instructions for the Test

Instructions used for the pilot testing would be the same as those for the final testing. From the observations of the pre-pilot tryout, some instructions where modifications were required, were prepared with the necessary modifications.

4.2.2.3 Selection of the Sample

In the pilot tryout, size of the sample would be
larger one than the size of the manuscript tryout sample. Moreover, it should include the students studying in II grade to V grade.

The sample would most probably be composed of 60 students as shown below:

Table 4.3

<table>
<thead>
<tr>
<th>Std.</th>
<th>Boys</th>
<th>Girls</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>II</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>III</td>
<td>8</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>IV</td>
<td>8</td>
<td>7</td>
<td>15</td>
</tr>
<tr>
<td>V</td>
<td>10</td>
<td>10</td>
<td>20</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
<td>29</td>
<td>60</td>
</tr>
</tbody>
</table>

The students included in this study possessed above normal intelligence and school performance.

4.2.2.4 Final Form of the Test

The final form of the test is a product of the process of all the tryouts of test items and the directions on an anvil. It gives clear idea to the investigator about the administering the test systematically and psychologically i.e. rapporting with the subjects under testing.
The final form of the test contains 0 items as shown in table nos. 4.1, 4.2.

In the beginning of each part, one sample example of how to respond the test items was given as a practice item (See Appendix-A).

The items in each part would be coined orderly and logically in a sequential way. The test booklet would be printed in such a way that the respondents could write the responses in the space given below under each item.

The investigator minutely would observe the ideas of students during the pilot testing and would note the accountable points observed by the researcher to measure the components of creativity as $N =$ Number of ideas (Fluency), $C =$ Category of ideas (Flexibility) and $U =$ Uniqueness (Originality). The total of all these scores given the creativity score of the students on the creativity test developed in the study.

4.2.3 Norms Established

The raw score as it is, cannot be interpreted, though it is a fundamental piece of information. The raw score does not give any idea about the individual. To interpret the meaning of the raw score, some point of
reference is a norm. Describing it, Anastasi\textsuperscript{4} writes: "As its name implies, a norm is the normal or average performance".

For inter-individual comparison, the following norms have been established for the present test.

(1) Grade Norms
(2) Standardisation Score
(3) Percentile Norms
(4) Grade Norms

4.2.4 Test Reliability and Validity

A research is always dependent upon measurement. Two important constructs in measurement are reliability and validity. The construct of any psychological tool can never be considered as complete unless it is tested for its reliability and validity.

According to Rammer and Gage\textsuperscript{5}:

"Reliability is the consistency with which a test yields the same results in measuring whatever it does measure".

Reliability refers to the extent to which a measuring device is consistent in measuring whatever it measures.
According to Anastasi, "The validity of the test concerns what the test measures and how well it does so".

Thus validity is the extent to which an instrument measures what it is supposed to measure.

These qualities are essentially important in educational research, because most of the measurements attempted in this area are obtained indirectly. It is essential, therefore, for the investigator to assess the reliability and validity of the creativity scale. So that it would measure precisely and dependably what it is intended to measure.

(a) Reliability

For determining the reliability of the test of creativity, the following two methods have been applied with sub-scales and total attitude score:

(1) Test-retest Reliability
(2) Split-half Reliability

(b) Validity

The validity of the scale has been assessed by finding the correlation between the total scale score and score
in each sub-scale using the product moment method.

Secondly, inter-sub-scale correlations have been computed by the product moment method determining the validity scale.

4.3 **Methodology of the Study**

Under this section investigator aims to study the Creative Ability of the primary school children in relation to the certain variables included in the study. This section consists of five sub-sections as shown below:

1. Tools used.
2. Sample Selected.
3. Variables therein.
4. Hypothesis Built
5. Statistical Techniques adopted

4.3.1 **Tools Used**

As mentioned in the previous captions, the investigator attempted to develop a tool to measure the creative ability of the students of the primary schools, for the measurement of intelligence of primary school children, the standardised test of General Ability Test for II to IV and V to VII were used.
The description and psychometric test used for the present study are shown below:

4.3.1.1 General Ability Test

For measuring the I.Q. of the primary school children, General Ability Test was used. One test is for Std. II to IV which is developed by R.M. Patel and the other one is for Std. V to VII is developed by J.Z. Patel. They are limited for Gujarati speaking children only. Each is divided into two parts:

Part I

Part-I tests the student's familiarity with the world around him through his experiences in the home, in the school and in the community. They are test-questions in various fields of Indian culture, Science, Social Science, Community affairs and the Arts. The test questions relate to the student's general knowledge of his surroundings—gained through his observations, his hobbies, radio, films, field-trips and conversations with other people.

Part II

Part-II avoids any cultural content; it presents
geometric drawings designed to test the student's power of abstract reasoning. This part of the test presents an equal challenge to all students regardless of their cultural backgrounds.

The number of right answers for both parts of the test are added together to get raw score to obtain the student's I.Q. and PR scores.

The General Ability Test for students are designed to be given to many pupils at one time. However, the test administrator should plan to have another teacher's help if there are more than 20 pupils to be tested at a time.

Each pupil to be tested will need one booklet, one answer-sheet and a pen or a pencil. The direction of the test is of 45 minutes.

Each part contains 25 to 38 items, and each item contains 5 alternatives from which student is expected to respond properly.

The GAT booklet, an answer-sheet and a question paper are to be given. The paper should be checked by the readymade answer key.
It is a simple procedure to obtain I.Q. and PR for the General Ability Test.

I.Q. and PR can be obtained with the help of the Age Group and Raw Score of the testee. First find out the Age of the testee in terms of years and months. Then enumerate the correct items on the General Ability Test with the help of the scoring key. The total of all the correct items is the Raw-score of the testee.

Now refer the table No. 1 of JGAT Norms and look down the column of raw score until you come to the number of the raw score. Directly across from the number of the raw-score are I.Q. and PR for the age group of the testee.

(b) Creative Ability Test

The CAT has been constructed and standardized by the investigator, for the children of class II to V. The detailed description of the process of test development, establishments of various norms and the reliability and validity estimated, have been given in the entire chapter V to follow.

4.3.2 Sample Selected

Sample is a process of selection of a subject. It is impossible and unnecessary to obtain data from the entire
population. The purpose of sampling is to study a small group that is assumed to be representative of the large group from which it is drawn.

According to Borg⁷:

"The factor that must often differentiate between good and poor research is not the funds available, the size of the sample or the sophistication of the statistics, it is care and thought that goes into the research plan".

The main work ahead was to administer tests to all types of studies in different primary schools. To have as big a sample as one can possibly have, is desirable for better norms. But it is not necessary that the representative sample should be too large. The real worth of the sample lies not in its size but in its accuracy and representativeness.

According to Lindquist⁸:

"It is a mistake to judge adequacy of a sample solely in terms of the number of pupils tested. However the school as well as the pupils must be taken into account".
According to Traver\textsuperscript{9}: 

"A representative sampling is one in which the characteristics of the sample are similar in important respects to the characteristics of the population sampled".

Hence, representative sampling should be carefully determined. There are different methods of sampling.

According to Garrett\textsuperscript{10}; they are:

1. Random Sampling 
2. Stratified or quota sampling. 
3. Incidental sampling, and 
4. Purposive sampling.

According to Rummel\textsuperscript{11}; they are:

1. Random Sampling 
2. Stratified Sampling. 
3. Area Sampling. 
4. Systematic Sampling 
5. Purposive Sampling and 
6. Quota Sampling

For the present test, stratified or quota sampling method has been adopted.
Stratified Sampling

According to Garrett:

"Stratified or quota, sampling (also called controlled sampling) is a technique designed to ensure representation and avoid biases by use of a modified random sampling method".

According to Guilford:

"It is a procedure that is introduced in sampling to help to prevent biases and also to assure a more representative sample known as stratification".

It is used whenever it is necessary to use different sampling methods with different strata of the population, or when there are systematically different characteristics for sub-groups within the population.

On the basis of stratified sampling it was decided to administer final tests practically in all the regions of Anand Taluka. This stratification of the total population is relatively homogeneous for commonly spoken Gujarati language. For selecting the sample for each level of these type, the investigator had to select such a sample, which would satisfy the following characteristics.
(a) In general, I.Q. of the students should be distributed normally.

(b) Writing ability of the students should be good.

(c) The school should have coeducational system so that sex-difference in creativity could be studied.

(d) The school should be known to the experimenter for easy approach and full co-operation of the staff and students as well.

(e) The school situated in either urban or rural area should have Gujarati medium.

(f) For the testing, Age limit is 7+.

Looking to the above requirements, the investigator selected the following schools which satisfy all the requisite conditions:

A. Prathmik Shala, Ahima.
B. Prathmik Shala, Bharoda.
C. Kumar Shala, Ode.
D. Ambalal Bal Shala, Anand - D.N. Complex.

After the selection of the school, the investigator consulted the principal and the concerned teacher of the school. Grade II to V were selected because:
(a) A child passes through the chronological age of 7 to 11 years at this stage.

(b) A student studying in Std. I has no writing ability, henceforth the investigator had the eliminated Grade I.

(c) To study the trends of creativity of the lower level of school.

(d) To complete a test battery of creative ability for K.G. to B.G.

4.3.3 Variables Under Study

The various variables and their levels at which they operate in this research study are tabulated in table 4.3.4.
Table 4.4
VARIABLES AND THEIR LEVELS

<table>
<thead>
<tr>
<th>Phase of Study</th>
<th>Sr. No.</th>
<th>Name of Variables</th>
<th>Nature of Variables</th>
<th>No. of levels</th>
<th>Name of Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>1</td>
<td>Grade</td>
<td>Independent</td>
<td>4</td>
<td>III, III, IV &amp; V Std.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Sex</td>
<td>Independent</td>
<td>2</td>
<td>Boys and Girls</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>B.O.</td>
<td>Independent</td>
<td>3</td>
<td>One, two and three+</td>
</tr>
<tr>
<td>II</td>
<td>1</td>
<td>Grade</td>
<td>Independent</td>
<td>4</td>
<td>II, III, IV &amp; V Std.</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Stream</td>
<td>Independent</td>
<td>2</td>
<td>K.G. &amp; Non K.G.</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>I.Q.</td>
<td>Independent</td>
<td>2</td>
<td>High and Low</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>Creativity</td>
<td>Dependent</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

The independent variables - Grade, Sex and Birth-order are considered in the first phase study, while Grade, Stream and I.Q. are independent variables are considered in second phase study.

The common independent variables are incorporated in both the phases of the study viz ... Grade

The facility of K.G. may or may not be possible in the education system so it is invariably a variable which
may affect the creativity of a child. The second variable I.Q. also affect creativity directly or indirectly. The family size is also an independent variable which more or less affects the creativity of a child.

4.3.4 Hypotheses Built

The hypotheses have been formulated according to the dependent variable creativity. These hypotheses are of the null form which are of a general nature related to the effect of interaction between various independent variables. The following null hypotheses are mentioned below phase-wise.

**Phase I (Grade x Stream x I.Q.)**

*Ho 1* There is no significant difference in the creativity of the students studying in grade II, III, IV and V.

*Ho 2* There is no significant difference in creativity between the students getting training and those not getting it in pre-primary schools (i.e. K.G.).

*Ho 3* There is no significant difference in creativity of the school children possessing above average and below average I.Q.
Ho 4 There is no interaction effect of grade and stream on the creativity of the students.

Ho 5 There is no interaction effect of grade and I.Q. on the creativity of the students.

Ho 6 There is no interaction effect of stream and I.Q. on creativity of the students.

Ho 7 There is no interaction effect of grade stream and I.Q. on the creativity of the students.

Phase II (Grade x Sex x B.O.)

In this phase grade x Sex x B.O. are the three independent variables which were considered at 4, 2 and 3 levels respectively. Thus for 4x2x3 factorial design is evolved with the following null hypotheses.

Ho 8 There is no significant grade difference in the creativity of the students studying in grade II to V.

Ho 9 There is no sex difference in the creativity of the students.

Ho 10 There is no significant difference in creativity of school children when the birth order was considered at higher level.
Ho 11 There is no interaction effect between Grade and Sex on creativity of the students.

Ho 12 There is no interaction effect on grade and B.O. on the creativity of the students.

Ho 13 There is no interaction effect of Sex and B.O. on the creativity of the students.

Ho 14 There is no interaction effect of grade, Sex and B.O. on the creativity of the students.

4.3.5 Statistical Techniques

In this study the factorial design is to be used to test the null hypothesis, formulated in the foregoing caption. Some factorial designs related to the influence of two or more independent variables are usually called factors, on a dependent variable. Here dependent variable is the creativity score measured on creativity ability test (CAT) developed by the investigator. While, independent variables are grade, stream, sex and birth order, usually called factors. The number of ways in which a factor is varied, is called the number of levels of the factors. A factor that is varied in two ways would be called to have two levels. In this study there are two phases of factorial design. In the first phase study, the grade has four levels: The stream has two levels.
students, those getting II to V training in K.G. and those not getting training in K.G. I.Q. has two levels: high and low. Thus grade x stream x I.Q. factorial design would have three factors with four levels of first factor, two levels of second factor and two levels of the third factor. Thus 4x2x2 factorial design could be evolved.

In the second phase study, grade has four levels, sex has two levels, male and female, and birth order has three levels: small, medium and big family. Thus grade x sex x birth order factorial design would have three factors with four levels of first factor, two levels of second factor and three levels in third factor. Thus 4x2x3 factorial design could be evolved.

In this study, factorial design with a randomized group is used to apply the analysis of variance ANOVA techniques suggested by Wersmeir. ANOVA is a technique for partitioning the variation in the observed data into two parts: arrangeable to different cases or combinations or combinations of causes. In ANOVA, the sample data can be made to yield to independent estimated population variance (i) between group variance and (ii) within group variance or error variance. The partitioning of variance in a three way factorial design as shown in the figure 4.1 below.
Before applying the ANOVA the investigator had to go through the test of homogeneity of variance by a simple approximate test known as $F_{\text{max}}$ test. 4x2x2 factorial design and 4x2x3 design had been evolved to test the null hypothesis. The summary of three way ANOVA had been given in the following tabular form.

**First Phase: ANOVA X 4x2x2 Factorial**  
\[ N = 112 \]  
\[ n = 7 \]

Table 4.5

<table>
<thead>
<tr>
<th>Score</th>
<th>df</th>
<th>SS</th>
<th>MSS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stream B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>I.Q. C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A x B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A x C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B x C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A B C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Second Phase**: ANOVA: 4x2x3 factorial

<table>
<thead>
<tr>
<th>Score</th>
<th>df</th>
<th>SS</th>
<th>MSS</th>
<th>F</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Birth-order C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A x B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A x C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B x C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A B C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The level of significance is 0.05 and 0.01 levels of confidence has been accepted in the present study.

In addition the usual testing of hypotheses the investigator was also interested in finding out the functional relationship. For this trend test had been attempted across grade and birth order. Lastly the computation of components of variance had been done to find the percentage of contributions in dependent variable to draw a pai diagram.
4.4 Resume

This chapter gives a Gestalt view of studying the problem systematically and scientifically. It leads the investigator to undergo the correct direction:

1. to accept the correct procedure of standardization of the test construction;
2. to build the right type of hypotheses;
3. to have proper relation of sample;
4. to use appropriate statistical techniques.

The next chapter deals with development of the creative test for this study.

References


12. Ibid., p. 206.