CHAPTER 4

CONSTRUCTION AND STANDARDISATION OF THE TOOL

'The behaviour of people in organizations is still the behaviour of individuals, but it has different set of determinants than behaviour outside organizational roles. Modifications in organizational behaviour must be brought about in different manner.'

- Danies Katz, and Robert L.Kaban
  In Rogus and Shoemaker,
  Communication of Innovation,
  London, Collier Macmillan, 1971, p.298

IV

CONSTRUCTION AND STANDARDIZATION OF THE TOOL (QUESTIONNAIRE)

4.1 Introduction

The main objective of the present study is to measure Innovative Proneness of the teachers of secondary and higher secondary schools for which the tool is not available. The investigator, therefore, decided to construct and standardize the tool for this purpose. This chapter embodies the complete account of the procedure of construction and standardization of the present tool.

The present tool will be the first of its sort in Gujarat. India in general and Gujarat in particular needs many such questionnaires and this is an attempt in that direction. Here is an attempt to provide a tool to measure innovative proneness of the teachers of Secondary and Higher Secondary Schools (of Gujarat State).

Construction and standardization of a questionnaire requires a good deal of pre-planning and pre-thinking.

Lindquist (1955) says, 'Planning is an essential item in all stages of a test construction'. Questionnaire is constructed for administrating it to a population or a section, and hence planning plays a dominant role. He further tells :

> ' Scale planning encompasses all the many operations of an outline or a table specifying the contents or operations to be covered by the test, but it must also involve careful attention to item difficulty, to types of items, to directions to the examiners, to arrange for tryout, to problems of test reproduction, to provision for expert review, to the provision of adequate equipment and facilities'.

4.2 The Present Plan of Work

In the light of the foregoing comments, the following steps were planned in the construction and standardization of a questionnaire in the present study :

The steps in the present work are :

1. Initially, the dimensions or the aspects of 'teacher innovativeness' to be incorporated in the tools were focussed on the basis of the previous research studies and the literature available in the field. The experts were also consulted in this connection.
2. The components of the Scales of Innovative Proneness were thought of according to the sections based on the main aspects of 'teacher innovativeness'.

3. A large number of items belonging to the area of Innovative Proneness of teachers of secondary and higher secondary schools were formulated in view of the component emvisaged.
4. These items before assembling in a Scale were edited ; the items having ambiguous meaning were eliminated.
5. The scale was administered to a sample of population for which the scale was to be standardized.
6. Scoring of each item was calculated.
7. This scale was again administered to a second group.
8. The validity, the reliability and norms which are the requisits of standardization were found out.
9. The final form of a scale was administered to the entire sample of the population.
10. The data was processed for Factor Analysis.

4.3 Scale Construction and Development of Innovative Proneness Scales

As stated in the previous chapter the instrumentation developed by the investigator seeks to identify and quantify four aspects of teachers' innovativeness as given below :

(i) Teachers' expressed attitudes towards specific innovations, having regard to the potential cumulative effect of attitudes arisng from past experience with innovations ;

(ii) Teachers' general attitudes to change or their change - related values ;

(iii) Teachers' preferred behaviours in relation to their perception of attributes of innovations; and

(iv) Teachers' preferred behaviour in relation to their perception of the setting and circumstances in which innovations are introduced.

In view of the above mentioned aspects of general change-related values and innovations, specific attitudes, and behaviours, the investigator constructed the four instruments as given hereunder :

1. Section I : The Inventory of Attitudes to Innovation (I.A.I.)
2. Section II : The Situational Characteristics Scale and the Innovation Characteristics Scale (S.C.S. and I.C.S.).
3. Section III: The Change-Related Values Questionnaire (C.R.V.Q.)
4. Section IV : Biographical Data

(a) Description of Each Section Scales

Section I : The Inventory of Attitudes to Innovation (I.A.I.)

Rationale and Construction : The Inventory of Attitudes to Innovation is a closed form - Likert type summated rating scale

designed to measure teachers' pre-disposition to adopt educational innovations. The inventory consists of thirty items each describing a specific innovation. The respondent is asked to consider each innovation independently, as if it were proposed for adoption in the schools. As criterion for item selection, innovations were categorized by type (e.g. innovations in content, teaching method, school organization, pupil grouping) and complexity (e.g. innovations ranging from the relatively simple adoption of teaching aids to innovations requiring changes in teachers value orientations).

Section II : Teachers' Perceptions of Situational Innovation Characteristics

Rationale and Construction : Research on the determinants and correlates of teacher 'innovativeness' suggests the 'antecedent condition', to use Rogers' term (1962), for the successful adoption of innovations include three major sets of variables. (i) Situational Variables (ii) Characteristics of Innovation, (iii) Personal Variables.

To explore the hypotheses that teacher 'innovativeness' would be significantly influenced by these variables the investigator constructed three scales : (i) The Situational Characteristics Scale (S.C.S.), and (ii) The Innovation

Characteristics Scale (I.C.S.), (iii) The personal variables. Biographical Data and attitude scores for all respondents were collected by means of separate questionnaires described in Section IV below.

Several studies have investigated relationships between teacher innovativeness and situational variables such as 'organizational climate' (Halpin and Croft, 1962), 'Organizational Character' (Minar, 1965), 'Organizational Health'(Miles, 1969), group comformity (Warren, 1948; Blan and Scatt, 1962; Pellagrin, 1966), 'Supportive Climate (Fox and Lippitt,1964; Watson, 1967; Sieber, 1968; Bhola, 1965), 'Peer Community Support' (Parker, 1970), 'Perception of Administrative Support', (Gross et al., 1971). The importance of a 'Supportive Climate' for successful adaption is stressed in study by Shipman (1972).

In a major review of adaption studies in education, anthropology and sociology Rogers (1962) identifies five characteristics of an innovation which may exert a significant influence on adoption - compatibility, complexity, relative advantage, communicability and divisibility. The importance of type and complexity of innovation is argued in a study of Macdonald and Rudduck (1971).

Gouldner (1957) hypotheses a distinction between the latent organizational identities of 'Cosmopolitans' and

'locals' as determinants of organizational behaviour. Eichaltz and Rogers (1969) suggest that innovation varies directly with cosmopoliteness, They also argue that the degree of risk involved in adapting an innovation may significantly influence teachers' innovativeness.

Section III : The Change-related Values Questionnaire

Rationale and Construction : The relationship between teacher innovativeness and their general change-related attitudea and values has been the subject of several studies, e.g., Kerlinger and Kaya (1959), Rolerach (1960), Eicholtz and Rogers (1964), Childs (1965), Evans (1968), Hilfiker (1968), Miller (1968), Forman (1971). The author has developed the 'Changes - Related values Questionnaire to assess some of the relationships hypothesized in these studies.

Section IV : Biographical Data

On a separate questionnaire respondents were requested to provide information on the variables like - Age, Sex, Teaching experience, Academic qualification, Professional qualification, Mobility, Inservice education, Reading habits and Professional satisfaction.

(b) Selection of the Components of the Three Scales of Innovative Proneness of Teacher

A questionnaire in its preliminary stage requires a large number of statements regarding the object. After studying the various definitions of innovative proneness as given by the experts, and the heads and teachers were interviewed, asking them their views and opinions regarding innovative proneness and frequency was prepared with the help of the respected guide, the investigator arrived at seven main components of Section I. The Inventory of attitude to Innovation, eight main components of Section II - The Situational and Innovative Characteristics Scales and six main components of Section III. The change related values questionnaire. This twenty one main components of the above three scales are given here as under :

Section I : The Inventory of Attitude to Innovation

Types of Innovation hypothesised :

1. Innovations in 'Individualization'.
2. Innovations in 'Curriculum organization'.
3. Innovations in 'Teaching-learning'.
4. Innovations in the use of 'Teaching Resources'.
5. Innovations in 'Internal school organization'.
6. Innovations oriented towards 'Staff Development'.
7. Innovations in 'School Community Relationship'.

Section II : The Situational Characteristics Scale and Innovation Characteristics Scale

8. Teachers' perceptions of the degree and kind of administrative support provided for innovation in the school (Administrative support).

9. Teachers' perceptions of the change related norms and values of their colleagues (Staff Norms).

10. Teachers' perceptions of the change-related norms and values of the educational system (System Norms).

11. Complexity - Teachers' perception of the complexity of the innovation.

12. Compatibility - Teachers' perception of the compatibility of the innovations.

13. Risk Taking - Teachers' perception of degree of risk involved in adoption (Riskness).

14. Localiteness - Perceived 'Local' orientation of the innovation.

15. Cosmopoliteness - Perceived 'Cosmopoliteness' of the innovation.

Section III : The Change-related Values Questionnaire

16. Traditionalism

17. Progressivism

18. Dogmatism

19. Venturesomeness

20. Conservatism

21. Change proneness

4.4 Collection of the Items

There are two ways of collection of items for a Questionnaire :

1. To translate the questionnaire available and standardized in foreign countries.
2. To construct a questionnaire independently for the specific area.

The translated items imply the following drawbacks :

1. The environment of foreign countries and Indian are different basically.
2. The customs, social taboos and the like make the material of one country unsuitable for the other.
3. Idioms and proverbs of one country cannot be actually translated. Translation would be at time mean such a drastic change that the norms of the original tests would not be applicable.

In view of the non-availability of a suitable tool for the Indian conditions, and because of the drawbacks prevailing in the foreign country's tool as enumerated above, the investigator decided to prepare a separate and independent tool on innovative proneness of teachers, based on the Indian condition.

The construction of the items is based on three sources, viz., (a) the existing inventories, (b) the descriptions of

these areas in the sociological and the psychological literature and (c) the discussions with persons who had studied these areas for the same purpose.

There can be no set rules for writing items. Thorndike (1955) puts it beautifully :

> 'Writing a good test is an art. It is little like writing a good sonnet or little like baking a good cake. The operation is not quite free and fanciful as writing a sonnet. It is not quite standardized as baking the cake'.

It lies somewhere in between, so discussions of the items writing is somewhere in between exhortation to the past to go out and express himself and the precise recepies of a good cook book. Lindquist (1935) says,

> 'Item writing is essentially creative. Each item as it is being written presents new problems and new opportunities. Just as there can be no set formula for producing a good story or a good painting so there can be no set of rules that guarantee the production of good test items'.

The items should serve the purpose of testing. There should not be boring to teachers. McCall (1949) suggests, 'Tests should be enjoyable to both pupils and teachers'.

(d) General Principles of Wording Items

The investigator observed the following general principles towards the framing of the better questionnaire.

1. Statements that refer to past should be avoided.
2. Statements that are factual or capable of being interpreted factual should be avoided.
3. Statements that may be interpreted in more than one way should be avoided.
4. Statements that are irrelevant to the psychological subjects under consideration should be avoided.
5. Statements that are likely to be endorsed by almost everyone or by almost no one should be avoided.
6. Statements that are believed to cover the entire range of the attitude scale of interest should be selected.
7. The language of the statements should be simple, clear, direct and easy to grasp.
8. Statements should be short, rarely exceeding twenty words.
9. Each statement should contain only one complete thought.
10. Statements containing universals such as all , always , none and never often introduce ambiguity and hence they should be avoided.
11. Words such as only, just, merely and others of a similar nature should be used with proper care and moderation in writing statements.
12. Wherever possible, statements should be in the form of simple sentences rather than in the form of compound or complex sentence.

13. The use of words that may not be understood by those who are to be given the complete scale, should be avoided.

14. The use of double negative should be avoided.

Keeping in view all these twentyone main components of the above three scales, the investigator prepare a list of items under each scale for the purpose of the study. These items varied in their degree of agreement - strongly agree, agree, tend to agree, tend to disagree, disagree, strongly disagree. The weightage was given to each item 5, 4, 3, 2, 1 and 0 respectively. Inversely keyed items were scored, 0, 1, 2, 3, 4 and 5.

Item scores for each of the seven components of the I.A.S., The S.C. and I.C. scales and the C.V.Q. were summed to yield a subscale total score. For the components of section I, 50 items, for Section II, 100 items and for Section III, 100 items were prepared showing various degree of agreement to disagreement. Bearing in mind the above general principles for writing the items, investigator prepared a list of 250 items for preparing the scale of innovative proneness of teachers of secondary and higher secondary schools.

All the items were carefully worded into simple language. They were edited and scrutinized again and again with the help of the respected guide. Items were revised in the light of the comments.

Lindquist (1955) expresses his views regarding the number of the items for tryout. He says, 'The number of items should be considerably larger than the number needed for the finished one'.

(e) Check-up of the Language of Items

Thorndike (1954) states, 'It is anxiousness of writing that the author of statement is not best qualified to judge the clarity of the statement - he cannot appreciate the difficulties that other will have with his ideas'.

After constructing the items for the questionnaire the investigator sought cooperation of language experts and experienced persons in the field of education. All the items were checked separately by the experts and some of their suggestions were carried out so that teachers may not find difficulty in understanding the language of the items. Thus, the items were made more practical.

(f) Compilation of the Items

Lindquist (1955) says,

> ' Once the individual items have been constructed, the problem remains of selecting from among those that survived the review process and tryout those which are to constitute the test, and of arranging the selected items into an appropriate order and avoiding undesirable overlapping among the items.'

From these items some were rejected on the basis of ambiguity and similarity. The items, which were slightly different in construction but giving the same meaning were rejected. While preparing the above list, the investigator has rewritten some of the items in proper language. Thus, a list of 225 items was compiled. The Table 4.1 sets of number of items included against each component of the three sections of the scale.

Table :4.1: The Number of Original Items in Each Component of the Three Sections of the Scales

No.of components	Number of Original Items in each Component of		
	Section I	Section II	Section III
1	7	10	15
2	5	12	15
3	7	9	15
4	6	10	15
5	7	10	15
6	7	10	15
7	6	12	-
8	-	11	-
Total No.of Items	45 +	90 +	90 = 225

Thus, 225 items prepared under twenty one components and it is now ready for giving it to judge for review of the items.

(g) The Language of the Scale

The scale is prepared in Gujarati for application in Secondary and Higher Secondary schools of Gujarat.

(h) Form and Contents of the Scale

Some have argued that use of several different kinds of items, lend interest to a test through its variety. Lindquist (1955) states :

> 'However, the interest value of a test depends primarily upon the quality of the items, rather than upon their external form, and if the items eventhough all of one form, there will usually be no problem of maintaining interest'.

The form of the item chosen was in the statement form and item consisted of positive as well as negative statements.

4.5 Review of the Item

Lindquist (1955) says :

> 'Test items should be reviewed before tryout on any sizable number of subjects, from three point of view (1) the accuracy and appropriateness of their subject-matter contents, (2) their technical merits apart from content, and (3) their editorial quality. Following the above views the investigator decided to give a list of 225 items to a group of experts for editing'.

(a) Selecting the Judges

The collection of items, thus prepared was given to large group of judges. Fifteen judges were selected for this purpose. The judges were instructed asfollows :

- This questionnaire contains 225 items regarding innovative proneness of teachers. You are requested to go through each item carefully and classify them into the various categories relating to innovative proneness, ranging from very high to very low'.

Out of fifteen judges, ten judges responded. The following table gives the composition of ten judges who responded :

Table :4.2: The Composition of Judges

Profession	Number of Judges
Professors	1
Readers	1
Lecturers	2
Educationists	2
Experienced Teachers	2
Principals of the Schools	2
Total	10

(b) Analysis of Judges' Ratings

After collection of questionnaire from judges, the investigator found out the number of times an item was given each scale position. This gave the investigator a simple frequency distribution and then a cumulative frequency distribution was prepared. From this frequency distribution the median values were determined. Also Q_1 and Q_3 positions i.e. 25th and 75th percentile points were obtained. These percentiles are useful in determining the ambiguity or otherwise of the items. This is found by following formula :

$$Q = \frac{Q_3 - Q_1}{2}$$

Thurstone and Chane (1929) regarded -

> 'Median value of the distribution for each statement was taken as scale value. The interquartile range Q was calculated in order to have an idea of the spread of the distribution about the scale value. This Q value is regarded as a major of ambiguity of a statement, and thus, it gave an objective criteria for eliminating unsuitable statement. These serve as the criteria for the scale.'

(c) Selecting the Items for Pre-Tryout

After a careful scrutiny, 25 items were rejected. These items having high Q values indicated that the items

do not carry uniform meaning to all the judges. Such items were eliminated as they indicated relative disagreement among the judges. The selected (200) two hundred items had a small Q values.

Table :4.3: The Number of Items in Each Component of the Three Sections of the Scales in the First Tryout with Number of Items Retained

No.of Section	No.of Compo-nents	No.of Original Items in each component	No.of detailed Items in each component	Retained Items for Next Tryout
I	1	7	1	6
	2	5	1	4
	3	5	1	4
	4	6	0	0
	5	7	0	7
	6	7	0	7
	7	6	2	4
Total	7	45	5	40
II	1	16	2	14
	2	12	2	10
	3	9	1	8
	4	10	1	9
	5	10	1	9
	6	10	1	9
	7	12	1	11
	8	11	1	10
Total	8	90	10	80
III	1	15	2	13
	2	15	1	14
	3	15	2	13
	4	15	1	14
	5	15	2	13
	6	15	2	13
Total	6	90	10	80
Grand Total	21	225	25	200

In this manner, the first form of the inventory was made ready for pre-tryout.

4.6 Pre-Tryout of the Questionnaire

After items have been written, criticized by experts and revised on the basis of their criticisms, it must ordinarily be tried out experimentally on the sample of teachers. Purpose of the pre-tryout was that once items were constructed and reviewed, the Questionnaire constructor was anxious to know how the items would work. The questionnaire was, therefore, pre-tried. Lindquist (1955) defines the pre-pilot test as, 'The preliminary administration of the tentative tryout units to a small sample for purpose of discovering gross deficiencies, but with no intention of analysing pre-tryout data for individual items'.

In pre-tryout stage omissions, ambiguities of inadequacies in the items may be discovered.

(a) Objectives of the Pre-tryout

The main objectives of the pre-tryout questionnaire were as follows :

1. To find out gross deficiencies in the items such as to correct answer, ambiguous words etc.
2. To find out the difficulties of the teachers in items.

3. To determine the time limit for the questionnaire.
4. To study the items for analysis.
5. To provide data needed to determine how many items should constitute the finished scale.
6. To determine the intercorrelations among the items in order to avoid overlap in item selection and to know how best to organize the item into sub-components.

(b) Procedure for the Pre-Tryout

The questionnaire of 200 items were duplicated for 50 teachers. No time limit was imposed. There are inherent difficulties in the test measuring innovative proneness by way of lack of clarity in the area to be measured. Clear definition of this is a first requisite, before any attempt is made to measure.

(c) Administering the Questionnaire

The questionnaire of 200 items was given to the 50 teachers of 5 schools - Secondary and Higher Secondary Schools of Gujarat for pre-tryout. Teachers were asked to return the questionnaire to the investigator on completion of their work. The following table shows the details of the sample for administering the questionnaire.

Table :4.4: The Sample for Administering the Questionnaire for Pre-tryout

Sr.No.	Name of the School	No. of Teachers
1.	Jivan Bharati Vidyalaya, Karelibag, Baroda	10
2.	New Era Girls High School, Baroda	10
3.	Vakal High School, Mobha Road	10
4.	Dayaram High School, Dabhoi	10
5.	Sardar Patel Vidyalaya, Vasad.	10
	Total	50

(d) Item Analysis

After administering the questionnaire there is some need for determining the value of each item for making the questionnaire constructor know the relative value of each item, he could select only the best for inclusion in the final form of the questionnaire. One of the main objectives of this tryout was to study the item for analysis. Item analysis serves many useful purposes in the technique of tool construction. The information obtained from the procedure of item analysis may be tested on the following lines :

1. It supplies information concerning the item as a whole.

2. It gives a measure of the correlation between the item and criterion.

3. It supplies measure of the internal consistency of the questionnaire.

Kelley has shown that the most accurate determination of item validation or internal consistency can be obtained by comparing approximately the upper and lower 27 percent of the total group. Micheels (1950) has expressed the same opinion.

Each item is now subjected to some form of item analysis. The investigator selected the top and bottom 27 percent of the subjects in terms of total scores on the items. The top group is called a 'high' group and the bottom group is called a 'low' group, in terms of total scores. For each item a frequency distribution is obtained for the high and low groups. Then the responses categories for all the items are dichotomized. The entire procedure is summarized in Table 4.5 below :

Table :4.5: Schematic Representation for Dichotomizing Response Categories

Responses Categories	High Group	Low Group	Total
27% High Group (Top)	a	b	(a + B)
27% Low Group (Bottom)	c	d	(c + d)
Total	a + c	b + d	

(e) Finding the Discriminating Power of the Statements

Many ingenious statistical procedure have been devised to provide discrimination indices. Among statistics proposed for expressing item discrimination power in the form of relationship, the biserial 'r', the tetrachoric 'r' and phi-coefficient have been suggested. The method used in the present work phi-coefficient for item discriminating. It is used because of its simplicity. Calculation of the phi-coefficient 'r' can be expressed in terms of the rotation of the table above.

$$\text{Thus, } r\,\phi = \frac{AD - BC}{\sqrt{(A+B)\,(C+D)\,(B+D)\,(A+C)}}$$

Phi is most useful in item analysis to know the item - item correlation. The phi values of 200 items of 27 percent lower and upper group were .16 to .82. The investigator selected those items with highest phi-values from .48 to .82.

After the analysis of 200 items, 50 items were to be rejected on basis of low phi-coefficient values. The following table shows the number of items in each component in the pre-tryout with number of items retained.

Table :4.6: The Number of Items in Each Component for Pre-Tryout with Number of Items Retained

No. of Section	No.of Components	No.of Original items in each component	No.of deleted items in each component	Retained items for next tryout
I	1	6	1	5
	2	4	1	3
	3	6	1	5
	4	6	2	4
	5	7	2	5
	6	7	2	5
	7	4	1	3
Total	7	40	10	30
II	1	14	2	12
	2	10	2	8
	3	8	2	6
	4	9	3	6
	5	9	3	6
	6	9	3	6
	7	11	3	8
	8	10	2	8
Total	8	80	20	60
III	1	13	3	10
	2	14	4	10
	3	13	3	10
	4	14	4	10
	5	13	3	10
	6	13	3	10
Total	6	78	20	60
Grand Total	21	200	50	150

Out of 200 items only 150 items were found valid, showing high phi-values from .48 to .82 and, therefore, they were retained for final form of the questionnaire. The number of items that should be included in the final form of the questionnaire is, and idealistic standpoint, determined by the statistical characteristics of the item, and amount of time like to be available or convenient for the administration of the questionnaire.

4.7 Tryout of the Questionnaire

Lindquist (1955) says,

> 'Once the gross deficiencies in the tryout forms have been eliminated, perhaps on the basis of a pre-tryout, it becomes necessary to obtain accurate information concerning the performance of each item in a sample of teachers similar to those with whom the final form of the test is to be used'.

Constructing Questionnaire items on the basis of pre-tryout work is not a sufficient and efficient procedure for a good questionnaire. It needs to be standardized, if it is to be a really good, useful, valid and reliable questionnaire to be widely used. This standardization procedure takes into account a number of further steps besides the pre-tryout. These steps are given by all authors of questionnaire construction include selecting adequate sample for pilot study, administering the pre-tryout form of

the questionnaire, item analysis and item selection for the final form of the questionnaire on the basis of difficulty and value and discrimination power and finally testing the validity and reliability of the questionnaire.

The main purpose for the final administration of the questionnaire was to provide data necessary for standardization of the tool, i.e. for determining the validity and the reliability of the tool. As mentioned above, the pre-tryout was carried out to study how the questionnaire worked. To make the questionnaire more efficient and valid, it was thought proper to administer the second tryout of the questionnaire.

Lindquist (1955) supports more tryouts,

> 'More than two tryouts may sometime be deemed advisable, particularly if the questionnaires are to be used to make important decisions about the examinees and if the time and resources, that the final form of the test will be highly efficient as well as valid.

(a) The Objectives of the Tryout

1. To identify weak and defective items.
2. To find out the validity and reliability of the questionnaire.
3. To establish the norms.

(b) Administering the Questionnaire

As the result of the second tryout would determine the quality and the nature of the items with respect to the population, the sample used for tryout testing was selected so as to resemble the sample of the population. To facilitate the calculation in the tryout, the questionnaire was administered to a sample of 50 teachers. For the present sample, 50 teachers were picked up from five secondary and Higher Secondary Schools of Gujarat.

Table :4.7: The Sample for Administering the Questionnaire for Tryout

Sr. No.	Name of the School	No. of Teachers
1.	Tulsidas Ranchhoddas Patel Vidyalaya, Sardarnagar, Baroda.	10
2.	R.B.Ranchhodlal Chhotalal Girls' High School, Ahmedabad.	10
3.	Shri Sarvajanik High School, Waghodia, Dist. Baroda.	10
4.	K.K.Parikh and Mehta R.P. Multipurpose High School, Amreli.	10
5.	Shri G.R.Vidyamandir, Satem, Ta.Navsari.	10
	Total ..	50

The Table 4.7 above gives the names of the schools and the number of teachers where the questionnaire was administered for tryout. From the score of this tryout the investigator

tried to work on the validity and reliability of the questionnaire.

4.8 Validity, Reliability and Establishing Norms

(a) Validity of the Present Questionnaire

The validity of the present questionnaire has been studied in number of ways.

1. Content Validity
2. Rating of the teachers with the ratings of the principals or heads or deans.
3. Item analysis by Phi-coefficient formula.

(1) Content Validity :

All questionnaire items have relied principally on the definitions of 'Innovative Proneness' given by experts. Again, the principals and teachers were interviewed and finally arrived at 21 components.

Anastasi (1958) said,

> 'This type of validation is based upon the original selection of items to be included in the test. The preparation of test items is preceded by a thorough and systematic examination of relevant course syllabi and textbooks, as well as by consultation with subject matter experts. On the basis of the information thus gathered, scale items are drawn up.

(2) Ratings of the Teachers with the Ratings of the Principals or Heads or Deans:

The validity of the questionnaire was further tested by correlating scoring of teachers with principal estimates of their innovative proneness into five points scale, viz.,

1 VH = Very High
2 H = High
3 A = Average
4 L = Low
5 VL = Very low

For testing the validity of the questionnaire the investigator selected six schools from Gujarat. The investigator discussed with the principals of the selected schools and requested to spare 6 teachers, two each with high innovative proneness, average proneness and low proneness. The questionnaire containing 150 items was distributed to these teachers for giving their responses. The investigator collected responses from 36 teachers from 6 selected schools and requested the principals to give their opinion for each teacher relating his innovative proneness with respect to the components.

Studying the responses of the selected teachers the positive statements were assigned values as 5, 4, 3, 2, 1, 0 and the negative statements the values assigned were 0, 1, 2, 3, 4, 5

and 0. Thus, the total value scores of each teacher were further subdivided components. Correlation was determined between the principal's score and the teachers score.

It was seen that the product moment coefficient correlation between the two sets of scores were .86, meaning a fairly good coefficient of correlation showing that questionnaire agreed with principal's estimates.

(3) Item Analysis :

Item validation was also done through Phi-coefficient formula as discussed above. It showed the relation of items with each other. So there was no need for cross validation. These proved that the questionnaire was valid.

(b) The Reliability of the Present Questionnaire

It was decided to check the reliability of the present questionnaire by the following methods :

(1) The Test-Retest Method

(2) The Split-Half Method

(1) Reliability by Test-Retest Method :

The investigator employed the Test-Retest Method for determining the reliability of the present scale. In the present work 100 teachers of Secondary and Higher

Secondary Schools of Gujarat were administered the questionnaire on 15 January 1978 and the same group of teachers were administered on 12th February 1978 that is after 27 days of interval. The scores of the subjects at both the administrations were correlated. The correlation between the first the second sets of scores give an estimate of the reliability coefficient. The mean score of the first administration was found to be high as compared to the mean score on the second administration. The correlation between the first and the second set of scores was found by the product-moment method.

$$r = \frac{\frac{\Sigma x'y'}{N} - C_x C_y}{\sigma'_x \sigma'_y}$$

The Test-Retest correlations for total scores and for factor scores are listed in Table 4.8 on the next page.

In Table 4.8, Test-Retest correlations for both factors in I Section and total score is shown. It shows that the factor correlations are predominantly above .73 level in Sections II and III and above .6 in Section I and for the Total scores are above .80. With the above high coefficient of reliability the investigator could say that the present scale is satisfactory.

Table :4.8: Test-Retest Correlation for Twentyone Components of Innovative Proneness of Teachers

No. of Section	No.of Items	Factor No.	Name of the Factor	Correlation
I	5	1	Individualisation	.63
	3	2	Curriculum Organisation	.64
	5	3	Teaching-Learning Process	.69
	4	4	Teaching Resources	.91
	5	5	Internal School Organisation	.66
	5	6	Staff Development	.66
	3	7	School Community Relationship	.62
Total Score	30	7	The Inventory of attitudes to Innovation	.84
II	12	1	Administrative Support	.92
	8	2	Staff Norms	.98
	6	3	System Norms	.86
	6	4	Complexity	.84
	6	5	Compatibility	.79
	6	6	Riskness	.90
	8	7	Localiteness	.83
	8	8	Cosmopoliteness	.81
Total Score	60	8	The Situational and Innovation Characteristics Scale	.77
III	10	1	Traditionalism	.92
	10	2	Progressivism	.96
	10	3	Dogmatism	.81
	10	4	Venturesomeness	.87
	10	5	Conservatism	.93
	10	6	Change Proneness	.73
Total Score	60	6	The Change-Related Values Questionnaire	.85
Grand Total	150	21		.86

Kelley suggests,

> 'A test with a reliability as low as 0.5 is useful for determining the status of a group in some subjects whereas reliability of more than 0.9 is useful for differentiating the status of an individual in a group.'

The reliability of the present questionnaire is no where less than 0.73 in Section II and III, and .6 in Section I. Therefore, it is concluded that the scale is sufficiently reliable.

of the Questionnaire

(2) Reliability by the Split-Half Method :

According to Garrett (1958), 'The Split-Half Method is generally regarded as the best of the methods for determining test reliability'.

A sample of fifty teachers of secondary and higher secondary schools were administered for determining the reliability values for the scale. Scores on the odd items of the scale were correlated with the even items of the same. In this method, the investigator divided the items into two equivalent parts and the correlation between the two parts showed the index of reliability. So from the split-half test reliability, the self correlation of the whole test was found out by the Spearman Brown formula :

$$r_{11} = \frac{2r_{\frac{1}{2}\frac{1}{11}}}{1+r_{\frac{1}{2}\frac{1}{11}}}$$

where, r_{11} = Reliability coefficient of the whole test

$r_{\frac{1}{2}\frac{1}{11}}$ = Reliability coefficient of the half test

The table given below shows the reliability coefficient of the Section I, Section II and Section III of the whole test by Spearman Brown formula.

Table :4.9: Reliability Coefficient of Each Section by Split-Half Method

No. of Section	No. of Items	No. of Components	Reliability Coefficient
I	30	7	0.91
II	60	8	0.90
III	60	6	0.67
Total	150	21	0.79

The reliability was found out by Split-Half Method and it was highly correlated 0.91, 0.90 and 0.67 respectively.

(c) Norms

The tool is proved valid and reliable. The investigator would like to make it standardized.

For standardization of the inventory for innovative Proneness scale for teachers, reliability and validity were already worked out and have been reported earlier. Norms in terms of percentiles have also been worked out with respect to each component of the three sections of the scale. The result in the form of percentile scores have been given in the Tables 4.10 to 4.12 on the succeeding pages.

Table :4.10: Percentile Points of the Components of Section I - The Inventory of Attitudes to Innovation

Percentile Points	Individualization	Curriculum Organization	Teaching-Learning Process	Teaching Resources	Internal School Organization	Staff Development	School Community
90	25.00	15.00	25.00	20.00	25.00	25.00	15.00
80	24.00	15.00	24.00	19.00	23.00	23.00	14.00
70	23.00	14.00	23.00	18.00	21.00	22.00	14.00
60	22.00	13.00	22.00	16.00	20.00	21.00	13.00
50	21.00	13.00	21.00	15.00	19.00	20.00	12.00
40	21.00	12.00	20.00	14.00	18.00	18.00	11.00
30	20.00	11.00	18.00	13.00	16.00	17.00	10.00
20	18.00	10.00	16.00	12.00	15.00	15.00	9.00
10	15.00	8.00	14.00	10.00	13.00	12.00	8.00

The Components - Individualization, Teaching Learning Process, Internal School Organization, and Staff Development have the highest percentile (25.00) and the component - School Community Relationships and Curriculum, School Organization has the lowest percentile (8.00).

Table :4.11: Percentile Points of the Components of Section II - The Situational and Innovation Characteristics Scale

Percentile Points	Administrative Support	Staff Norms	System Norms	Complexity	Compatability	Riskness	Localiteness
90	35.00	52.00	26.00	29.00	29.00	40.00	40.00
80	34.00	48.00	24.00	27.00	27.00	38.00	39.00
70	32.00	44.00	21.00	26.00	26.00	37.00	38.00
60	30.00	39.00	18.00	24.00	25.00	35.00	36.00
50	28.00	35.00	17.00	23.00	24.00	34.00	34.00
40	26.00	31.00	15.00	21.00	22.00	32.00	32.00
30	24.00	26.00	13.00	20.00	20.00	30.00	30.00
20	22.00	18.00	10.00	18.00	18.00	26.00	27.00
10	16.00	12.00	7.00	15.00	15.00	22.00	23.00

The Component staff norms, has the highest percentile (52.00) and the component system norms has the lowest percentile (7.00)

Table :4.12: Percentile Points of the Components of Section III - The Changed Related Values Questionnaire

Percentile Points	Traditionalism	Progressiveness	Dogmatism	Venturesomeness	Conservatism	Change Proneness
90	47.00	48.00	44.00	43.00	43.00	50.00
80	46.00	46.00	41.00	40.00	40.00	49.00
70	43.00	44.00	38.00	38.00	36.00	48.00
60	41.00	42.00	35.00	35.00	32.00	45.00
50	39.00	40.00	32.00	32.00	31.00	43.00
40	37.00	38.00	30.00	30.00	28.00	41.00
30	36.00	36.00	28.00	29.00	26.00	38.00
20	33.00	32.00	25.00	27.00	24.00	35.00
10	30.00	30.00	21.00	24.00	19.00	30.00

The component change proneness has the highest percentile (50.00) and the component - Conservatism has the lowest percentile (19.00)

Table :4.13: Percentile Points of Sections I, II and III as a Whole

Percentile	Sections			Total
	I (The Inventory of Attitudes to Innovation)	II (The Situational and Innovation Characteristics Scale)	III (The Changed Related Values Questionnaire)	
90	143	261	270	644
80	136	240	251	610
70	132	228	236	580
60	126	216	224	559
50	120	205	216	540
40	116	191	206	519
30	107	181	199	501
20	96	171	184	474
10	87	155	172	430

Section I has the highest percentile 143.00 and lowest percentile 87.00

Section II has the highest percentile 261.00 and lowest percentile 155.00

Section III has the highest percentile 270.00 and lowest percentile 172.00

This proved that the questionnaire is standardized and it is ready for administration. The investigator has given the names of the questionnaire for measuring innovative proneness of teachers of Secondary and Higher Secondary Schools, 'Innovative Proneness Scale' (I.P.S.) for teachers. (See Appendix A).

4.9 Factor Analysis

This section deals with factor analysis. One of the objectives of the present investigation is to study the internal structure of the inventory prepared by the investigator. Keeping this in view, the factor analytical approach has been applied. The main purpose in the factor analysis is to identify or to determine various groups or clusters of items which correlate highly with items within that group. It should be mentioned here that all the 21 variables relating to innovative proneness have been described earlier, based on these variables factor analysis technique has applied. The principal component method was used for the analysis of the data in present study. This method was applied for some reasons. By this method each factor extracted the minimum amount of variance and derives the smallest possible residuals.

First of all, 21 X 21 Factor Intercorrelation Matrix based on the respondents factor scores was computed. Based on these Variables, Factor Analysis of the correlation matrix 21 X 21 was carried out. The purpose of the inter-correlation matrix was to determine the number of factors that could be considered sufficiently important and again these factors have to be related to facilitate the interpretation of the factors. Intercorrelation matrix is given in Table 4.14 on the next page.

Table 4.14 includes correlation matrix 21 X 21 ; five principal components were extracted out by the principal axes method. The datawise of extraction of factors based on the original correlation of factors based on the original correlation matrix (Vide Table 4.14) is presented in the original principal factor matrix (21 X 5) in Table 4.15.

Table 4.15 indicates original principal component matrix (21 X 5) which contains loadings of five factors that are extracted out.

Table :4.14: Inter-Correlation Matrix (21 X 21)

Sr.No. of Compo-nents	Serial Number of Components as listed below																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
1		.56	.61	.37	.49	.53	.43	.28	.03	.08	.32	.34	.42	.42	.10	.31	.39	.13	.22	-.02	.49
2			.52	.3[illegible]	.47	.55	.39	.22	.009	.06	.26	.31	.36	.25	.08	.22	.34	.12	.21	-.02	.37
3				.47	.62	.61	.58	.24	.002	.05	.32	.28	.38	.45	.10	.38	.49	.25	.36	.08	.49
4					.48	.53	.43	.25	.08	.10	.26	.27	.24	.29	.15	.22	.30	.13	.19	.03	.26
5						.68	.52	.35	.13	.17	.37	.30	.38	.36	.19	.32	.47	.27	.29	.10	.39
6							.58	.36	.09	.14	.43	.40	.43	.44	.21	.31	.45	.24	.30	.03	.44
7								.2[illegible]	.05	.05	.33	.29	33	.34	.13	.3[illegible]	.43	.26	.32	.13	.39
8									.46	.46	.44	.42	.27	.25	.46	.1[illegible]	.27	.18	.24	.03	.27
9										.74	.32	.26	-.04	-.009	.58	.18	.02	.36	.34	.38	.06
10											.40	.30	.03	.05	.60	.16	.07	.28	.30	.30	.06
11												.66	.53	.45	.32	.31	.36	.21	.30	.08	.44
12													.57	.47	.37	.36	.37	.14	.26	.04	.45
13														.71	.07	.42	.47	.16	.25	-.02	.55
14															.13	.44	.50	.23	.33	.06	.54
15																.16	.19	.33	.36	.30	.16
16																	.60	.50	.54	.40	.59
17																		.43	.53	.23	.67
18																			.63	.63	.34
19																				.54	.49
20																					.17
21																					

List of 21 Components :

1. Individualisation
2. Curriculum Organization
3. Teaching-Learning Process
4. Teaching Resources
5. Internal School Organization
6. Staff Development
7. School-Community Relationship
8. Administrative Support
9. Staff Norms
10. System Norms
11. Complexity
12. Compatibility
13. Riskness
14. Localiteness
15. Cosmopoliteness
16. Traditionalism
17. Progressivism
18. Dogmatism
19. Venturesomeness
20. Conservatism
21. Change Proneness

Table :4.15: Original Principal Component Factor Matrix (21 X 5)

Sr. No.	Names of the Components	F_1	F_2	F_3	F_4	F_5
1.	Individualization	.65	-.33	-.12	-.15	.41
2.	Curriculum Organization	.57	-.32	-.14	-.27	.46
3.	Teaching-Learning Process	.71	-.32	.04	-.31	.07
4.	Teaching Resources	.53	-.21	-.18	-.37	-.40
5.	Internal School Organization	.70	-.19	-.12	-.35	-.12
6.	Staff Development	.74	-.25	-.17	-.27	-.13
7.	School Community Relationship	.64	-.22	.04	-.30	-.27
8.	Administrative Support	.52	.29	-.48	.02	.06
9.	Staff Norms	.31	.78	-.26	-.11	.07
10.	System Norms	.35	.71	-.36	-.06	.09
11.	Complexity	.65	.13	-.33	.34	-.13
12.	Compatability	.64	.06	-.33	.43	-.04
13.	Riskness	.65	-.29	-.05	.50	-.06
14.	Localiteness	.66	-.22	.06	.41	-.16
15.	Cosmopoliteness	.41	.63	-.27	-.05	-.02
16.	Traditionalism	.64	.10	.46	.18	.04
17.	Progressivism	.73	-.10	.33	.12	.01
18.	Dogmatism	.51	.45	.50	-.12	-.05
19.	Venturesomeness	.62	.37	.43	-.04	.05
20.	Conservatism	.29	.57	.53	-.16	-.04
21.	Change Proneness	.73	-.13	.24	.26	.26
Percent of Variance		35.82	14.02	9.27	7.22	3.61
Cumulative Percent of Variance		35.82	49.84	59.10	66.32	69.93

Table :4.16: Rotated Factor Matrix (21 X 5)

Sr.No.	Components	F_1	F_2	F_3	F_4	F_5	h^2
1.	Individualisation	.31	.06	.05	.27	.75	.73
2.	Curriculum Organisation	.32	.07	.02	.12	.78	.73
3.	Teaching-Learning Process	.60	-.03	.22	.21	.51	.71
4.	Teaching Resources	.79	.10	.01	.12	.05	.65
5.	Internal School Organization	.70	.15	.14	.19	.33	.67
6.	Staff Development	.71	.14	.08	.29	.34	.73
7.	School Community Relationship	.71	-.01	.22	.20	.17	.62
8.	Administrative Support	.21	.65	-.05	.28	.19	.59
9.	Staff Norms	-.02	.85	.26	-.07	-.03	.79
10.	System Norms	.01	.86	.16	.02	.03	.77
11.	Complexity	.23	.45	.03	.66	.05	.69
12.	Compatibility	.14	.40	-.01	.72	.12	.71
13.	Riskness	.18	-.03	.07	.83	.19	.77
14.	Politeness	.25	.04	.18	.76	.09	.69
15.	Cosmopoliteness	.10	.76	.22	.09	-.02	.63
16.	Traditionalism	.11	.01	.66	.44	.17	.67
17.	Progressivism	.29	.05	.51	.48	.27	.66
18.	Dogmatism	.15	.21	.81	.05	.01	.73
19.	Venturesomeness	.14	.23	.76	.20	.14	.71
20.	Conservatism	.01	.23	.80	-.13	-.11	.72
21.	Change Proneness	.14	-.01	.42	.60	.41	.72
	Factor Number - Percent Variance	14.55	14.40	14.58	16.47	9.23	
	Cumulative Percent of Variance	14.55	28.90	43.52	60.00	69.92	
	Percent Variance	20.81	20.59	20.85	23.55	14.20	
	Cumulative Percent Variance	20.81	41.40	62.25	85.80	100.00	

The rotation of factors was done on the line of Kaisser's (1959) computer programme of varimax rotation. The related varimax factor matrix is presented in Table 4.16 with Factor Loadings on five factors.

The interpretation of results is based on the varimax rotated factors. Five factors were finally identified. They are named, and discussed below.

Table :4.17: Varimax Factor I

Sr.No.	Name of the Variables	Loading
1.	Teaching Resources	0.79
2.	Staff Development	0.71
3.	School Community Relationship	0.71
4.	Internal School Organization	0.70
5.	Teaching Learning Process	0.60
6.	Curriculum Organization	0.32
7.	Individualization	0.31

Varimax Factor I consisted of the seven (7) variables shown above and counted for 20.80 cumulative percent of variance among all the factors. The significant loadings of varimax Factor I, arranged in descending order are given in Table 5.4 for the sake of convenience. Varimax Factor I is characterized by significant loading for seven variables. All

variables are found to be positive. The significant loading were shared by variables, Teaching Resources 0.79, Staff Development 0.71, School Community Relationship 0.71, Internal School Organisation 0.70, Teaching Learning Process 0.60, and Curriculum Organization 0.32, Individualization 0.31. This factor seems to reflect the Teaching Resources. As the highest loading is .79 this factor can be named as 'Teaching Resources'.

Table :4.18: Varimax factor II

Sr.No.	Name	Loadings
1.	System Norms	.86
2.	Staff Norms	.85
3.	Cosmopoliteness	.76
4.	Administrative Support	.65
5.	Complexity	.45
6.	Compatability	.40

Factor II accounted for 41.40 cumulative percent of variance and was made up of six variables. All variables are positively loaded. The significant loading were shared by variables System Norms .86, Staff Norms .85, Cosmopoliteness .76, Administrative Support .65, Complexity .45,

Compatability .40. This factor seems to determine System Norms and Staff Norms, it can be named as 'System and Staff Norms'.

Table:4.19: Varimax Factor III

Sr.No.	Name	Loading
1.	Dogmatism	.81
2.	Conservatism	.80
3.	Venturesomeness	.76
4.	Traditionalism	.66
5.	Progressivism	.51
6.	Change Proneness	.42

Factor III comprised of six variables and accounted for 62.65 cumulative percent of variance.

Varimax Factor III is characterised by significant Loadings for six variables. All are positively loaded. The significant Loadings were shared by variables Dogmatism .81, Conservatism .80, Venturesomeness .76, Traditionalism .66, Progressivism .51, Change Proneness .42. This factor is dominated by Dogmatism, and Conservatism, so this Factor can be named as 'Dogmatism-Conservatism'.

Table :4.20: Varimax Factor IV

Sr.No.	Name	Loading
1.	Riskness	.83
2.	Localiteness	.76
3.	Compatability	.72
4.	Complexity	.66
5.	Change Proneness	.60
6.	Progressivism	.48
7.	Traditionalism	.44

Varimax Factor IV comprised of seven variables and accounted for 85.80 cumulative percent of variance.

Varimax Factor IV consists of seven variables. All are positively loaded. The significant loadings were shared by variables Riskness .83, Localiteness .76, Compatability .72, Complexity .66, Change Proneness .66, Progressivism .48, Traditionalism .44. This factor seems to emphasise Riskness, so this Factor can be named as 'Riskness'.

Table :4.21: Varimax Factor V

Sr.No.	Name	Loading
1.	Curriculum Organization	.78
2.	Imdividualisation	.75
3.	Teaching Learning Process	.51
4.	Change Proneness	.41
5.	Staff Development	.34
6.	Internal School Organization	.33

Varimax Factor V consisted of six variables and accounted for 100.00 percent of variance. Varimax Factor V consist of six variables. All variables are positively loaded. The significant loading of the variables are Curriculum Organization .78, Individualization .75, Teaching Learning Process .51, Change Proneness .41, Staff Development .34, Internal School Organization .33. This factor seems to emphasise 'Curriculum Organization'. So this Factor can be named as 'Curriculum Organization'.

4.10 Conclusion

Thus, the present chapter gives a complete account of the procedure followed for construction and standardization of the scale on the basis of the data obtained in the tryouts. The items were prepared and assembled into the finished question

scale was then ready for a trial administration. Lindquist says,

> 'The trial administration, as it is defined serves to indicate exactly how the test will be finished in actual use. This means that nominal changes can be made after the trial administration and that the sample employed must be essentially like the group with whom the test is to be used. The trial administration is a final check on time limit and on the procedure of administration'.

The present chapter also deals with a Factor Analysis of the questionnaire prepared by the investigator as it was one of the objectives of the present study.

The Factor Matrix (Vide Table 4.15) comprises five principal axes components. It explains the correlation matrix (21 X 21) (Vide Table 4.14). The five factors were extracted through Factor analysis and it explains the percent common variance. The naming and interpretation of the related Varimax Factors have shown the composition of the five important factors implicit in the 21 variables. The Factors named were : (1) Teaching Resources, (2) System and Staff Norms, (3) Dogmatism-Conservatism, (4) Riskness, (5) Curriculum Organization. Among all the Factors System Norms possesses the highest significant Loading (.86). So it is the most dominating Factor.

The next chapter deals with the Innovative Proneness of Teachers of Secondary and Higher Secondary Schools.

CHAPTER IV
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