CHAPTER V

ABOUT THE STUDY
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Improvement of class room teaching by suitable development of social-emotional climate in the classroom has been the subject of concerned research abroad, especially in U.S.A. Teacher classroom behaviour, it is believed, is the chief ingredient of the right type of classroom climate. Focus of attention has therefore been on studying the patterns of teacher influence using reliable observational tool developed for the purpose.

The purpose of the present investigation has been discussed in the first chapter. The present chapter embodies methodology, design and procedure alongwith description of tools, encoding and decoding procedures and the relevant statistical techniques employed in conducting the present study.
DESIGN OF THE STUDY

Method:

The study has been focussed on some aspects of classroom behaviour of science teachers in macro and micro situations. While attempting it, the investigator has also developed his own tool for observing classroom verbal behaviour of science teachers. The study may be considered as one following the normative survey method and the cross sectional approach. The whole work was completed in three stages stated below:

(a) A pilot study and development of STBI
(b) The macro study
(c) The micro study

Sample:

Generalizability of the findings of any research is, of course, dependant upon a sampling procedure followed and ideally either a representative sample would be desirable (8).

For the present study the population may be considered of comprising of science teachers (Physics, Chemistry, Biology, Mathematics) of U.P. The cluster random sampling technique was employed. In the beginning the whole U.P. was divided into the pairs of adjoining districts. Two such pairs were then randomly selected for the sample. Further a random selection of 18 schools was made from these four districts. Then the clusters of science teachers were taken up for the study. The selected districts include Allahabad, Aligarh,
Bulandshahr and Pratapgarh.

A. Sample for pilot study

The pilot study was undertaken on 50 science teachers (30 male, 20 female) selected, as discussed above. The classroom verbal behaviours were observed and encoded through Flanders Interaction Analysis System (FIAS).

B. Sample for Macro study

The macro study was aimed at analyzing classroom behaviour of science teachers through the Science Teacher Behaviour Inventory (STBI) developed by the investigator himself. Personality factors had also been studied. The sample consisted of 120 science teachers (60 male, 60 female). These 120 teachers were subdivided into groups of 20 each and later termed as A, B and C. The criteria for assignment of groups based on the composite of the percentage of marks at graduate, post graduate and B.Ed. levels. The following scheme was followed:

- 55% and above: Group A
- 48% to 54%: Group B
- Below 48%: Group C

The lay-out of the sample has been presented below:

Contd.
Science Teachers

120

Male Science Teachers (60)  Female Science Teachers (60)

'A' Grade Teachers  'B' Grade Teachers  'C' Grade Teachers  'A' Grade Teachers  'B' Grade Teachers  'C' Grade Teachers
20  20  20  20  20  20

C. Sample for Micro study

In order to adjudicate the usability of Science Teacher Behaviour Inventory (STBI) in micro-situations a cluster of 20 science teachers was taken keeping in view the convenience and administrative feasibility. Thus twenty science student teachers from N.M. College, Kalakankar (Pratapgarh) were selected.

A scrutiny of the foregoing tables reveal that the composition of the sample, considering the various factors, as mentioned above, is fairly representative. The following other considerations were also kept in view, while selecting the subjects in the sample for the present study.

1. That they belong to all the possible range of experiences 1 to 15 years.
2. That the subjects are from different socio-economic status.
3. That the sample is represented by nearly equal number of graduates and post-graduates.
4. That the grades A, B, C were also verified on the basis of Principal's opinion regard their teaching performance.

PROCEDURE OF THE STUDY

First of all before taking this study, a seminar was organised in which it was discussed properly so that the behaviours of the science teachers may be analysed and the underlying limitations of Flanders interaction category system may be removed by developing such a system which may analyse completely verbal and non-verbal upto some extent, the behaviour of the science teachers of Indian classes. On this very basis the researcher took a sample of fifty science teachers for first pilot study and analysed the behaviours through Flanders interaction category system and on the basis of this study, there are some limitations of F.I.A.C. System, these limitations create hinderance in the proper analysis of the behaviour of science teachers to analyse the behaviours of science teachers and to simultaneously remove the limitations of F.I.A.C.S., science teacher behaviour inventory was developed in three stages. In the first stage two hundred students from U.P., Rajasthan and M.P. were randomly selected and asked to write or note down the activities of their science teachers which they did in their classes and the responses received were collected and classified in such a way that common items did not keep their identities separately and conversed into minimum number of categories.

In the second way, all the 92 scales were undertaken
and their main common items were observed and classifying the items they were fused, reorganised along with the responses, which were categorized in the first stage.

In the third and the final stage scales of the first and second stages were fused and mixed together and their items classified and categorized in the final form and this final form was put in the seminars at Patiala, Bhopal, and Jullundur and discussed. After the discussion, the final shape of S.T.B.I. was given and thus it was named S.T.B.I.

While using S.T.B.I., 120 teachers of science including Physics, Chemistry, Maths, and Biology teachers were selected and observed and also dividing them into groups on the basis of sex and grading were compared and analysed. A study was also made of the relations between the personality traits of these science teachers and the elements of the S.T.B.I.

In the end while using S.T.B.I. in the micro-teaching situation, selected 20 science teachers were observed, analysed and compared on the basis of pre-test and post-test design. This very tool was used as a feedback only few skills had been taken for the micro-teaching situation, and lastly it was concluded that it can be very well applicable in the field of teacher education with fruitful results in studying the behaviour of science teacher in our classes.
Analysis of the Behaviour of 50 Science Teachers Through Flanders' System

Limitation of Flanders' System for Science Teachers

Development of S.T.B.I.
(i) Through the Analysis of available scales
(ii) Through the events of items collected from 200 students
Fused both and restructured the S.T.B.I.

Analysis of behaviour of 120 Science Teachers
(i) Comparison on the basis of sex
(ii) Comparison on the basis of grades
(iii) Relationship with personality traits of G.Z.T.S.

Analysis of behaviour of 20 science teachers on micro-teaching situation.
Comparison on the basis of Pre and Post-tests

1. Mathematical structure through Factor Analysis
2. Reliability - Observer Agreement & Stability coefficient
3. Validity
1. Flanders Interaction Analysis Category System (used for pilot study)

2. Personality and Guilford Zimmerman Temperament Survey

3. Science Teacher Behaviour Inventory, developed by the Investigator.

Personality was an elusive term and a variety of definitions was evident in the literature, e.g. Alport identified approximately fifty different definitions of personality, and his list was probably not all inclusive. One common definition of personality was stated in terms of a person's appearance and a set of specified rules of a person's appearance and a set of specified rules on how to get along with others. This definition did not consider the actual behaviour of the individual but rather the effects that personality had on others. Such a definition was usually referred to by Psychologists as the Layman's definition of personality. (11, p.3)

Personality originally came from a Greek word, 'persona' which referred to a mask worn by a Greek actor on the stage. The actor held the mask in front of his face and this audience knew the part he was playing (5,p.2). The definitions of personality were often classified into several categories of definitions rather than quotes given by individual authors. These categories included stimulus omnibus, integrative, hierarchical, totality and adjustmental definitions (11,p.4) and (5,pp.3-5).
One of the most common ways to study of personality was the trait approach. "A trait is any distinguishable relatively enduring way in which one individual differs with another" (5, p. 61). In other sense, traits referred to consistent patterns of actions or underlying, depth characteristics of personality. When the psychologist spoke of the trait approach to personality, he simply suggested a method for discovering personality based on a person's behaviour under various circumstances. This approach of describing personality belonged to the integrative category of personality definitions (9). The definition or description of personality, using the trait approach, was that an individual's personality was composed of his own particular or unique pattern of traits. In other words, 'persona' is the organisation of stable structure (traits) within a person that disposes him to act in certain ways. These structures are in reality hypothetical constructs that are inferred from behaviour (9, p. 49). Such a definition was based on the assumption to which most psychologists agreed, that no two persons had the same identical personality. Every individual's personality is unique. This does not mean that particular trait did not apply to nor was characteristics of another person. It meant that a person's traits, considered collectively, were different from all other person's traits. Consequently, person as a whole is different from persons as a whole, although they may have characteristics patterns of behaviour or traits which were similar.
The idea of a trait and the naming of it came from the observation of behaviour. Behaviour was observed in a number of situations, and the traits were inferred from these observations. Behaviour which illustrated particular type of trait, were known as trait indicators. The trait itself was not observed as it was an abstraction which applied to a number of different behavioural characteristics. For example a person who was observed on several occasions to be even tempered, optimistic, cheerful, and retained his composure in a difficult situation was said to have the trait of emotional stability.

In this example, the trait was emotional stability and the behaviours were the trait indicators of emotional stability. Thus the traits were abstract generalizations of the similarity seen between a group of teachers (11, p.14) (5, p.83).

Since there are at least 18000 different traits described in the English language, it was not surprising to find both common and unique traits (9, p.53). By this was meant that certain traits were found widely distributed throughout population or among certain groups. These were common traits. Other traits applied only to an individual, these were unique traits. Although it was necessary to identify both kinds of traits in order to adequately describe personality. Psychologists gave major attention to the former. Common traits offer a higher degree of generality than unique traits. (5 and 9 p.57).
The procedure for inferring a broad trait from several narrow traits was usually accomplished through factor analysis. This was a statistical method used by many psychologists to identify patterns of traits that 'go together' or clusters of traits. On the basis of factor analysis the narrow traits having highly correlated with one another or that they have some common quality. By this many traits might be reduced to a relatively small manageable number of broader traits that were related to one another but were distinct from the other clusters of traits. This procedure was used by Cattell when he reduced 4000 trait names to thirty five clusters of traits. (9, p.6) It was also used by Guilford and Zimmerman when they developed the Guilford-Zimmerman temperament survey. Traits could be determined through self-ratings and by the ratings of others. Guilford preferred the self-ratings personality - inventory approach for determining an individual's traits. He felt that it was more analytical, specific and gave a more nearly correct evaluation of a person's traits. Thus the self-rating, personality inventory was the basic design of the Guilford-Zimmerman temperament survey (5, p.56-61).

The GZTS was a self-report inventory that provided a general assessment of ten individual traits. These traits are: (1) General activity; (2) Restraint ascendance; (3) Sociability; (4) Emotional stability; (5) Objectivity; (6) Friendliness; (7) Thoughtfulness; (8) Personal relations and (9) Masculinity. Each of these traits was identified through the use of factor analysis (6, pp.2-3).
The adaptation of the Guilford-Zimmerman temperament survey in Indian conditions, by Y.G. Mathew was used in this study (Manual 2) (12). This GZTS consisted of 200 statements, approximately twenty for each trait, about the actions and feelings. The individual responded to these items by indicating a yes or no depending on whether he saw the statement as being characteristic of himself or not. An uncertain category (?) was also provided for ten individuals who did not feel they could answer yes or no. The purpose of this survey was to locate clusters of behaviors that hang together and were distinct from the other clusters.

The individual answers or rather to say more correctly responses to the question or statements scored by designating a 'correct' response as one point and an 'incorrect' response being equal to zero. This method of scoring was convenient and also kept the average Proportions 'passing' nearer .5, a level at which reliability could be higher. A high score for a particular trait category indicated the positive qualities of that trait, and a low score indicated the negative qualities of that trait, therefore, the trait was as being on a continuum ranging from zero to twenty point.

(1) Administration

Best results will be obtained, if the test is administered individually or in small groups under supervision. The investigator administered the GZTS individually for getting the
results. Ideally, any implication that the individual's future status will hinge on the outcome should be avoided but it is not possible in true sense. Instruction printed on the test booklet should not be altered by additions.

(ii) Scoring

The best 100 items cover the traits G R A S and E and the second hundred or half items traits O F T P and M. The items are arranged in the cyclic order. The responses for each trait fall in the same column. Count the number by '✓' marks and '✗' marks seen through the stencil or scoring key and enter at spaces provided at the bottom. The raw scores should appear on the answer sheet in the order indicated on the stencil. The raw scores may be copied on, to the data reporting sheet.

(iii) Reliability

The reliability of the individual trait scores using the Kuder Richardson formula, was based on college students (both male and female). The separate reliability ranged from .75 to .85 (clustering at approximately .80 (41, p.5-6). The standard error of measurement for this instrument ranged from 2.2 to 2.6. From these values, it was probable (two to one) that any attained score was within 2.5 units of the 'true' score for the individual (6, p.5).

(iv) Validity

The validity of the original GZTS has been demonstrated
in a variety of studies which include correlation with rating, factor analysis, effects of semi-starvation on test scores, differential clinical diagnosis. Correlation with grade-point averages, prediction of vocational success and vocational adjustment has been calculated. This test has been found useful in the selection of teacher supervisors.

3. Science Teacher Behaviour Inventory

A Science Teacher Behaviour Inventory has been developed by the investigator. This STBI contains 20 categories. All statements or events that occur in the classroom are categorized in one of six major elements or sections: (1) Structuring the Teaching; (2) Structuring the Learning; (3) Structuring the Material; (4) Structuring the classroom control; (5) Structuring the Silence Activities; and (6) Confusion, or anything other than teacher talk or student talk or the other categories present in the STBI.

The larger sections of Structuring the Teaching and Structuring the Learning are sub-divided in order to make the total pattern of classroom behaviour of teacher-pupil interaction more meaningful. Other elements are also sub-divided into the smaller categories. These all 20 categories are mutually exclusive; yet together they are totally inclusive of all the verbal interaction and the activities in silence occurring in the presence of the teacher in the classroom.
Structuring the Teaching

This head having the five smaller categories:

**Category 1**
Teacher utilizes students' response / accepts ideas / praises - Teacher utilizes and clarifies the students' responses. Praises or encourages students' action or behaviour saying uh-huh or 'yes' or 'correct' or 'go-on' are included.

**Category 2**
Teacher handles / builds students' response. Teacher restructure, reorganizes or modifies the students' responses. Sometimes developing and accepting ideas or responses for the improvemental purposes also included.

**Category 3**
Teacher summarizes / writes on Black Board. Teacher uses the B.Bd. for concluding the lesson or summarizing the ideas underlying the lesson or clarifying the main points of lesson. Draws the figures or diagrams on the B.Bd. for the clarification or for development of the lesson are also included.

**Category 4**
Teacher poses questions - asking a question about content or procedure with the intention that the pupil should answer. Questions, can be Essay type or Short answer or Objective type. All questions, however, closed or open (narrow or broad), which requires answers, and are not commands or criticism, fall in category 4.

**Category 5**
Teacher gives lecture, facts, concepts, notes. lecture is the form of verbal behaviour used to give information, instructions, facts, concepts, opinions, ideas, notes or orientation to the pupils. Whenever the teacher is explaining, discussing, giving opinion or facts or concepts, this category is also used.

Structuring the Learning

Structuring the learning divided into three categories
Category 6  Student-student interaction. Here the mutual talking of the students comes under this category. Student gives the response to the student or students, ignoring the developmental nature of the work or the activities of the teachers.

Category 7  Student initiations / asks questions, talk by students which they initiate. The questions, of any type, posed by the pupils come under this category. Any information or opinion about the content given by students and replies occurring in conversation between students also included.

Category 8  Student gives response. When student answers a question asked by a teacher, or when he responds verbally to a direction the teacher has given, then category is applicable.

Structuring the Material

This head is related to the use of material or audio or visual or audio-visual type of aids. This is divided into two small categories.

Category 9  Teacher uses resource material / charts / maps / diagrams etc. In this category, teacher uses the material aid of such a type in which the main role played by the teacher and the lesser chance of the participation of students.

Category 10 Teacher shows models / demonstrates / experiments. This category involves the use of visual types aid, in which teacher demonstrates or performs the experiments. Here the participation of student is more than in category 9.

Structuring the Classroom Control

This element is related to the discipline or the control of the class in the classroom. This element was
divided into four sub-categories.

Category 11 Teacher provoked to anger / criticizes / penalizes / reprimands. This category shows the irritative behaviour of the teacher, when he provoked to anger / criticized / penalizes the students or reprimands to the students.

Category 12 Teacher gives direction / commands / moralizing / controls. In this category teacher creates the environment by giving the directions or commands or moralizing or controls the students' activities for intended to change student behaviour from non-acceptable to acceptable.

Category 13 Teacher admits fault / personal ignorance / postpones. Here teacher change his behaviour by accepting his fault or personal ignorance. Sometimes, teacher postpones the some activities for creating the better environment.

Category 14 Teacher supervises. In this category, he observes the home work or class work or supervises the other works done by the students in the class.

Structuring the Silence Activities

The silence activities were divided into four main categories.

Category 15 Teacher pauses. This category classify the silence due to the pauses of the teacher. When a teacher gives the lecture, then the small pauses, greater than 3 seconds, comes under this category.

Category 16 Teacher provides opportunity to think / students' thinking. When the teacher asks a question, then he allows a bit of time for thinking to the answer and in other case while student solves or performs an experiment than he thinks, for the better performance, then this category encodes the behaviour.
Category 17
Students copying notes / diagrams etc. Student copying the notes or diagrams from other papers or from the Black Board or draws some picture of apparatus, then this category comes.

Category 18
Students experimenting (individually or in group). Generally when the students in the laboratory, then they performs the experiments or sometimes they also do some work of experiments in the class, then we code these events under this category.

Confusion

Confusion also classified into two categories.

Category 19
Interuption by external agency. Sometimes the peon or other persons come to the class for specific purposes, then the work has been stopped at that time events come under the category 19.

Category 20
When no meaningful activity is going on. This category is for non-functional behaviour or perhaps even chaos. This is behaviour when no apparent instruction or learning is taking place.

The final form of the Science Teacher Behaviour Inventory has been given in the previous chapter i.e. Development of S.T.B.I.

ENCODING OF BEHAVIOURAL DATA

Since a thorough knowledge of the categories is basic to the use of this technique for analyzing teacher-pupil interaction, the first step is the memorization of these categories i.e. Categories of Science Teacher Behaviour Inventory. Once these are learned so that response is automatic, they should be practiced by categorizing the classroom
behaviour of the teacher or statements from tapes of various teaching situations. These categories are recorded on specially designed sheet for this purpose. After working on these tapes for 5 to 7 hours, observers begin to develop the ability to make judgements easily and to categorize consistently. The preference has been given to those categories, which occur rarely in the classroom. Then the reliability has been calculated or set with the help of the expert in the field of Interaction. This reliability will not come down by .80. Hence it represents the level of minimum desirable Intra-Inter observer reliability. Considerable practice is required to develop the ability to make the accurate judgments necessary.

Observation

Prior to the final observation, the investigator did a pilot observation in Multipurpose School of Regional College of Education, Ajmer. After observing few teachers, the final observation started in the region of Pratapgarh and Allahabad.

The programme was designed such as each teacher was observed for two periods. The second observation was made when the teacher took the same class on the occasion immediately next to the first observing occasion. The second observation was in continuation of the first one.

Observational Procedure

The observer sat in a class taking a place from where students and teacher could conveniently be watched.
Teacher's Behaviour patterns were classified into 20 categories. At the end of every three seconds' period, it was decided as to which category best represents the communication events just completed. The observer put down the category number on a paper depending on the behaviour of the teacher or students simultaneously continued this at a rate of 18-23 observations per minute. Observer notes were merely a sequence of numbers written in columns from top to bottom on the specially designed sheets. Observer used marginal notes to explain any unusual things, things not described in the categories. After the class, the observer sat in a room and wrote few additional informations and the various activities of the class during the period of observation.

DECODING PROCEDURE

Tabulation of Categories into Matrix

There is a method of recording the sequence of events in the classroom in such a way that certain facts become readily apparent (2). This method consists of entering the sequence of numbers into a 20-row by 20-column table, which is called a Matrix. The generalized sequence of the teacher-pupil interaction can be examined readily in this matrix. Suppose, that the following categories (tallies) came for 1st time.

5, 3, 15, 5, 5, 5, 9, 9, 15, 4, ..........
Then we have now classified the following sequence of numbers in this position:

\[
\begin{array}{ccccc}
\text{Ist} & \text{IIInd} & \text{IIId} & \text{IVth} & \text{Vth} \\
5, & 15, & 5, & 5, & 9, \\
\hline
\text{Last step} & 4 & 5 & \ldots...
\end{array}
\]

Tabulations are now made in the matrix to represent pairs of numbers. Notice the listing above that the numbers have been marked off in pairs.

The first pair is 5-3, the second pair is 3-15 etc. The particular cell in which tabulation of the pair of numbers made is determined by using the first number in the pair to indicate the row and the second number in the pair for the column.

Thus, 5-3 would be shown by a tally:

\[
\begin{array}{c}
\text{First step} \\
\text{Second step} \\
\text{Third step} \\
\text{Fourth step}
\end{array}
\]

\[
\begin{array}{c}
\text{First} \\
5 \\
\text{Second} \\
5 \\
15 \\
\text{Third} \\
5 \\
\text{Fourth}
\end{array}
\]

\[
\begin{array}{c}
\text{Second} \\
5 \\
\text{First} \\
5 \\
1 \\
\text{First step} \\
3 \\
\text{Second step} \\
5 \\
\text{Fourth step}
\end{array}
\]
in the cell formed by Row 5 and column 3. The second pair 3 - 15, would be shown in the cell formed by Row 3 and column 15. The third pair 15 - 5, is entered into the cell, Row 15 and column 5 and so on and so forth. Notice that each pair of numbers overlaps with the previous pair, and each number, except the first and the last, has been used twice. This circle closed by the last pair i.e. last category and the first.

The matrix thus prepared provides a comprehensive pattern of classroom interaction. 16 number of interesting interpretation can be derived from this matrix.

COMPUTATION OF BEHAVIOUR RATIOS

1. Percent Teacher Talk

The percent teacher talk indicates the total percentage of the teacher talk i.e. how much talk does the teacher give in the whole period? Here, 1, 2, 3, 4, 5, 9, 10, 11, 12 and 13, namely 10 categories are directly or indirectly related to the teacher's talk. This ratio can be calculated by the total tallies in the categories 1, 2, 3, 4, 5, 9, 10, 11, 12 and 13. Then this sum is multiplied by 100 and finally divided by the total numbers of Tallies i.e. the grand total of the master matrix.

2. Percent Teacher Lecture

This variable of a teacher indicates the total time used in giving the lecture. Here the teacher delivers the
lecture directly. This is independent variable and can not be related to the other categories like Structuring the Material i.e. 9 and 10 categories. This can be had by the total tallies in the 5th category, multiplied by 100 and finally divided by total tallies i.e. 'N' of the master matrix.

3. Indirect Teacher Talk

In the above ratio, all the indirect talks, delivered by the teacher, come under this head. It means that it shows the indirect mode of a teacher, which is given in a particular period. Here 1, 2, 9 and 10 categories come under this heading. This can be calculated by the sum of the 1, 2, 9 and 10 categories, multiplied by 100 and divided by the total tallies i.e. 'N'.

4. Direct Teacher Talk

The aforesaid variable represents the teacher's direct statements, given in the class. These talks are directly delivered and influence the pupils in the direct manner. The categories 3, 4, 5, 11, 12, 13 come under the Direct Teacher Talk. The Direct Teacher Talk ratio can be calculated by the sum of the total tallies on the categories No. 3, 4, 5, 11, 12 and 13. This sum too is multiplied by 100 and divided by total tallies i.e. 'N'.

5. Teacher Question Ratio

This ratio, as the name indicates, points out to the tendency of the teacher, to ask questions during the more
content oriented part of the class discussion. This T.Q.R. can be had by the multiplication of 100 to the total tallies on the 4th category divided by total tallies of the matrix i.e. N.

6. Teacher Response Ratio

Teacher Response Ratio indicates the teacher's tendency to react to the ideas and feelings of the pupils or learners. The ratio provides an index of the emotional climate in the classroom. The computational procedure will reveal that it is a 100 times multiplied proportion of positive and affective categories 1, 2, 3, 9 and 10 to the total of 1, 2, 3, 9, 10, 11, 12 and 13 categories.

7. Praise and Acceptance Ratio

As the name suggests, Praise and Acceptance Ratio indicates the 100 times multiplied proportion of the category 1 to the sum of the categories 1, 2, 3, 4, 5, 9, 10, 11, 12 and 13. It means that this ratio shows the proportion of Praise and Acceptance in the Teacher Talk only, not the percentage of this category in the whole matrix. It is a part of the teacher talk or the time devoted for the Praise and Acceptance in the Teacher Talk.

8. Percent Pupil Talk

Percent Pupil Talk indicates the emphasis given to the Talks of the pupils in the class, or to say: How much do
our pupils talk in the class, in the presence of the teacher. This talk includes the student's initiations, student's responses as well as student-student interaction can also be noted. This talk also includes the categories of column 17 and 18. This ratio can be calculated to sum of the tallies on 6, 7, 8, 17 and 18, multiplied by 100 and finally divided by the total Number of Tallies i.e. N.

9. Pupil Initiation Ratio

As the name suggests Pupil Initiation Ratio indicates the proportion of student talk 'Judged to be an act of initiation'. This ratio can be computed by multiplication of 100 in the total tallies on category 7 and this product is divided by the sum of the total tallies in the categories 6, 7, 8, 17 and 18. This indicates that the pupils' initiation is the proportion of the student's initiation to the total talk of the students.

10. Pupil Response Ratio

Pupil Response Ratio represents the student's tendency to react to the idea, feeling and Teacher Talks, mostly questioning. The ratio provides an index of the emotional climate in the classroom. It can be computed by the product of 100 and column 8 divided by the sum of the total tallies on the 6, 7, 8, 17 and 18 categories.

11. Percent Silence Ratio

About the above ratio, as the nomenclature indicates,
points to the silence period during the teaching-learning process, going on in the class. It shows that the total percentage time of silence in the classroom during the teaching. It is computed or to say proportion of the product of 100 and total tallies on the categories of 14, 15, 16, 17 and 18 columns. It is usually the period in which non-verbal behaviour of Teacher influence the activities of the pupils.

STEADY STATE RATIO

How often do teachers or pupils change their events of behaviour rather or to say categories of behaviour in classroom? This question concerns the flexibility of classroom behaviour during teaching or the rapidity with which the behaviour changes. This change of behaviour or categories of behaviour is assessed through the Steady State Ratio. In other words, Steady State Ratio indicates the extent to which the teacher talk and pupil talk remain in the same category for a period longer than three seconds. Teacher Steady State Ratio (TSSR) and the Pupil Steady State Ratio (PSSR) represent the index for teacher behaviour and student behaviour respectively. Higher is the Steady State Ratio, the less rapid value will be the Transition State Ratio in the classroom behaviour of teachers and students. All the diagonal cells of a matrix shows the steady state ratio while the other cells (i.e. except the diagonal cells) are called Transitional Cells and representing the movement from one category to another.
(i) Steady State Ratio

Steady State Ratio indicating the total time to items or categories for the analysis of teacher behaviour, remains in the same category. It can be calculated by the percentage proportion of the 20 Diagonal Cells (i.e. 1-1, 2-2, 3-3, 4-4, 5-5, .... 18-18, 19-19, and 20-20) to the grand total of the matrix i.e. N.

(ii) Teacher Steady State Ratio

This T.S.S. indicates the extent of time for which teacher talk remains in the same category for a period longer than three seconds. It can be the percentage proportion of the sum of the tallies in cells 1-1, 2-2, 3-3, 4-4, 5-5, 9-9, 10-10, 11-11, 12-12, 13-13, and 14-14 to the total tallies present in the matrix i.e. N.

(iii) Pupil Steady State Ratio

As the nomenclature indicates the extent to which the pupil talk remains in the same category for a period longer than three seconds. It is the percentage proportion of the sum of tallies in the cells 6-6, 7-7, 8-8, 17-17, and 18-18 to the total tallies in the master matrix i.e. 'N'.

(iv) Transition State Ratio

All the cells, except diagonal cells, are called the Transition cells. These Transitional cells represent the movement of the teachers or the pupil or both from one category.
to the other category. It can be calculated by adding all
the tallies in Transition Cells and multiplied by 100 and
finally divided by the grand total of the tallies in all the
cells i.e. 'N'.

I/D Ratio

The prime importance in interpreting the matrix is
given to the Teacher Talk and the second importance to be
given to the Indirect and Direct Statements of the teachers.
I/D Ratio is employed in order to find out the kind of
emphasis given to motivation and control in a particular
classroom. This ratio is a measure of relative balance
between Indirect and Direct influence behavioural pattern
within the Teacher Talk. This ratio is obtained by dividing
the total of the frequencies in columns 1, 2, 4, 9 and 10
by the total sum of the 1, 2, 3, 4, 9, 10, 11, 12, and 13.
This ratio clearly indicates the nature of the teacher
influence i.e. Indirect or Direct.

Flow Pattern Diagram

In the matrix, there are two types of cells namely
'Steady-State Cells' and 'Transition Cells'. The Steady
State Cells lie on the diagonal from upper left to lower right
of the matrix. All the sequential pairs in which the two
number \( [1-1, 2-2, \ldots] \) being identical, are tabulated in
Steady State Cells. All the other cells are transition cells.
The Flow Pattern Diagram indicates the mutual relationship
among the Steady State Cells and the Transition State Cells.

This diagram is based on the fact that the communication is represented by steady state cells of the only one type while the transition cells represent the transition with other cells. The load of steady state cell represents time spent on that particular activity or category and the load of transition cell represents the change of one type of communication or category to the other type of communication.

**COMPUTATION OF OBSERVATION MATRIX**

**Behaviour Ratios**

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Symbol</th>
<th>Description for Computation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Percent Tr. (Teacher) Talk</td>
<td>PTT</td>
<td>$\frac{1+2+3+4+5+9+10+11+12+13}{N} \times 100$</td>
</tr>
<tr>
<td>2. Percent of Tr. Lecture</td>
<td>PTL</td>
<td>$\frac{Col. 5}{N} \times 100$</td>
</tr>
<tr>
<td>3. Indirect Tr. Talk</td>
<td>ITT</td>
<td>$\frac{1+2+9+10}{N} \times 100$</td>
</tr>
<tr>
<td>4. Direct Tr. Talk</td>
<td>DTT</td>
<td>$\frac{3+4+5+11+12+13}{N} \times 100$</td>
</tr>
<tr>
<td>5. Teacher Question Ratio</td>
<td>TQR</td>
<td>$\frac{Col. 4}{N} \times 100$</td>
</tr>
<tr>
<td>6. Teacher Response Ratio</td>
<td>TRR</td>
<td>$\frac{1+2+3+9+10}{1+2+3+9+10+11+12+13} \times 10$</td>
</tr>
<tr>
<td>7. Praise &amp; Acceptance Ratio</td>
<td>PAR</td>
<td>$\frac{Col. 1}{1+2+3+4+5+9+10+11+12+13} \times 10$</td>
</tr>
<tr>
<td>8. Percent Pupil Talk</td>
<td>PPT</td>
<td>$\frac{6+7+8+17+18}{N} \times 100$</td>
</tr>
<tr>
<td>9. Pupil Initiation Ratio</td>
<td>PIR</td>
<td>$\frac{Col. 7}{6+7+8+17+18} \times 100$</td>
</tr>
<tr>
<td>Ratio</td>
<td>Symbol</td>
<td>Description for Computation</td>
</tr>
<tr>
<td>-------------------------------------------</td>
<td>--------</td>
<td>------------------------------------------------------------------</td>
</tr>
<tr>
<td>10. Pupil Response Ratio</td>
<td>PRS</td>
<td>( \frac{\text{Col.8}}{6+7+8+17+18} \times 100 )</td>
</tr>
<tr>
<td>11. Percent Silence Ratio</td>
<td>PSR</td>
<td>( \frac{14+15+16+17+18}{N} \times 100 )</td>
</tr>
<tr>
<td>12. Pupil Steady State Ratio</td>
<td>PSSR</td>
<td>( \frac{(6-6)+(7-7)+(8-8)+(17-17)+(18-18)}{N} \times 100 )</td>
</tr>
<tr>
<td>13. Tr.Steady State Ratio</td>
<td>TSSR</td>
<td>( \frac{(1-1)+(2-2)+(3-3)+(4-4)+(5-5)+(9-9)+(10-10)+(11-11)+(12-12)+(13-13)+(14-14)}{N} \times 100 )</td>
</tr>
<tr>
<td>14. Steady State Ratio</td>
<td>SSR</td>
<td>Sum of All Diagonal Cells ( \frac{N}{N} \times 100 )</td>
</tr>
<tr>
<td>15. Transition State Ratio</td>
<td>TSR</td>
<td>Sum of All cells Ex.Diagonal cells ( \frac{N}{N} \times 100 )</td>
</tr>
<tr>
<td>16. Indirect/ Direct</td>
<td>I/D</td>
<td>( \frac{1+2+9+10}{5+4+5+11+12+13} )</td>
</tr>
</tbody>
</table>

**BROAD ELEMENTS**

<table>
<thead>
<tr>
<th>Element</th>
<th>Computational Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Structuring the Teaching</td>
<td>Sum of 1+2+3+4+5</td>
</tr>
<tr>
<td>2. Structuring the Learning</td>
<td>Sum of 6+7+8</td>
</tr>
<tr>
<td>3. Structuring the Material</td>
<td>Sum of 9 + 10</td>
</tr>
<tr>
<td>4. Structuring the Classroom Control</td>
<td>Sum of 11+12+13+14</td>
</tr>
<tr>
<td>5. Structuring the Silent Activities</td>
<td>Sum of 15+16+17+18</td>
</tr>
<tr>
<td>6. Confusion</td>
<td>Sum of 19 + 20</td>
</tr>
</tbody>
</table>
OBSERVERS 'RELIABILITY'

According to Gage, the term 'Reliability Coefficient' refers to the correlation to be expected between scores based on observations made by different observers at the same time or by the same observer at different times. The correlations between scores based on observations made by different observers at the same time will be referred to as a coefficient of 'Observer Agreement'. A correlation between scores based on observations made by the same observer at different times will be referred to as 'Stability Coefficient'.

Here we have computed 'Observer Agreement' and 'Stability Coefficient' by using the Scott's formula.

A method of estimating reliability should be as simple and quick to calculate as possible. Bales (1950), proposed the adaption of chi-square which was found to be less appropriate for our purposes than was Scott's (1955) Coefficient. Scott's method is unaffected by low frequencies and can be adapted to percent figures. It can be estimated more rapidly in the field and is more sensitive at a higher level of reliability (2).

Scott's (15) coefficient provides a simple and quick method of estimating intra and inter observer reliability.

Scott calls his coefficient 'pi'. The formula is

\[
(\text{reliability}) \ 
\frac{1}{T} = \frac{P_o - P_e}{1 - P_e}.
\]
\( P_0 \) represents the proportion of agreement between two observers and \( P_e \) represents the agreement between two observers that occurs simply by chance. Which is found by squaring the proportion of tallies in each category and summing these over all categories.

\[
P_e = \sum_{i=1}^{k} P_i^2
\]

where \( P_i \) is the proportion of tallies falling into each category and \( k \) is the number of categories.

Scott's formula states that reliability is equal to the amount that two observers exceeded chance agreement divided by the amount that perfect agreement exceeds chance(2).

\[
= \frac{\text{Total agreement between observers - chance agreement}}{\text{Greatest possible agreement - chance agreement}}
\]

The description of the statistical techniques employed in the present study provides the basic framework through which the treatments of findings were subjected. The detailed procedure and rationale underlying each of these are indicated in appropriate places where relevant data are presented. It is hoped that the analysis and interpretation of our findings thus obtain a suitable perspective for the appraisal of the hypotheses formulated in the study.

Validity of STBI

For a test or a battery having the sub-tests, we totally depend upon the Factorial Validity or Constructive Validity for their inter-correlations (3) of these sub-tests.
According to Anastasi:

"The factorial validity of a test in the correlations between that test and the factor common to a group of tests or other measures of behaviour." (1)

The correlations among the inter elements of the science Teacher Behaviour Inventory can be computed by following Pearson product moment method, which is used in the calculation of coefficient of correlation from raw or obtained scores (7).

$$ r = \frac{N \sum XY - \overline{X} \sum Y}{\sqrt{\left[N \sum X^2 - (\overline{X})^2\right] \left[N \sum Y^2 - (\sum Y)^2\right]}} $$

Here $X$, and $Y$ are the raw scores and $N$ is the total number of cases.

Validity with respect to External Criteria

The validity coefficients in relation to the external criteria i.e. grading of teachers done on the basis of Principal's opinion and the average scores obtained in the graduation, post-graduation and Teaching degree levels were also computed.

The details of both the type of validity and the reliability have been given in the next chapter.

The Statistical Techniques

It is obligatory on the part of a research worker
that he should be able to make either probability or logical inference concerning the tenability of his testable hypotheses. The acceptance or rejection of these hypotheses will ultimately determine the contribution of the investigation in the scientific development of a particular area. This is especially true for statistical techniques in the analysis for interpretation of the data.

Statistics which in the present century have made such contribution to the methodology of behavioural sciences are now a prerequisite of most researches.

Completion of any scientific analysis is possible only with the use of some form of statistical processing. This may involve depicting differences by complicated inferential statistics, such as the analysis of variance or by simple comparison obtained by counting the number of occurrence. The statistical analysis should be planned well in advance for their application. Each statistical method is based upon its own specific assumption regarding the sample population and research conditions. These factors are considered in advance. Both types of statistical methods were used for interpreting and inferring the results. Data was collected on the specially designed sheets (Appendix I), one for each teacher. The data were gathered according to sub-group wise and finally combined in the form of Master or Pooled matrices. The findings were drawn on sub-group wise and compared. The box diagrams or flow pattern diagrams were also prepared. Following statistical measures were used for drawing
the findings:

1. Tabulated tallies in the form of matrix.
2. Computed Behaviour Ratios
3. Correlations.
4. Applied mean, Standard Deviation and 't'-test for measuring the significance of the differences.
5. Determined the reliability and validity using known techniques.
6. Determined the mathematical structure of S.T.B.I. through factor analysis.

In this chapter, 'About the Study', a complete picture of methodology, sample, procedure, tools, reliability, validity and the statistical techniques used had been discussed. In the next chapter, the applications of Science Teacher Behaviour Inventory in Macro and Micro-teaching situations and personality correlates of teacher behaviour have been presented for the analysis of teacher behaviour of Science teachers.
REFERENCES


13. Scott, William A. 'Reliability of Content Analysis' The case of Nominal Scale Coding 'Public Opinion Quarterly' No. 19 (1955)

14. Thurston, L.L. 'Current issues in factor Analysis' 'Psychological Bulletin' No.37 (1940)