

CHAPTER - III

METHOD AND PROCEDURE

3.0.0 Introduction

This chapter discusses, in brief, the methodology employed in the present study. In order to achieve the objective, namely, "To identify a set of desirable teaching competencies of physics teachers of Standard IX", two approaches were adopted. First, the different presage, process and product variables of teaching were measured and factor analysed to arrive at the set(s) of desirable teaching competencies. Second, the views expressed by students about their physics teacher were content analysed and a profile of a competent physics teacher was developed. The purpose of adopting the second approach was to validate the competencies identified through the first approach and make the results and their interpretation more meaningful and comprehensive.

The different variables included in the study are as follows: four presage variables, 86 teacher behaviours under the process variable and one product variable. The details of these variables are presented in Table 3.1.

TABLE 3.1
THE VARIABLES UNDER STUDY

Sr.No.	Presage Variables	Process Variables	Product Variables
1.	Teacher's intelligence		Students' liking for their teacher
2.	Teacher's attitude towards teaching	86 behaviours exhibited by the teacher in the classroom	
3.	Teacher's interest in teaching		
4.	Teacher's self perception of his classroom behaviour		

The study was conducted at two stages, namely the pilot study and the final study. The pilot study enabled standardisation of the tools constructed by the investigator and also provided guidelines for conducting the final study.

The details of the sample, the tools, the guidelines for the final study, the collection of data and the statistical techniques employed are described in the following paragraphs.

3.1.0 The Sample

As the study required the actual teaching-learning situation, a live classroom was the unit of sample. The population of the study consisted of all teachers of Standard IX teaching physics through the medium of English and their

students engaged in this teaching-learning process in all secondary schools of the city of Bangalore. The details of samples drawn for the pilot and the final studies are given below.

3.1.1 The Sample for the Pilot Study

The city of Baroda was chosen for the pilot study as the investigator was stationed there ~~are~~^{at} the time of conducting this study. The two urban areas, i.e., the cities of Bangalore and Baroda compared sufficiently with each other with regard to the educational aspects such as the types of schools, classroom conditions like the physical equipment, the environment, the student-teacher relationship, etc., teacher characteristics such as their sex, age, qualifications, teaching experience and the like. Therefore, there was adequate ground to consider the educational environment of these two cities as comparable. Further, the investigator was not interested in comparing those attributes of these studies that would not intervene with the school system.

Five secondary schools were randomly selected for the study from among the ones which imparted instruction through the medium of English. This was done because (i) the investigator was not conversant with the regional language of Baroda, and (ii) the regional language of Bangalore was different from that of Baroda, and hence the data gathered from these two regions would not be comparable. The teachers teaching the subjects of English, science, mathematics and

social studies in the grades VIII, IX and X of these schools constituted the sample of teachers. A rationale for restricting the sample in the final study to physics teachers of Standard IX is provided in the caption 3.3.0. Some teachers could not be included in the sample because of their unwillingness to participate in the study. Ten to 15 students from the classes of each teacher were randomly selected to comprise the sample of students. In all, 23 teachers from five secondary schools and their 241 students were included in the pilot study.

The schoolwise and gradewise composition of these teachers and their students involved in the study is schematically presented in Table 3.2.

TABLE 3.2
SCHOOLWISE AND GRADEWISE COMPOSITION OF TEACHERS
AND STUDENTS

Sr.No.	Name of the School	Grade	Number of Teachers	Number of Students
1.	Experimental School	IX	1	10
2.	Rosary School	VIII	5	50
3.	Baroda High School	VIII	1	10
		IX	2	20
		X	2	20
4.	Navrachna High School	VIII	2	20
		IX	1	10
		X	3	21
5.	Sanskar High School	VIII	2	31
		IX	1	18
		X	3	31
Total			23	241

Of the 23 teachers, 12 were male and 11, female. Their age ranged from 23 to 50 years, and their teaching experience from 3 to 20 years. All of them were trained graduates.

3.1.2 The Sample for the Final Study

To begin with, a list of all the secondary schools imparting instruction through the medium of English in the city of Bangalore was made. Using the technique of random sampling, 100 schools from the list were chosen. In this selected sample, all types of schools, i.e., government/private, aided/unaided, and boys/girls/mixed were included. The physics teachers of Standard IX in these schools constituted the sample of teachers.

A classroom where the teachers and students were engaged in the teaching-learning process was taken as the sampling unit. Each teacher was observed in a class only once irrespective of how many sections of Standard IX he taught physics. This was done, because it was assumed in this study that the behaviour generated by the same teacher in the different sections would be the same as a result of the homogeneity of the sections in respect of pupils' ability, their socio-economic status, the classroom environment, the physical equipment, etc. Thus, the teaching-learning situations considered in this study were mutually exclusive with respect to the teachers and students.

Majority of the schools had more than one section in Standard IX. In many of these schools, more than one teacher taught physics to these different sections. Therefore, the total number of teachers that taught physics in these 100 schools was 160. But only 130 teachers from 79 schools were included in the final sample because some teachers were reluctant to participate in the study.

The list of schools and the number of teachers from each of these schools that constituted the sample is provided in Appendix A.

Of the 130 teachers, 71 were male and 59, female. All of them were trained graduates, some of them possessing higher qualifications. Their age ranged from 21 years to 50 years, and their teaching experience from one through 30 years. The different details about these teachers are schematically presented in Tables 3.3, 3.4 and 3.5.

TABLE 3.3
AGEWISE AND SEXWISE COMPOSITION OF TEACHERS

Age in years	S e x		Total	Percent
	Male	Female		
46-50	5	5	10	7.6
41-45	11	11	22	16.9
36-40	17	9	26	20.0
31-35	14	13	27	20.8
26-30	22	15	37	28.5
21-25	2	6	8	6.2
Total	71	59	130	100

TABLE 3.4

DISTRIBUTION OF QUALIFICATIONS OF TEACHERS

Qualifications	Number of Teachers	Percentage
B.Sc., B.Ed.	93	71.5
B.Sc., M.Ed.	14	10.8
M.Sc., B.Ed.	8	6.2
Others	15	11.5
Total	130	100.0

TABLE 3.5

DISTRIBUTION OF TEACHING EXPERIENCE OF TEACHERS

Teaching Experience in years	Number of Teachers	Percentage
26-30	2	1.5
21-25	4	3.1
16-20	17	13.1
11-15	37	28.5
6 -10	34	26.2
1 - 5	36	27.6
Total	130	100.0

For collecting data regarding the students' liking for their teacher on the Student Liking Scale, 15 to 20 students from each of the 130 classrooms were randomly selected to form the sample of students. Thus, in all, 2305 students participated in the study.

Based on the mean student liking score for each teacher, ten teachers that were liked best and ten that were disliked most by their students were chosen. From each of the classrooms of these 20 teachers, five students were randomly selected to constitute a second sample of students. These 100 students were interviewed on a semi-structured Interview Schedule to gather data regarding their views about their physics teacher.

3.2.0 The Tools

In all, seven tools were used to collect data regarding the different presage, process and product variables. The description of each of these tools is given below.

3.2.1 The Standard Progressive Matrices, Sets A, B, C, D and E

This test prepared by Raven (1960) is a test of ^aperson's capacity ^{at} ~~of~~ the time of the test to apprehend meaningless figures presented for his observation, see the relations between them, conceive the nature of the figure completing each system of relations presented and, by so doing, develop a systematic method of reasoning.

By itself, this is not a test of 'general intelligence' but of observation and clear thinking. Since this is an essential aspect of intelligence, the word 'intelligence' is used to mean 'observation and clear thinking' in this report for purposes of brevity and simplicity.

The test was administered to all the 130 teachers in the sample according to the instructions provided in the guide to the test. The record forms were marked with the help of the marking key. The total score obtained for each teacher provided a measure of his ability to observe and think clearly. A sample of a record form and the marking key are provided in Appendix B.

3.2.2 Teacher Attitude Scale

This scale standardised by Grewal (1975) is a test of an individual's attitude towards teaching in general. In all, seven sub-scales have been used to measure the person's attitudes towards (i) teaching profession, (ii) professional growth, (iii) school students, (iv) methods of teaching, (v) school discipline, (vi) co-curricular activities, and (vii) self concept.

The scale consists of 70 statements, 49 positive and 21 negative, related to the above mentioned areas. Responses to each statement are given on a six point scale. For a positive statement, a weight of six is given to strongly agree and a weight of one to strongly disagree. For the negative

statements, the scoring is reversed. Scoring is done on the basis of scale-product technique which consists of ascertaining the weight of each response ^{is} first and then multiplying the same with the scale value of that statement (See Appendix C for a copy of the scale, the scoring key and the scale values of each statement). The total score on all the statements yields a measure of a person's attitude towards teaching.

The factorial validity of the scale has been established by administering it to 200 trained graduate teachers and factor analysing the data. Correlation coefficients of inter-subareas range from 0.29 to 0.60. The split-half reliability coefficients for the seven sub-scales and the entire scale range from 0.39 to 0.99. The re-test reliability coefficients of the test range from 0.10 to 0.79.

In this study, only the total score on the entire scale is considered because the purpose of the investigator was not to probe into the measures of attitude towards every area of teaching but towards teaching in general.

3.2.3 Interest Inventory for Teachers

This inventory standardised by Grewal (1975) is a test which measures the teaching interests of an individual. In all, seven sub-scales have been used to measure a person's interest in different areas of teaching. They are (i) teaching interests, (ii) interest in students, (iii) literary interests, (iv) co-curricular interests, (v) medical interests, (vi)

scientific interests, and (vii) artistic interests.

The inventory consists of 50 positive statements related to the above mentioned seven areas. Responses to each statement are given on a five point scale. The statement is scored according to the method of summated ratings ranging from a weight of five for strongly liked through a weight of one for strongly disliked. The total score on all the statements provides a measure of a person's interest in teaching (see Appendix D for a copy of the inventory and the scoring key).

The factorial validity of this inventory has been established by administering it to 520 trained graduate teachers and factor analysing the data. The range of loadings in factor I is found to vary from 0.71 to 0.99 which indicates that this factor accounts for about 98 percent of the common variance. The split-half reliability coefficient of the test is 0.88 and the re-test reliability coefficients range from 0.58 to 0.82 for the different sub-scales.

In this study, only the total score on the entire inventory is considered because the purpose of the investigator was not to probe into the measures of interest in different areas of teaching but only teaching in general.

3.2.4 Observation Schedule

This schedule was used to gather data related to the teacher classroom behaviour. It was constructed and

standardised by the investigator in the pilot study. Therefore, in this section, the details of the construction and standardisation procedures of this tool are discussed in detail. This tool has been discussed prior to the Teacher's Self Rating Scale (TSRS), an other tool to measure a presage variable, because the Observation Schedule formed the basis for the construction of the TSRS. The specific aspects discussed here are, a rationale for constructing the tool, the format, the observation and scoring procedures, the training of observers, the standardisation of the tool and the final form of the schedule.

A number of coding systems have been developed by educators interested in describing relevant classroom interactions (Medley and Mitzel, 1963; Simon and Boyer, 1970). These systems vary greatly in their specificity of teaching behaviours. Some focus on the affective climate of the classroom (Flanders, 1970), while others focus on the cognitive demands made by the teachers (Lynch and Ames, 1971), teacher control behaviours (Fink and Semmel, 1971), teaching strategies (Bellack et al. 1966), nonverbal behaviours (Galloway, 1968), and a host of other interactive behaviours.

These systems, while they have an intrinsic appeal to the researchers, also have certain drawbacks. Most of them use high inference variables with ambiguous terminologies and global definitions. Little attention has been given to the development of concurrent and explicit low inference definitions of the behavioural parameters of these concepts.

Some systems, however, have been constructed with highly specific teacher behaviours, but they restrict themselves to very few of them, thus limiting the degree of their applicability to research situations. A few systems concentrate on only verbal behaviours of the teachers, while others, only on nonverbal behaviours.

For the present study, no observational instrument from among the existing systems could be selected because the study purported to identify factorial structures of teaching competencies from a wide variety of presage, process and product variables. It necessitated, to begin with, analysing the complex act of teaching into discrete components called teacher behaviours. Gage (1968) also advocates such a strategy of analytical ^a approach to teaching. By adopting such a strategy, according to him, teaching is analysed into limited and rather well defined components that can be taught, practised, evaluated, predicted and controlled in new ways. Gage and his associates (Gage, 1968) are making teaching skills the basis for research on teaching. Gage (1963) has further pointed out, "..... Many scientific problems have eventually been solved by being analysed into smaller problems whose variables are less complex." Perhaps a 'micro approach' to even competence research will reduce the complexities of the problem.

Dellinger (1974) also emphasises the need for educational research to provide the teacher with conceptual models which are (i) more comprehensive in nature (account for more variables) and (ii) more process oriented.

Thus, based on the above propositions, an observational instrument which consisted of almost an exhaustive list of low inference verbal and nonverbal teacher classroom behaviours was constructed for the present study.

To begin with, a list of teacher behaviours was made with the help of the teaching skills and their components. These teaching skills, conceptualised by Passi (1976) and De Sales (1976) at the Centre of Advanced Study in Education, Baroda, purported to achieve a specific purpose when performed by the teacher in the classroom. In all, 85 verbal and non-verbal teacher behaviours were included in the Schedule which could be clustered into 15 teaching skills. The number of teacher behaviours (or components) under the different skills was not necessarily the same. The actual distribution of teacher behaviours under the different skills is visually represented in Table 3.6.

The teachers were intimated beforehand about the nature and purpose of observation and willingness on their part was ensured. Students were also informed about the purpose of observation and were assured that the data gathered would be kept highly confidential. This enabled both the teachers and students to behave in a manner they would behave otherwise. No other formal and systematic effort was made to minimise the observer-presence-effect. Moreover, it is realised that a teacher cannot do what she cannot do. She cannot be 'adaptable' if she has not learned to be adaptable (Ryans, 1960). Observers seem to have little effect on the situations they

TABLE 3.6

DISTRIBUTION OF TEACHER BEHAVIOURS UNDER THE
DIFFERENT TEACHING SKILLS

Sr.No. Teaching Skill	No.of teacher behaviours
1. Introducing a lesson	4
2. Fluency in questioning	7
3. Probing questioning	5
4. Explaining	8
5. Stimulus Variation	7
6. Silence and nonverbal cues	5
7. Pacing the lesson	4
8. Using audio-visual aids	6
9. Illustrating with examples	5
10. Using blackboard	4
11. Reinforcement	5
12. Achieving closure	4
13. Recognising attending behaviour	4
14. Classroom management	11
15. Giving assignment	6
Total	85

observe (Heyns and Lippitt, 1954). Kerlinger (1973) also points out that individuals and groups seem to adapt rather quickly to an observer's presence and to act as they would usually act. But he cautions the researchers by saying, "..... if the observer takes care to be unobtrusive and not to give the people observed the feeling that judgments are being made, then the observe^r as an influential stimulus is mostly nullified."

The sampling unit of observation was the occurrence of a teacher behaviour. The 85 behaviours on the schedule constituted the 85 categories. The observer sitting behind the pupils in the last row in the classroom, put a tally against the behaviour as it occurred while a teacher taught in the classroom. Apart from this, she also recorded qualitative comments about the performance of the teacher with respect to each behaviour in symbolic form whenever possible. This was only an additional information the observer gathered and not a prerequisite of the schedule.

To have data comparable among all the observations, each class was observed for a period of 30 minutes irrespective of how many behaviours occurred. At the end of the 30 minutes, a score for each of the 85 categories was given based on the tallies and the qualitative comments, if any. These scores ranged from one to seven, one denoting very poor performance of the teacher with respect to a particular behaviour and seven denoting very good performance with respect to that behaviour. Thus, it resulted into 85 scores on 85 behaviours

for every observed teacher. A copy of the Observation Schedule and the scoring key are provided in Appendix E.

Serious attention was given to the training of the observers since this tool could not be used by untrained observers. Prior to actual observation, the investigator and an other researcher working in the area of teaching competency discussed and clarified with each other the definitions of each of the categories, the method of observation and scoring procedure. After making sufficient preparations to this end, many preliminary observations of different teaching situations in school classrooms were made. The scores for each behaviour on the schedule were compared between the two observers to see the extent of agreement. When the two observation assessments did not show much discrepancy, the observations of the teachers in the sample of the pilot study were made. This resulted in 85 scores on 85 categories for each observer for the 23 teachers.

From these data, the Scott's coefficient of reliability for inter-observer agreement was computed for these teachers, and it ranged from 0.78 to 0.82. The content validity was established by giving it to ten teachers in the sample and other experts working in the area of teaching and implementing their suggestions in the schedule. It was seen that over a large sample of classroom observations, no behaviour of the teacher was unrecorded on the schedule. This indicated to the investigator that the tool, by and large, consisted of all the behaviours that the teachers would normally exhibit

in a secondary school classroom. Nevertheless, the investigator was aware of the fact that the behaviours in the schedule were by no means exhaustive.

Based on the suggestions of the teachers and experts, and experiences of the investigator gained during the pilot study, some modifications were made in the final form of the Observation Schedule. They are discussed below.

It was observed that some behaviours in the Schedule were repeated because the teacher could achieve different purposes by exhibiting the same behaviour. For example, the behaviour 'pausing' could be used either for drawing and sustaining the attention of the students or for maximising pupil participation. But when this behaviour occurred in the classroom, the observer, more often than not, was unable to judge the intent behind such a behaviour. She, therefore, put a tally against that behaviour in as many places as it was repeated in the Schedule. This gave rise to inflated and biased data. Therefore, in the revised Schedule, such a behaviour was retained under only one skill.

Since all the behaviours under the skill of silence and nonverbal cues were repeated elsewhere in the Schedule, this skill was excluded from the final form. Hence the revised Schedule consisted of fourteen skills.

Some behaviours were not explicit and, hence, they were further analysed into more discrete but meaningful behaviours.

Some behaviours were shifted from under one skill to the other depending on the purpose they achieved. For example, the behaviour 'redirecting questions to pupils' helped the teacher draw and sustain their attention better than probe into the answers of a pupil. Therefore, this behaviour was shifted under the skill of stimulus variation.

With these modifications, the final form of the Schedule consisted of 86 well defined categories that could be clustered into 14 teaching skills and that were mutually exclusive. On this Schedule, any behaviour of the teacher resulted in only one tally against that behaviour. The distribution of teacher behaviours under the different skills in the revised Schedule is given in Table 3.7.

Using the revised Observation Schedule, the 130 teachers in the sample of the final study were observed in their classrooms. The observation and scoring procedures were the same as those followed in the pilot study. Thus, data regarding the 86 behaviours of the 130 teachers were gathered. A copy of the revised Observation Schedule along with the ^{Scoring key and the} operational definitions of each of the categories is provided in Appendix F.

3.2.5 Teacher's Self Rating Scale

This scale, developed by the investigator, is a test which measures the self concept of a teacher about his teaching behaviour in the classroom.

TABLE 3.7

DISTRIBUTION OF TEACHER BEHAVIOURS UNDER THE
DIFFERENT TEACHING SKILLS

(The Final Form)

Sr.No.	Teaching Skill	No.of Teacher Behaviours
1.	Introducing a lesson	4
2.	Fluency in questioning	8
3.	Probing questioning	4
4.	Explaining	7
5.	Stimulus variation	11
6.	Pacing the lesson	5
7.	Using audio-visual aids	9
8.	Illustrating with examples	6
9.	Using blackboard	4
10.	Reinforcement	5
11.	Achieving closure	3
12.	Recognising attending behaviour	2
13.	Classroom management	11
14.	Giving assignment	7
		—
	Total ...	86
		—

The first draft of the scale consisted of 15 statements related to the 15 teaching skills constructed in the first person. Each statement is in terms of the attainment of a purpose for which a teaching skill is intended. Under each statement is the specification of teacher behaviours (in other words, components of the skill) through the performance of which that purpose would be achieved by the teacher. These teacher behaviours have one - to - one correspondence with those in the Observation Schedule that was used to observe the actual teacher classroom behaviour. The teacher would have indicated on completing the scale the extent to which he thinks he achieves the intended purpose by exhibiting a particular skill.

Every teacher would indicate the degree of self perception about his teaching behaviour as many number of times as there are behaviours under each statement. Therefore, each behaviour is followed by a five point scale ranging from strongly agree to strongly disagree. The weightage given is from five for strongly agree through one for strongly disagree. The total score for each statement is the total of these weights given to each of the behaviours under that statement. This score yields a measure of teacher's self perception of that particular skill. Thus, this scale provided 15 scores on 15 variables in the pilot study.

For standardising this scale, it was administered to the 23 teachers in the sample of the pilot study and data regarding the 15 variables were gathered for all the teachers.

The split-half reliability coefficient of the scale was computed by using the Spearman-Brown Prophecy Formula and it was found to be 0.91. The validity of the tool was determined by interviewing ten teachers in the sample and other experts working in the area of teaching and ensuring if the statements in the scale were understood by them as they were meant to be understood. A copy of the first draft of this scale and the scoring key are provided in Appendix G.

Since the behaviours on this scale and those on the Observation Schedule had a heavy overlap, any change in the Schedule resulted in a concomitant change in this scale. Therefore, the final form of the Teacher's Self Rating Scale consisted of 14 statements related to the 14 teaching skills that were included in the final form of the Observation Schedule. Alongside, suggestions given by the teachers and other experts were implemented and this resulted in slight modifications in the statements.

The final form of this scale was administered to the 130 teachers in the sample of the final study and data regarding the 14 teaching skills for these teachers were gathered. A copy of the final form of the Teacher's Self Rating Scale alongwith the scoring key is given in Appendix H.

3.2.6 Student Liking Scale

This scale, developed by the investigator, was used

to collect data from the students regarding the extent to which they like their physics teacher.

The first draft of the scale consisted of 16 statements, 15 positive and one negative, related to the 15 teaching skills included in the first draft of the Observation Schedule. The statements are preceded by a phrase, "I like/do not like my teacher because....." They are in the form of effects the teacher would produce on them as a result of performing the various teaching skills. Item numbers 11 and 12 constitute two aspects of one skill and therefore are considered one. The student would indicate on this scale the extent of his liking for his teacher that he has developed on account of the effects the teacher has produced on him by performing the teaching skills. The scale does not include other aspects of the teacher that may result in the student's liking for him. A provision has been made at the end of the scale for the students to write any other comment regarding their physics teacher.

Each statement is followed by a five point scale ranging from strongly agree to strongly disagree. For positive statements, a weight of five is given for strongly agree and a weight of one for strongly disagree. For the negative statement, the weightage is reversed. The score on each statement is a measure of the student's liking for his teacher for that particular skill. The scores on item

numbers 11 and 12 are added to give a composite score, since they denote two aspects of the same skill. Thus, this scale provided 15 scores on 15 variables in the pilot study. A copy of the first draft of the Student Liking Scale along with the scoring key are given in Appendix I.

For standardising this scale, it was administered to the 241 students in the sample of the pilot study and data regarding the 15 variables for all the students were gathered. The split-half reliability coefficient of the scale was computed by using the Spearman-Brown Prophecy Formula and it was found to be 0.78. The validity of the tool was established by interviewing 25 students in the sample and ensuring if the statements in the scale were understood by them as they were meant to be understood.

Since the skills implicit in the statements on this scale and those included in the Observation Schedule had a heavy overlap, any change in the Schedule resulted in a concomitant change in this scale. Therefore, the final form of the Student Liking Scale consisted of 15 statements, 14 positive and one negative, related to the 14 teaching skills that were included in the final form of the Observation Schedule. Scores on item numbers 10 and 11 on this scale were added to give a composite score since they denoted two aspects of the same skill. Alongside, suggestions given by the students were implemented and this resulted in slight modifications in the statements.

Though instructions were provided in the scale to indicate to the students how they should respond, it was found in the pilot study that they needed frequent guidance while they responded to the scale. Therefore, in the final study, the investigator, through a small introduction, built a rapport with the students, ensured cooperation from them, and provided guidance wherever necessary.

The final form of this scale was administered to the 2305 students in the sample of the final study and data regarding the 14 teaching skills about the 130 teachers were gathered. A copy of the final form of the Student Liking Scale ^{along with the scoring key} is provided in Appendix J.

3.2.7 Interview Schedule

A semi-structured interview schedule was employed to gather data regarding the views of the students about their physics teachers.

This was used to obtain additional information about the teachers and also to validate the data gathered through the other tools. Ten preliminary interviews were conducted by the investigator in order to get the necessary training in the skill of conducting the interviews.

The interview centred around 14 main questions closely related to the 14 statements in the Student Liking Scale. These questions sought to know (i) to what extent the students liked their teachers on account of the effects the teachers

produced on them through the performance of the 14 teaching skills, and (ii) how exactly the teachers behaved in order to produce these effects on them. The interview was limited to only the teaching skills and their effects and not any other aspect of the teacher that may have resulted in student liking for the teacher.

The investigator, prior to the interview, with a few introductory statements, built a rapport with the students which was very necessary for a frank expression of the views on the part of the students. Though the interview centred around the 14 questions, many a time, the investigator resorted to discussion, thus enabling the students to express freely their likes and dislikes about their physics teacher.

Thus, qualitative data were gathered from the 100 students in the sample. Of these, 50 belonged to the group which liked their teachers best and 50, to the one which disliked their teachers most. Two typical interview reports, one of the best liked teacher and an other of the most disliked teacher, are provided in Appendix K.

The seven tools discussed above were used to measure the different presage, process and product variables. This yielded data, in all, on 117 variables. The details of the variables, their code and the respective tool are presented in Table 3.8.

TABLE 3.8

VARIABLES, THEIR CODE AND THE RESPECTIVE TOOL

Sr. Variable No.	Code	Tool
1. Teacher's intelligence	INT	Raven's Standard Progressive Matrices Sets A,B,C,D and E
2. Teacher's attitude towards teaching	TAS	Teacher Attitude Scale
3. Teacher's interest in teaching	IIT	Interest Inventory for Teachers
4. Teacher's self perception about introducing the lesson	TINT	Teacher's Self Rating Scale Scale
5. fluency in questioning	TQN	
6. probing questioning	TPQ	
7. explaining	TEXP	
8. stimulus variation	TSV	
9. pacing the lesson	TPAC	
10. using audiovisual aids	TAVA	
11. illustrating with examples	TIWE	
12. using the blackboard	TBB	
13. reinforcement	TRE	
14. achieving closure	TAC	
15. recognising attending behaviours	TRAB	
16. classroom management	TCRM	
17. giving assignment	TASS	
18. Teacher behaviour of using students' previous knowledge for introducing the lesson	PKG	Observation Schedule

Table 3.8 (contd.)

Sr. Variable No.		Code	Tool
19.	Teacher behaviour of using appropriate devices for introducing	APD	
20.	maintaining continuity for introducing	CON	
21.	uttering relevant statements or questions for introducing	REL	
22.	asking grammatically correct questions	GCQ	
23.	concise questions	CONQ	
24.	relevant questions	RELQ	
25.	specific questions	SPEQ	
26.	pausing after a question	PAUQ	
27.	not repeating the questions often	REPQ	
28.	not repeating students' answers often	REPA	
29.	sufficiency of the number of questions	SUFQ	
30.	prompting questions	PROQ	
31.	seeking further information questions	SFIQ	
32.	refocusing questions	REFQ	
33.	increasing critical awareness questions	ICAQ	
34.	using explaining links	LINE	
35.	using beginning and concluding statements	BCSE	
36.	avoiding irrelevant statements	RELE	
37.	maintaining continuity in the sequence of ideas	CONE	

Table 3.8 (contd.)

Sr. Variable No.	Code Tool
38. Teacher behaviour of using appropriate vocabulary	VOCE
39. speaking fluently	FLUE
40. avoiding vague words and phrases	VAGE
41. pausing to draw and sustain attention	PAUS
42. using facial cues	FACS
43. using head movements	HEMT
44. using hand movements	HAMT
45. moving purposefully in the class	BOMT
46. focusing the important points	FOCS
47. modulating the voice	MODS
48. talking with proper speed	PSS
49. redirecting the questions to different pupils	REDS
50. changing the interaction styles	INTS
51. changing the sensory channels	SCCS
52. observation of pupils to check pace	OBPA
53. asking questions to check pace	AQPA
54. making statements to check pace	SMPA
55. using pace reducing techniques	PRT
56. using pace increasing techniques	PIT
57. using realistic aids	RAV

Table 3.8 (contd.)

Sr. Variable No.	Code Tool
58. Teacher behaviour of using big enough aids	BAV
59. using aids which are authentic and uptodate	AUAU
60. moderately used aids	MOAV
61. sequenced aids	SEAV
62. integration of aids	INAV
63. aids used at the appropriate time	APAV
64. provided in a proper atmosphere and environment	PAAV
65. cognizance of individual differences of pupils	IDAV
66. illustrating with simple examples	SEG
67. examples relevant to the concept or rule	REG
68. interesting examples	INEG
69. appropriate media	AMEG
70. appropriate approach	AAEG
71. sufficiency of the number of examples	SFEG
72. legible writing on the black-board	LBB
73. neat writing on the black-board	NBB
74. appropriateness of written work	APBB
75. organisation of the black-board work	ORBB
76. using positive verbal reinforcement	PVRE

Table 3.9 (contd.)

Sr. Variable No.		Code	Tool
77.	Teacher behaviour of using positive non-verbal reinforcement	PNRE	
78.	avoiding negative verbal reinforcement	NVRE	
79.	avoiding negative nonverbal reinforcement	NNRE	
80.	avoiding inappropriate use of reinforcement	IARE	
81.	consolidating the major points	CONS	
82.	providing opportunities for application	APPL	
83.	linking students' previous knowledge with new knowledge	PKNK	
84.	observation of verbal and non-verbal behaviour	ORAB	
85.	asking questions to recognise attending behaviour	AQRB	
86.	making a beginning statement for classroom management	BSCM	
87.	planning for the day's lesson beforehand	PLCM	
88.	giving directions for classroom management	GDCM	
89.	rewarding their attending behaviour	RACM	
90.	making them assume responsibility	ARCM	
91.	ignoring minor misbehaviour	IMCM	
92.	changing the teaching strategy	TSCM	
93.	giving scope to ask questions and clarify doubts	SQCM	

Table 3.8(contd.)

Sr. No.	Variable	Code	Tool
94.	Teacher behaviour of accepting feelings and/or ideas of pupils	AFCM	
95.	controlling emotions	CECM	
96.	avoiding threats of punishment	ATCM	
97.	motivating them while giving assignment	MASS	
98.	defining the objective of the assignment	DOAS	
99.	considering individual differences among pupils	IDAS	
100.	setting appropriate time limit	TLAS	
101.	giving it at the proper stage of the lesson	PSAS	
102.	providing opportunities for applying the new knowledge	APAS	
103.	supervision of the assignment	SPAS	
104.	Student liking for introducing the lesson	SINT	Student Liking Scale and Interview Schedule
105.	questioning	SQN	
106.	probing questioning	SPQ	
107.	explaining	SEXP	
108.	stimulus variation	SSV	
109.	pacing the lesson	SPAC	
110.	using audiovisual aids	SAVA	
111.	illustrating with examples	SIWE	
112.	using the blackboard	SBB	
113.	reinforcement	SRE	

Table 3.8 (contd.)

Sr. Variable No.		Code	Tool
114.	Student liking for achieving closure	SAC	
115.	recognising attending behaviours	SRAB	
116.	classroom management	SCRM	
117.	giving assignment	SASS	

3.3.0 Guidelines for the Final Study

It was observed in the pilot study that there were some typical behaviours exhibited by the teacher in relation to certain subjects and certain grades. Combining the data regarding many subjects at different grades would conceal information crucial to a particular grade or subject matter or both. Further, factor analysing such data would only give rise to global teaching competencies that may not prove of much use to the educationist or the practitioner^{ti}. Therefore, the final study was restricted to only one grade and one subject matter.

Further, physics was chosen for the study, because the investigator was more conversant with this subject than any other. This enabled her to make the classroom observations more confidently.

Standard IX was chosen for the study for two reasons: (i) During the observations in the VIII grade classrooms, it was noticed that few of the students who had studied through the medium of their regional language till Standard VII had difficulty in understanding some of the concepts in physics. At such moments the teacher resorted to the regional language and explained the terminologies. This was a drawback for the observer in that she could not record the verbal behaviours of the teachers since she was not conversant with the regional language. (ii) As the pupils of Standard X were to appear in the examination conducted by the State Board of Secondary Education, the entry of an observer into their classrooms was considered a disturbance and in many of the schools the principals were reluctant in this regard.

These difficulties did not exist with regard to Standard IX. Therefore, this grade was chosen for this study.

3.4.0 The Collection of Data

The tools described in 3.2.0 were used to collect the data regarding the different variables. The different stages of data collection are as follows:

- (i) All the 130 teachers were observed once by trained observers in the actual classroom situation using the Observation Schedule. This resulted in data on 86 variables.

- (ii) 15 to 20 students in each of the 130 classrooms were randomly selected and asked to complete the Student Liking Scale. This yielded data on 14 variables.
- (iii) The 130 teachers provided information on the Standard Progressive Matrices, Sets A, B, C, D and E, Teacher Attitude Scale, Interest Inventory for Teachers and Teacher's Self Rating Scale. This provided data on 17 variables (1+1+1+14).
- (iv) 100 students of whom 50 belonged to the group which liked the teacher best and 50 which disliked the teacher most were interviewed on the Interview Schedule. This provided additional data about the students' liking for their teacher.

The tools employed, the number of variables studied and the respective sample are presented in Table 3.9.

3.5.0 The Statistical Techniques Employed

To study the factorial structure of teaching competencies, the principal-component method of factor analysis was employed. The factors thus extracted were rotated through the varimax method for a meaningful interpretation of the factors.

TABLE 3.9

THE TOOLS USED, THE NUMBER OF VARIABLES STUDIED AND
THE SAMPLE OF THE STUDY

Sr.No.	Tool	Variable	Sample	Total number of variables
1.	The Standard Progressive Matrices, Sets A, B, C, D and E	Presage	Teachers	1
2.	Teacher Attitude Scale	Presage	Teachers	1
3.	Interest Inventory for Teachers	Presage	Teachers	1
4.	Teacher's Self Rating Scale	Presage	Teachers	14
5.	Observation Schedule	Process	Teaching learning situation	86
6.	Students' Liking Scale	Product	Students	14
7.	Interview Schedule	Product	Students	
	Total	117

The views expressed by the students about their physics teacher in response to the open ended question in the Student Liking Scale and the interview were content analysed in order to develop a profile of a competent physics teacher.
