INTRODUCTION

Teacher effectiveness, according to N.L. Gage (9), predominently concerns the field of teaching. Valid criteria in this area may revolutionise our present day educational systems all over the world. Inspite of many diverse researches in this field, no standards have been, so far, laid down for predicting teacher effectiveness. According to Biddle & Ellena (4) decisions in this area are taken mostly on the basis of past experience and intuition. The study on teacher effectiveness is largely contradictory and inconsistent. Currently, we are not in the know of a correct procedure how to select as well as to encourage. The same applies to assessment and training for teacher effectiveness (4 p.vi).

While reviewing the studies in this area, one comes across the following modified paradigm:

| Potential Relationships | Variables on Teacher Effectiveness |
The dependent variable in this paradigm is the variables on Teacher Effectiveness, and the task then reduces to its measurement. It is disappointing to note that all these researches have produced disappointing results (9 p.119). The correlations can be computed between the potential relationship and the variables on teacher effectiveness. In this respect, Mitzel has suggested the paradigm (fig.No.1) for research of teacher effectiveness (9).

This paradigm describes four classes of information for researcher who seeks fundamental knowledge concerning teacher effectiveness. The paradigm makes the provision for classroom behaviours, a dominant factor in studying teacher effectiveness. Its importance is further indicated in contemporary Research on Teacher Effectiveness (4 p.20) by Biddle and Ellena.

"It is unlikely.....that significant advances will be made in understanding teacher competence (effectiveness) without a clearer picture of teacher behaviour and its effects." (4)

The actual behaviour of the classroom teacher is crucial and it does influence pupil learning. It is, therefore, necessary to devise means of observing and recording this behaviour. In this connection, Mitzel has suggested another ideal framework having four different types of elements on each of which it is essential to procure the needed information not only to clarify problems in this area but also solving them fruitfully, the frame work
suggested by him seems quite an ideal one. These elements described in terms of variables are prediction source (type one variable); contingency factors (type two variable); classroom behaviour (type three variable), and criteria of effectiveness related to intermediate educational goals. The paradigm reveals that teacher's classroom behaviour is extremely important for educational research in the area of teacher effectiveness.

It is of historical interest to mention that in the earliest attempts before World War I, Horn (13) in 1929 developed a device primarily to record students behaviour making some provision for systematically recording the teacher's classroom behaviour. Some other attempts after this are: Puckett (16) in 1929, Barr (16) in 1929, Wrightsome (24) in 1934, Anderson and Brewer (3) in 1945, Hughes & associates (1 in 1949, Withall (23) in 1949, Medley and Mitzel (17) in 1958, Flanders (15) in 1959 and again in 1963, Galloway (10) in 1962, Farakh (19) in 1965, Ober (18) in 1967, Bently and Miller (20) in 1970, Smith (20) in 1971, and Hall (20) in 1972.

Insipite of these numerous researches, there is still a need for additional research in the area of teacher classroom behaviour. There are three reasons for this:

1. Withall (23) and Flanders (8) were interested only in Verbal behaviour with the assumption that the Verbal behaviour of the teacher was an adequate sample of the teacher's total classroom behaviour.
2. Galloway (10), dealing with non-verbal behaviour of the teacher, made clear that non-verbal behaviour was not an adequate sample of the teacher's total classroom behaviour.

3. Hall makes a plea for non-verbal behaviour. It seems that one behaviour supports the other i.e. either taken separately is incomplete.

According to Mitzel (17) personality is one that makes up teacher classroom behaviour. The assumption of a relationship between person's personality, his unique pattern of traits and his behaviour is supported in literature. To quote Guilford:

"Perhaps something needs to be said in defence of our reference to personality traits as determiners of behaviour, which implies that they are 'causes'. It is not uncommon to look upon traits in this manner, refers to traits as 'determining tendencies', or long range mental sets or dispositions of readiness to behave in certain ways. To those who are reluctant to think in terms of 'causes', let us say that all we need to mean is that behaviour can be partially accounted for, or predicted by, these personal properties called traits. It is not necessary to assume that trait by themselves can bring about behaviour or even account for its properties. Behaviour does not occur without temporary instigating forces provided by drives or motives on the one hand and by external stimulation on the other. Behaviour is a joint product of temporary organic conditions, the situation, and personality traits, all operating together at the moment." (12)

DEFICIENCIES IN SCIENCE EDUCATION

Due to historical circumstances, we inherited a clerical system of education. Despite our best efforts to improve it, it is still with us in slightly altered forms. Science teaching in our country suffers from several defects.
While surveying the history of science teaching in India in his book on *Problem Solving in Science*, Vaidya (22) mentions the chief defects in our present science education programmes. These defects are as follows:

1. Science teaching, strictly speaking, is oral in character.

2. The aims and objectives of science teaching and education look grand on paper but most of them vaporize when translated into action.

3. There is no differentiated and sequential curriculum psychologically or empirically determined for various categories of students.

4. Science teaching is too much bookish. A sound concept of curriculum material is yet to develop.

5. Methods employed for science teaching are dull and void of constructive imagination.

6. The academic content of the B.Sc. degree is inadequate.

7. There is hardly any supervision and availability of expert advice in science teaching by the competent people. This difficulty increases when science is taught in the regional language.

8. There is complete block-out of research in science education.

These defects do not result solely from lack of equipment, personnel bricks and mortar. It is necessary to have a close look at the teaching-learning process which goes on in our classroom. Even this is not sufficient. First, science appears to come out of the teacher's mouth after having read the book for it lacks experiences in developing 'conceptual schemes as guides to flexible yet systematic
lesson organization', learning experiences and outcomes and organizational objectives included. A subjective decision, largely speaking to one's own classroom is included in regard to the predetermination of classroom experience. It is so because it is not at all feasible to preplan all experiences likely to be made available to the given class because some 'occur spontaneously as a result of the complex factors attending human interaction and the momentary increases of the participants'.

NEED FOR THE STUDY

Within, at least, fifteen years or so in the wake of revolution in Science Teaching, science has changed both in content and form (21). In objectives also, there appears to be a marked shift, from general objectives through specific objectives, to behavioural objectives (Anderson, 1965). Again in teaching-learning process, there is greater stress, on demonstration, experimentation and investigative projects. Here, teaching means creating situations in which children can discover concepts or structure or structured situations.

Influenced by Jean Piaget, Prof. Robert Karplus, in this connection has developed three distinct lessons, namely, exploratory lesson, invention lesson and the discovery lesson. Consider the following Mealworm Puzzle Problem in which children are complete to answer it, when posed in a multiple choice form pictorially:
Now consider the following gains:

i. Reasoning patterns used by students may be broadly classified as concrete or formal.

ii. An individual forms new reasoning patterns with the aid of self regulation, an active process of searching for and testing new ideas.

iii. The learning cycle of exploration / concept introduction / concept application can stimulate self-regulation.

It should not be lost sight of that reasons for their choice also solicited.

Specially in our country, the researches conducted in
this respect are few and negligible (5). The classroom behaviour of science teachers has been little examined in this country. However considering the present status of the literature, the statements given below reflect the need for this study:

1. A study of teacher classroom behaviour is a prime requisite for better understanding of teacher effectiveness.

2. Studies of the teacher classroom behaviour of science teachers are limited in number.

3. Most of the studies of teacher classroom behaviour are restricted to the observation of verbal or non-verbal behaviour of teachers.

4. Very few studies reported to have investigated teacher personality in relation to the classroom behaviour.

5. Few researches have been conducted in the area of micro-teaching and classroom behaviour of teachers.

The present problem is incidentally influenced to some extent by the work of Jean Piaget, one of the greatest thinker of the century. However, no explicit attempt has been made in this area. Some work in this area is in progress at R.C.E. Ajmer.

STATEMENT OF THE PROBLEM

The present problem is an extension and comprehensive work of investigator's M.Ed. dissertation. The present study is an attempt to observe, categorize and record the teacher behaviour, in regular classrooms. Second, an attempt is made to determine the relationships that exist between certain
personality traits and teacher classroom behaviour. In this study, no value judgments are made concerning the behaviours and on the selected personality traits which the teacher may exhibit. The teachers remain anonymous. It simply is an effort to prepare inductively comprehensive instrument for analyzing the classroom instruction. It is an exploratory study, undertaken to develop a Science Teacher Behaviour Inventory. In other words, the purposes of this study are as follows:

1. To develop a reliable category system for first-hand systematic observation of the classroom behaviour of science teachers.

2. To determine the relationship between selected personality traits and classroom behaviour of science teachers.

3. To find out the possibilities of using this observation system, namely STBI, in determining and analyzing the behaviour of science teachers in Macro & Micro-teaching situations.

MACRO TEACHING SITUATION

"The destiny of India is being shaped in her classrooms" (15)

Really the above statement is not merely a hyperbolic statement. It is true that average Indian students possess the capability of becoming the future destiny makers of India. Inspite of all this, our traditional classes are running on the same pattern as they were before independence. Even today the number of students in classes is increasing and usually the number varies from 30 to 60 in a class. In the same way,
the per capita load on teachers is on the increase and the improvement of teaching-learning process has proved to be a bit difficult. The size of the class, is usually 30-60 students, which is to be taught continuously or supervised for 30 to 45 minutes.

Here the meaning of Macro-teaching is mainly concerned with the same traditional classes. This sort of teaching-learning process has no room for teachers to make a creative impact on students. There is a striking balance between the two countries, namely U.S.A. and India, where one comes across the statement of John Dewey made at the beginning of this century. Lastly classroom even until now remains the private property of the teacher. To put in other words, it has remained uninvaded, especially in our country.

"The student adjusts his actual methods of teaching, not to the principles which he is acquiring, but to what he sees succeed and fail in an empirical way from moment to moment. ....In this way the controlling habits of the teacher finally get fixed with comparatively little reference to principles in the psychology, logic and history of education. In theory, these latter are dominant, in practice the moving forces are the devices and methods which are picked up through blind experimentation, through examples which are not rationalized, through precepts which are more or less arbitrary and mechanical, through advice based upon the experience of others"(2)

MICRO-TEACHING SITUATION

It would be better to recognize micro-teaching as a system of controlled practice that makes it possible to
concentrate on specific teaching under controlled conditions so as to acquire competence in one skill at a time before proceeding to another. Micro-teaching system is employed to develop classroom skills. Micro-teaching derives its name from the fact that it is an approach to train teachers in which normal teaching is scaled down. The term 'micro' denotes a reduction in the length of time of a lesson, the amount of subject matter covered and the size of the class, and teaching complexity can be reduced to develop required teaching skills. It also adds scientific implication of precision in the sense that micro-teaching makes it possible to analyze the recorded behaviour of a micro-teaching-teacher objectively (1). The lesson for microteaching is called the single concept lesson which lasts for 3 to 7 minutes. This is done with a small size group of pupils or volunteers 3 to 8 in number. The lessons are generally recorded on Audio-Video-tape with a view to reobserve teacher behaviour objectively and precisely. This helps the teacher in acquiring the "5Rs": these are recording, reviewing, responding, refining and reducing. In this way, Micro-teaching procedures help student teacher to acquire such behaviours i.e. skills which are deemed necessary to increase the effectiveness of teaching learning process.

The term 'micro-teaching' was derived by Dwight Allen (1) while he pioneered the process under the auspices of the experimental programme in teacher education sponsored by the Ford Foundation and Kettering Foundation grant to further
microteaching at Stanford University. Peck and Tucker (1973) state that microteaching is a combination of a conceptual system for identifying precisely specified teaching skills with use of video tape feedback to facilitate growth in the teaching skills. Similarly McCollum and LaDue (1976) state that microteaching is an opportunity to gain classroom capabilities and expertise before the student teacher starts entering the micro-teaching situation. Micro-teaching is essentially meant for either pre-service or in-service teachers to develop and improve upon their instructional skills. Micro-teaching was born out in 1963 but it developed very slowly. Klard (1969) in a "Survey of Microteaching in Secondary Education Programme reported that, out of 442 colleges, 141 NCATE Colleges and Universities were using microteaching. The micro-teaching cycles comprise the following steps:

- Teach $T_1$
  - View
  - Critique
  - Think
  - Structure
- Reteach $T_2$
  - Review
  - Recritique
  - Rethink
  - Restructure
- Reteach $T_3$
SECTION B

WHAT IS INTERACTION?

It has already been mentioned that teaching-learning process, as it goes on in our classroom is a very complex phenomenon quite comparable to the measurement of the velocity of light, for infinite number of events happen when a teacher is teaching a class. It is, therefore, not sensible to count each and every event which may relate to cognitive, affective and psychomotoric aspects of the instructional goals. Thirty to forty students usually present in the class react not only to the teacher and his instructional materials (strategies and tactics included) but also amongst themselves to a varying degree during the different phases of the lesson. Still, it is open to the class or any one of its members to initiate a talk with little concern for what the teacher is trying hard to put across. Perforce of circumstances, any investigator is compelled to sample all these events, just like a doctor who draws a small sample of blood through the projecting needle. And here the simile ends. It is not sufficient to sample these events but to classify them into suitable categories and subject them to statistical treatment. The final step is to relate the resulting relation to the overall behaviours of teachers and their students, and suggest an imaginative theory of class room interaction which must enhance learning through added interactions, for it is based upon exchange of communication between teacher and his materials on the one
hand and his pupils taken both individually and in groups, on the other hand. It is only then the whole phenomenon is put on a scientific footing. Thus studies on professional growth of teachers, educational growth of pupils and enhanced growth of both in relation to each other become quite critical for understanding the complex phenomenon of teaching-learning and process through systematic process through systematic observation, using varied techniques relevant to the problems under study.

In a limited context, one of the profitable ways to study teacher behaviour is to observe him interacting with his students in multivariated situations in the classroom. Even students amongst themselves may be made to interact incidentally as well as intentionally. Several tools are currently in vogue which record varied informations in various categories through the medium of observation. The use of gadgets is not barred. Interaction analysis is, therefore, a workable technique or procedure which observes, classifies or codes varied classroom events both verbal and non-verbal within the context of the lesson for sharp results. Flanders in 1970, one of the leading workers in the field, has termed it as a specialized research tool which samples worthwhile minimum information about many events occurring in the classroom (6). Whereas pitfalls are many, his definition is still worth consideration. He writes:

"It is an analysis of spontaneous communication between individuals, and it is of no value if
no one is talking, if one person talks continuously, or if one person reads from a book or report. Unless additional records are kept, following kinds of information will be ignored — right, wrong, good or bad content information — whatever is being used; the variety of instructional materials being used; the various classroom formation during learning activities; the preparation of teachers as revealed by lesson plans; and anything else not directly revealed by verbal communication of the total complex called 'teaching'; interaction analysis applied only to content — free characteristics of verbal communications". (8)

This definition too is limited in that it ignores non-verbal means of communication, as well as it is not useful for practical subjects like science.

ASSUMPTIONS UNDERLYING INTERACTION PROCESS

If philosophical analysis of the Act of Teaching is excluded, it can be safely said that observation of classroom behaviour of teachers and students is as old as the history of teacher training programme in the country for teaching practice (now internship in teaching) in one form or another, constituted one of its essential ingredients. However, a systematic reflection, interest and observation appeared at about the turn of the present century, a trend which has been followed intensively within the last forty years or so with the assistance of 'Front like experiments' and result has been the availability of several tools of observation, about a hundred in number, suiting individual interests and purposes of investigation, the few notable workers among the many being: Haggerty (1932), Anderson and others (1946), H.V.
Parkins (1950), J. Wayne Wrightstene (1958), Flanders (1960, 1963, 1965, 1966, 1974), and Richard L. Ober (1972 & 1977) who have influenced this field over the years. Due to recency of the field, their findings are still open to scrutiny because they are yet to acquire universal acceptance. All these tentative findings rest upon the following assumptions:

1. Classroom situation comprising teacher, pupils, instructional and illustrative materials and objectives of instruction constitute a complex gestalt which is open to observation, description and analysis.

2. Since it is open to observation, it is possible to identify several detachable components which are, in turn, open to varied measurement reliably as well as validly. Measures both of high and low inferences are, thus, possible to be obtained.

3. Each component on aspect summarizes within it similar behaviour contacts. Depending upon the objective of investigation, each component is inclusive or exclusive implying there by that a given classroom situation can be seen from different standpoints. This step, taken component-wise, helps to reproduce the classroom behaviour of teachers and students to a varying degree on paper, tape, film and video-tape.

4. The dominant behaviour of classroom is neither verbal nor non-verbal alone. It is both with silent activity and confusion intervening.
5. Teaching learning process is enhanced in subtle ways which need to be discovered. Their role is like that of catalytic agents in chemistry, while remaining the same they appear to influence classroom behaviour to a considerable extent.

6. Teacher and pupil behaviours are quite modifiable implying thereby that effective patterns of teacher exist.

7. Example is no longer necessarily superior to precept. If identifiable patterns of good teaching exist, self knowledge is superior to all because facts objectively collected through systematic observation, with scant regard for supervisor opinions, stare in the face which exert positive educational influence.

8. Attitudes, attributes and past experience within a given culture both for teachers and students play critical role in the teaching learning process. Teacher, no longer, is the sole agent of pupil's knowledge, skills and attitudes, etc.

9. Teachers can solve successfully several of their professional difficulties if they learn to analyse their classroom behaviours in all their varied aspects. To quote systematic observation of teaching:

"The creation of a positive socio-emotional atmosphere and the manipulation and control of the learning stimuli are contingent upon skills that can be identified and described in functional and strategic terms and in turn that can be learned and measured. The teachers
can - with awareness and control - develop strategies of teaching that can be true both to their philosophies and to learning theory."

It needs hardly be mentioned that explosive knowledge and controversies arise only when they are imaginatively challenged by the researchers from various vantage points.

**INTERACTION ANALYSIS AND MICRO-TEACHING**

Mr. Fuchs' statement is worth noting regarding the Interaction Analysis and Micro-teaching at the very outset, he writes:

"Both interaction analysis and micro-teaching present alternatives to the ritual socialization of the teacher to the classroom that is the usual outcome of practice teaching and intern-ship."

The interaction analysis and micro-teaching are included in teacher training programme. Sometimes they are accompanied by other programmes/teacher counselling. In spite of many differences all these approaches have one thing in common, namely, the aim of aiding a more varied and flexible repertoire of performance capabilities in teacher and classroom roles that will mutually support and be productive.

Interaction analysis has been developed by Ned Flanders and it has proved its merit for micro-teaching. It has been so modified as to comprehended non-verbal communication in
its framework. The Rocky Mountain Educational Laboratory developed a modified version of Medley and Mitzel's Observation Schedule and Record and Meier and Brudenell simulated Lesson Analysis Chart in conjunction with the modified Interaction Analysis to give student teacher comprehensive feedback on each micro-lesson.

Classroom behaviour description provided by interaction analysis are a source of useful feedback for individuals. It has been also used as prescriptive tool in micro-teaching. Programmes which combine systems of coding verbal communication with micro teaching has been implemented at various places such as - Temple University in '61 again in 1967-68, it has been further carried out at the University of California by Minnis. The major advantage that resulted out of various experiments conducted at various universities is the greater specification of the skills to be practised and more objective information about the performance itself.

Combining micro-teaching and the category system to instruct teachers in the use of enquiry has been carried out in several projects such as Experienced Teacher Fellowship Programme, Carnegie Mellon University, 1968-69, Experienced Teacher Fellowship Programme, Mexican-American Project, Sacramento State College 1969-70. These various projects yielded encouraging results.
OBJECTIVES OF THE STUDY

It is for the first time that the classroom interaction is being investigated at Ph.D. level in the University of Avadh and also in the eastern region of U.P. specially in science subjects. It is a new area which is coming up strong, especially at Centre of Advanced Study in Education, Baroda (Gujrat). Secondly due to the recent revolution in science teaching abroad, the content and form of science teaching is changing fast. Against this background the following were the aims and objectives of the present study.

1. To prepare inductively comprehensive instrument for analyzing the class room instruction with special reference to science.

2. To develop the same by analyzing the various science systems in vogue and to restrict the science teacher behaviour inventory in the light of emerging trends.

3. To explore the classroom behaviour of science teachers as exhibited through Flanders interaction category system (FIACS) and science teacher behaviour inventory.

4. To determine the reliability and validity of the STBI.

5. To determine the relationship if any, between the various aspects of the STBI and some outside variables (i.e. personality traits sex, etc.)

6. To determine the mathematical structure of the STBI through factor analysis and interpret the same psychologically.

7. To point out the main educational implications of this study for other school subjects and programmes.
8. And lastly, to explore the possibilities of using STBI in determining and analyzing the behaviour of science teachers in the micro-teaching situation.

The study mainly consists of two parts (i) Exploring the behaviour of science teachers through Flandres Interaction Category System (FIACS) and then draw the limitations of the FIACS for science teaching, (ii) the main and basic aim was to develop a reliable and valid inventory for analyzing scientific instruction in our day-to-day classroom.

HYPOTHESES

The present study aims at exploring as well as testing the following hypotheses:

\[ H_1 \] Keeping in the view the changing nature of science both in content and form, a reliable category system for first hand systematic observation of the classroom instruction in science can be developed.

\[ H_2 \] If so, it can yield reliable and valid data which can be significant to statistical analysis in both micro and macro-teaching situation.

\[ H_3 \] There is a positive relationship between the process (sub scores also included) of the STBI and the cut side variable i.e. personality traits and sex

LIMITATIONS

Being an exploratory study, the limitations of the study are many. The chief among them are as follows:
1. It does not investigate teacher effectiveness or consolidate literature in this area.

2. It ignores value judgements.

3. It does not aim at establishing predictive relationships.

4. It does not consider pupil achievement.

5. No control was exercised in regard to choice of the lessons actually chosen by the individual teachers.

6. Except the tape recorder no gadgets were used in the study.

7. All the calculation work done with the assistance of pocket calculator and the electronic calculators 1207 and 1407. The computer facility was not available in time.

8. The quality of the observable data collected will be limited by the writer's skills, abilities and the extent of training.

Lastly, it is an exploratory study undertaken to develop to a Science Teacher Behaviour Inventory on a series of small sample of teachers, if this at all could be done.
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