CHAPTER VI

TEACHERS OF MATHEMATICS
According to Roy Dubisch a good teacher is, "One who has the ability to convey information in a logical and thought-provoking fashion." The work of the teacher is really the task of developing the capacity of each child, rather than pouring in information. It is the process of guiding the pupils so that they seek and find, not one of compelling the pupils.

The job of a good teacher in mathematics is his willingness to take up a careful analysis of his job and to be guided by that analysis in the preparations and conduct of his work.

"However, a mathematical theory is never a limited collection of ideas and theorems; it is primarily a way of manipulating certain concepts, a way of thinking which can be applied both to very simple cases and to very complex situations (where a teacher's first duty is to reduce everything to simple terms). It is arbitrary to regard any theory as complete as it always has ramifications which it would be equally arbitrary to separate from the theory itself and which, in most cases, serve to throw a very useful light on the theory."2

With regard to the quality of a teacher, the Secondary Education Commission had said;

"The intelligent and wide awake teacher has numerous opportunities to kindle new interest, to expand and strengthen existing ones and to satisfy their innate desire to touch life at many points. It is by exploring different avenues of interests and activities that he can truly discover himself and begin to specialise in due course."3
Therefore, it is said that -

"A teacher is more like a gardener who tends each plant, gives water and sees that plenty of plant food is available in the soil so that the plant may take its own nourishment."\(^4\)

It is the teacher who sparks off the effort, clears the road and controls the speed of learning of the pupils. The Secondary Education Commission has rightly remarked:

"A good teacher should always be able to exploit the educational possibilities explicit in these subjects."\(^5\)

A true teacher has the intellectual maturity to direct his pupils in the right direction.

"The teaching of a modernized programme in mathematics makes quite different demands upon the teacher than did instruction in traditional programmes. Not only is there required a completely new orientation towards the nature of mathematics, but also a more global approach in methods of teaching the subject. In addition, the steady increase in mathematical knowledge at advanced levels, and with the increase a necessary shift in patterns of organization of the school content, both demand a teacher who is continuously a student of his field of endeavour."\(^6\)

Therefore the teacher should be continuously updating himself. In this connection K.S. Sidhu has stated:
There are two equally important aspects of any true profession viz., significant knowledge and effective technique. One cannot be efficiently professional if there is any serious weakness in either of the two.\textsuperscript{7}

Howard P. Fehr stated in this connection:

"We may include that a teacher's knowledge cannot possibly be limited to what he teaches, that it is not sufficient to have a good knowledge of his instructional subject and that he cannot know it really well unless he knows a good deal more than he shall ever be called on to instruct.\textsuperscript{8}

But Hoyle has classified teachers into two categories.

According to him:

"Teachers may be categorised as 'restricted' and 'extended' professionals. Broadly, the restricted professional is the man who sees his work simply within the confines of his classroom, relies on his intuition and experience rather than constant reappraisal, may well be an excellent classroom performer but does not see his work within the wider context of society. The 'extended' professional, on the other hand, seeks to improve his practice, get well informed on educational and pedagogical issues, and sees schooling problems within the context of the society at large.\textsuperscript{9}

A true teacher tries to be well-informed and fulfils the needs of the students. In this regard, Dubisch had said:

"A good teacher is a human and mature person who knows his subject thoroughly, has a keen interest in it, and tries to get it across to his students in a thought-provoking fashion.\textsuperscript{10}
DESIRABILITIES:

An effective teacher possesses some desirable qualities. Anybody with required educational qualification can never be a successful teacher, unless he possesses some qualities that the teacher should have.

Joseph Lee, Kenneth Frasure and Mauritz Jonson have specified some of the desirable qualities of the teachers. According to them:

"On the whole, the results indicate a list of characteristics that teachers want from fellow teachers, that administrators seek in teachers, that curriculum directors and supervisors feel are essential. There is also wide agreement on personal limitations.

We find that attributes teachers ought to have, among others, at least, are:

1. To have initiative, self-motivation, drive.

2. To be responsive to opportunities and to invitations to study, to research, to self-evaluate, to compare notes, to participate in planning policy, etc.

3. To be alert to educational trends and aware and informed about educational issues.

4. To be able and willing to experiment sensibly, independently and with others, and to be tactful about and sympathetic with colleagues.

5. To have sufficient self-control and enough information and ideas as well as interactive skill to engage in intensive work with others."
Roy Dubisch with the assistance of Vernon E. Howes has expressed the most common desirabilities of a good mathematics teacher in a concise manner. According to him:

"There is widespread agreement among both teachers and students that a good teacher must know his subject and have an enthusiasm for it. In addition, however, he must have or develop the ability to

1. Present material in a thought-provoking way.
2. Explain clearly the reasoning needed to develop the subject and the technical skills necessary to apply this reasoning."

The mathematics teacher is different from the teachers of other subjects because he has to deal with a subject full of abstractions and generalisations. Therefore, he should possess the following qualities.

"1. Proficiency in fundamental skills;
2. Comprehension of basic concepts;
3. Appreciation of significant meanings;
4. Development of desirable attitudes;
5. Efficiency in making sound applications;
6. Confidence in making intelligent and independent interpretations."
According to Prof. Sidhu, a mathematics teacher should possess:

1. Prerequisite training
2. Professional training
3. Selective academic training
4. Supervised practice teaching
5. Inservice training
6. Professional activities
7. School activities
8. Mathematical Organisations
9. Departmental duties
10. Administrative duties
11. Community activities.

Therefore, a teacher of mathematics should possess the following qualities:

1. He should be properly qualified and trained for possession and the subject of teaching.

2. Should be emotionally stable and mentally healthy.

3. Should have enough control and confidence in himself along with wide range of information in general and on the subject of teaching in particular and the skill to engage himself in intensive work with teachers and students.

4. He should be able to present material in a thought-provoking way.

5. He should possess command over the subject-knowledge of basic concepts, power of expression and making sound application.
6. Possess and develop mathematical attitudes.

7. He should be confident, intelligent and should have independent interpretations.

8. He should master effective teaching techniques.

9. He should be exact, accurate, reasonable and very systematic in solving mathematical problems.

10. He should be free from personal bias, and prejudices. He should treat all students equally well.

11. He should be very frank in admitting his own ignorance.

Realities:

The theoretical imperatives are highly idealistic and are far away from the stark realities prevailing in the schools of Orissa. The theoretical frame of reference indicates the goals to be achieved. The following section delineates the realities on the basis of the responses to the questionnaire.

Number of Teachers:

First of all, it was the intention of the researcher to ascertain the total number of teachers of the 220 secondary schools taken for the study.
TABLE 6.1

TOTAL NUMBER OF TEACHERS WITH QUALIFICATIONS

<table>
<thead>
<tr>
<th>Teachers with qualifications</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) P.G. trained teachers</td>
<td>171</td>
</tr>
<tr>
<td>b) Graduate trained teachers</td>
<td>387</td>
</tr>
<tr>
<td>c) Intermediate trained teachers</td>
<td>125</td>
</tr>
<tr>
<td>d) Trained Matriculates</td>
<td>145</td>
</tr>
<tr>
<td>e) Untrained teachers</td>
<td>326</td>
</tr>
<tr>
<td>f) Other teachers (classical teachers, P.S.T. etc.)</td>
<td>481</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>1635</td>
</tr>
</tbody>
</table>

(Vide Question No. 8 in the 'General Information' section of the Teachers' Questionnaire).

The total number of teachers shown in the Table 6.1 belonged to 220 schools having classes from Class I to X, IV to X, VI to X and classes VIII to X.

Without taking into consideration the classes included in the schools, the average teachers per school was 7.34. The standard staffing pattern prescribed by the B.S.E., Orissa for a three class secondary school with no sections is:

TABLE 6.2

STANDARD STAFFING PATTERN

<table>
<thead>
<tr>
<th>Sl.No.</th>
<th>Category of teacher</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Headmaster (Trained graduate or post graduate)</td>
<td>1</td>
</tr>
</tbody>
</table>
Most of the schools are inadequately staffed. The shortage of staff has its own ramification in school administration, increased work-load and the consequent apathy and negligence.

Number of Teachers in Mathematics with their qualifications:

The researcher wanted to ascertain the number of teachers teaching mathematics (compulsory) in the secondary schools along with their educational qualifications. Total number of mathematics teachers with their qualifications from 220 secondary schools has been presented in the Table 6.3.

**Table 6.3**

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Teachers M.A./M.Sc. in Mathematics</td>
<td>7</td>
<td>1.21</td>
</tr>
<tr>
<td>Qualification</td>
<td>Count</td>
<td>Percentage</td>
</tr>
<tr>
<td>--------------------------------------------------</td>
<td>-------</td>
<td>------------</td>
</tr>
<tr>
<td>b) Teachers B.A./B.Sc. with Honours in Mathematics</td>
<td>15</td>
<td>2.61</td>
</tr>
<tr>
<td>c) Teachers - B.A./B.Sc. with Mathematics</td>
<td>301</td>
<td>52.43</td>
</tr>
<tr>
<td>d) Teachers-I.A./I.Sc. with Mathematics</td>
<td>251</td>
<td>43.72</td>
</tr>
<tr>
<td>Total</td>
<td>574</td>
<td>99.97</td>
</tr>
</tbody>
</table>

(Vide question No.9 in the 'General Information' Section of the Teachers' Questionnaire).

It was found that 301 (52.43%) teachers with mathematics as a subject of study at the B.A. or B.Sc. and 251 teachers (43.72%) with Intermediate qualification were teaching mathematics at the secondary school level. There were only 1.21% of the teachers with post-graduate qualifications in mathematics. 2.61% of the teachers were graduates with Honours in mathematics.

It was obvious that there was short-supply of adequately qualified teachers in mathematics in the secondary schools of Orissa.

Qualifications indicate basic knowledge, skills and attitudes. Higher academic qualifications enable a teacher to understand and teach the subject with greater understanding and confidence.
Teachers' Age:

The age of the teacher is an index of his behaviour as well as his maturity. Professional efficiency of a teacher increases with the advancement of age and experience.

TABLE 6.4

TEACHERS' AGE

<table>
<thead>
<tr>
<th>Age in Years</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>55 - 58</td>
<td>11</td>
</tr>
<tr>
<td>50 - 54</td>
<td>13</td>
</tr>
<tr>
<td>45 - 49</td>
<td>57</td>
</tr>
<tr>
<td>40 - 44</td>
<td>156</td>
</tr>
<tr>
<td>35 - 39</td>
<td>142</td>
</tr>
<tr>
<td>30 - 34</td>
<td>88</td>
</tr>
<tr>
<td>25 - 29</td>
<td>91</td>
</tr>
<tr>
<td>20 - 24</td>
<td>16</td>
</tr>
</tbody>
</table>

(Nvide Question No.14 in the 'General Information' section of the Teachers' Questionnaire).

Teachers below the age of 34 were considered as youngsters; and those between the ages 35 to 58 as elderly teachers. Of the total 574 teachers, 379 (66%) were in the age-range 35 to 58 and 195 (34%) in the
age-range 20 to 34. This indicates that two thirds of the mathematics teachers belong to the category of the 'experienced'. This is a heartening finding. However, the 'experienced' teachers are unable to achieve professional growth due to lack of a well-coordinated inservice programme. The preservice programme is the lifebuoy of the school teachers in the state. Of the total sample of 574 teachers 412 teachers (71.77%) had an experience of ten years or more; whereas 162 teachers (28.23%) had less than ten years teaching experience.

Teaching Experience:

As per the research findings of Klausmeier (1966-69), an experienced teacher is in a privileged position to implement psychomotor and affective objectives of the curriculum in an effective manner. His teaching skills and interaction with pupils and contact with others are of a superior order. Table 6.5 gives a picture of teaching experiences of secondary school teachers in mathematics.

<table>
<thead>
<tr>
<th>Experience in Years</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>30 - 34</td>
<td>15</td>
</tr>
<tr>
<td>25 - 29</td>
<td>21</td>
</tr>
<tr>
<td>20 - 24</td>
<td>76</td>
</tr>
<tr>
<td>15 - 19</td>
<td>184</td>
</tr>
<tr>
<td>10 - 14</td>
<td>116</td>
</tr>
</tbody>
</table>
Specialisation in teaching:

Professional training is as important as academic qualification. The professional training equips the teachers with pedagogical skills. The State provides Bachelor of Education Course for graduates and post-graduates in the Colleges of Education. The Secondary Training Schools offer the Certified Teachers' Course for those with Matriculation and Intermediate qualifications.

Technically the trained teachers are qualified to teach. But these teachers lack the basic knowledge relating to the techniques of teaching new mathematics. So refresher courses, orientation courses etc. need to be mounted for such teachers.

(Vide Question No. 14 in the 'General Information' section of the Teachers' Questionnaire).
Professional Enrichment Programme:

A teacher's professional efficiency increases by attending refresher courses, seminars, workshops and extra-mural lecture programmes. In the age of explosion of knowledge, it is essential for the teachers to rise up to the time and be well-informed. The Table 6.6 provides the information relating to professional enrichment programmes for teachers of mathematics in Orissa.

<table>
<thead>
<tr>
<th>Enrichment Programmes</th>
<th>No. of teachers participated</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Refresher Courses</td>
<td>11</td>
<td>1.91%</td>
</tr>
<tr>
<td>Workshop in Mathematics</td>
<td>16</td>
<td>2.78%</td>
</tr>
<tr>
<td>Summer Institutes</td>
<td>22</td>
<td>3.83%</td>
</tr>
<tr>
<td>Total</td>
<td>49</td>
<td>8.52%</td>
</tr>
</tbody>
</table>

(Vide Question No.14 in the 'Style of Writing' section of the Teachers' Questionnaire).

The professional enrichment programmes have great importance in upgrading the quality of teachers. But from table 6.6 it was evident that only 49 (8.52%) teachers had
attended such programmes considering each teacher attending a single programme. As many as 91.5% of the teachers did not get any opportunity to improve their professional competence through participation in in-service programmes. This is a dismal picture. Urgent steps need to be taken to organise a large number of in-service programmes, and more so in view of the advances in the content and methodology of this abstract science.

**Number of Students Studying Mathematics:**

The number of students studying mathematics at the secondary stage of 220 schools of Orissa was 25826; which gave an average of 117.4 students per school.

**Teacher Student Ratio:**

In the teaching-learning process, the establishment of rapport between the teachers and the students, plays significant role. They understand one another and thereby confidence in the students is developed, which in turn promotes learning. Therefore, it was essential for the researcher to know the student-teacher ratio in order to assess the effectiveness of teaching. The student teacher ratio was approximately 45:1.
The ratio 45:1 is certainly too great. Since a teacher has to cover the courses, check up classroom performance of the students, and correct the homework in addition to his own preparation, it is certainly very difficult for him to do justice to his job.

Rapport with the Students:

The relationship between the students and the teachers was very cordial (38.6%); cordial (53.4%); and neutral (3%). On the whole, the majority of the teachers maintain a fairly good relationship with their students.

Teachers' Negative Contribution to Mathematics:

Some students develop a dislike for mathematics due to certain common drawbacks in teaching the subject; and some due to behavioural problems. These have been shown in Table 6.7.

**Table 6.7**

<table>
<thead>
<tr>
<th>Causes for disliking mathematics</th>
<th>f</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Mathematics teachers explain only one or two problems and leave other problems for homework.</td>
<td>197</td>
<td>35.43</td>
</tr>
</tbody>
</table>
b) Mathematics teachers are cruel and mete out punishment to the students without understanding the difficulties of the students.

c) Mathematics teachers fail to clarify mathematical ideas in the class.

d) Do not bother to clarify the doubts of the students.

Total = 334

N=556

(Vide Question No.28 of the Students Questionnaire)

Mode of Teaching:

Much of the success in learning depends on the effectiveness of teaching. A successful teacher tries to clarify the doubts of the students within the limited facilities available. Most of the schools of Orissa do not have teaching aids and the teachers have to manage with blackboard and chalk. A question was addressed to the students to indicate the effectiveness of the teachers through the chalk and talk approach.

<table>
<thead>
<tr>
<th>Mode of teaching</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>a) Explain clearly with the help of blackboard.</td>
<td>489</td>
</tr>
</tbody>
</table>

**TABLE 6.8**

**MODE OF TEACHING OF TEACHERS.**
(Vide Question No. 29 of the Students' Questionnaire)

Table 6.8 showed that 9.89% students were of the opinion that the teachers of mathematics did not use blackboards during teaching. They simply explained the problems and mathematical concepts verbally. 2.16% of the students were not satisfied with the teaching of the teachers. 88.1% of the teachers were fairly successful adopting the traditional talk and chalk method.

Methods Used:

A single method of teaching mathematics can never satisfy the students of varying abilities. The teacher has to follow different methods of teaching for better understanding of the students.

From the responses of the students it was seen that 27.33% of the students (152 out of 556) were of the opinion that the teachers followed only a single method
in teaching Mathematics. But 404 students i.e., 72.66% of the students viewed that the teachers followed different methods in teaching mathematics.

More than one method be followed in the class according to the needs of the students in order to clarify their doubts and to enable them to solve problems in a variety of methods.

Clarification of Doubts:

In teaching mathematics, importance should be paid to clarify doubts of the students. If not clarified, the future learning will be affected, and the students will not be interested in learning the subject.

50.07% of the students were satisfied with the teaching of the teachers with respect to clarification of doubts. 46.40% of the students' doubts were not totally clarified and 2.53% of the students' doubt were not at all clarified.

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