CHAPTER VIII

EXAMINATION AND EVALUATION OF MATHEMATICS
EXAMINATIONS:

The entire educational system of India seems to be revolving around examinations. Examinations mould the objectives, shape the methods of instructions and provide directions for study. Schools are evaluated on the basis of their results in public examinations. The weekly, monthly and half yearly examinations are given very little weightage; it is the annual examination and specially those conducted by the statutory external authorities that are valued most. The cancer of examinations is eating into the vitals of the educational system. Healthy interaction between the teachers and the taught has yielded to a sort of examination mania. Here, ends justify the means. Rote learning, rampant copying, rigorous drills are all resorted to. The market is flooded with guides, notes, guess-papers, keys, short cuts, refresher-courses, and even 'one-hour series' and 'last-minute tips'. Teachers, administrators, politicians, and parents are all victims to this vicious circle and they grovel in the guagmire of corruption. Examination has become the central concern of the educational system.

The examinations themselves are defective. Formative evaluation is in the marginalia; it is the summative evaluation that is important. Evaluation of the teacher is given very little credence; it is external evaluation that is relied upon.
The examinations are mostly written and are of the essay type. Oral examinations, practical examinations and internal assessments are taken lightly or are sabotaged. Since the attainment of independence in 1947, educationists have been unsuccessfully trying to free the educational system from the clutches of the traditional and unimaginative examination system.

Examinations test only the cognitive aspects; the affective and conative domains are totally forgotten. Even in the cognitive domain it is the knowledge of the specifics that is emphasised most. Even the ways and means of dealing with specifics which include conventions, trends and sequences, classification and categories, criteria, methodology are not given due importance. The knowledge of principles and generalization is essential for the proper understanding of mathematics; but even in this sphere the treatment lacks a thorough approach; knowledge of theories and structures is at best marginal.

The intellectual abilities like comprehension, translation, interpretation, extrapolation, application, analysis including analysis of elements, relationships and organizational principles, synthesis, and evaluation on the basis of internal and external criteria are not developed through a well-structured curriculum, and are much less evaluated through the easy type examination.
Even before the exposition of the taxonomy of educational objectives under the editorship of Benjamin S. Bloom in 1956, the Secondary Education Commission, 1952 had expressed its deep dissatisfaction and anguish at the way the examination system was conducted in India. It stated:

"Both the internal and external examinations in this century are more or less modelled on similar lines and they follow the same general pattern. Both are intended to test mainly the academic attainments of a pupil and his progress in intellectual pursuits. These do not test the other aspects of the pupil's development; or if they do, it is only indirectly. The twentieth century has witnessed a widening of the meaning and scope of education...

Unfortunately our present system of education still lays exclusive emphasis on the intellectual attainments of the pupils and this has been due mainly to the influence of our examination system. The examinations determine not only contents of education but also the methods of teaching - in fact, the entire approach to education. They have so pervaded the entire atmosphere of school life that they have become the main motivating force of all effort on the part of pupil as well as teacher. It is not often clearly realised that a pupil's effort through out his education is concentrated almost wholly on how to get through the examinations. Unless a subject is included in the examination scheme the pupil is not interested in it."

With regard to the system of examination prevailing in our country the New Education Policy (1986) in its booklet entitled "National Curriculum for Primary and Secondary Education" has remarked:
"Current practices, however, leave much to be desired. A great deal of importance is given to the year-end evaluation which is modelled after the external Board Examination. This is specially true for classes VI to VIII. External examinations suffer both from inherent limitations and inadequacies which can be removed. An experimental examination is not compatible with the efforts of all institutions which vary both in resources and in the clientele they serve. Nor can a paper-pencil test, to be answered within constraints of time, be comprehensive enough to do justice to the objectives of education that go beyond knowledge and understanding. The external examination thus tends to introduce distortions in curriculum transaction.

Examinations have been used more for grading the students than for evaluating the teaching-learning process to the pupil's progress with a view to guiding them. Since the grades (Marks obtained) are widely for selection in institutions of higher learning and for employment, the grades obtained in examinations require undue importance. This practice leads to the pupils, teachers and parents away from meaningful education."

The written examinations have been vehemently criticised now-a-days on the ground that they lack objectivity, validity and reliability. They are purely subjective in nature as different examiners value differently. Again the essay-type examinations favour rote-memory and selected reading. It is not valid in the sense it does not measure exactly what is desired to be measured. The purpose is not to measure the neatness of hand writing, spelling, grammar rather its objective
is to measure knowledge, understanding, application and skills of the pupils. Through essay-type tests only a selected portion of the course content can be assessed. Sometimes, the language of test items (questions) is so defective that the pupils fail to understand the expected answers. Therefore, committees and commissions have criticised this essay-type examination and have recommended introduction of objective evaluation.

Watson expressed his criticism of examinations in these words:

"It must be admitted that examinations have a considerable influence on what is taught in schools, so that in the majority of cases, topics which are not examined will not be taught. More importantly, methods of approach which do not easily lend themselves to examination by the normal methods will also fail to be used. Consequently there is a considerable tendency for examination questions to take a routine form, of familiar type to those the candidate has already attempted in the course of his normal lessons. This can lead and often does lead to a situation in which much of the time spent on mathematics consists of working through back papers, on the type of questions which are expected.

To what extent it is possible to set questions which demand some investigation by the candidate, some inventiveness, such as the formulation of hypotheses, their verification and proof (where this lies within the power of the candidate)? 'Open-ended' questions of this type might well have some influence on teaching, and one hopes, would lead to a greater emphasis on mathematics as exploration rather than the
assimilation of techniques and results in cut-and-dried form. I do not under-estimate the difficulties of this approach. There seem to be two main objections, first that questions of this vague type are much more difficult to answer, and candidates prefer something routine which they feel they can do; secondly, that it is not possible to mark questions of this nature as objectively as is usual in mathematics. The first of these objections seems the stronger of the two, for I admit that it is not easy to find questions of a suitable nature. However, I think this might be tried. As to the second objection, this problem is one which has to be faced by examiners of other subjects in the curriculum and I think it would be worth the sacrifice entailed if the cramping effect of examinations could be reduced.  

Therefore, there is an imperative need to introduce objective and scientific evaluation in place of the traditional essay-type examinations. Mathematics helps to develop thinking, reasoning and analytic powers of the pupils and they apply mathematics in their day-to-day life. It is essential to know whether the pupils had been able to learn mathematics in the true sense so that they can analyse, synthesise, reason and apply mathematical principles in their everyday life. For its assessment, evaluation is a sine qua non.

EVALUATION:

Evaluation plays an important role in many facets of the school programme. It contributes directly to the teaching-learning process used in classroom instruction, curriculum development, marking and reporting, school administration and school
research programmes, etc.

It is an integral part of planned education. In teaching-learning process, need arises at various points to assess the progress of the pupils. Therefore, evaluation becomes a continuous process, forms an integral part of the total system of education and is ultimately related to educational objectives. But the term 'Evaluation' is misunderstood very often as measurement or examination. Evaluation, measurement and examination are not synonymous terms. The term evaluation is broader and much more comprehensive than measurement and examination. Both measurement and examination are limited to quantitative description of pupil behaviour, whereas evaluation includes both quantitative and qualitative description of pupil behaviour. Therefore, evaluation exercises a great influence on the pupil's study habits and thus helps not only to measure educational achievement, but also to improve it.

In order to define the word 'Evaluation', Gronlund says:

"From an instructional standpoint, evaluation may be defined as a systematic process of determining the extent to which instructional objectives are achieved by pupils."
Evaluation judges the merits of an educational system. According to Peter G. Dean:

"Evaluation is, therefore, a broader term; it measures the achievements of pupils, teachers and curriculum, and is linked with the themes of change and choice."5

The Education Commission (1964-66) in its report had stated:

"The new approach to evaluation will attempt to improve the written examination so that it becomes a valid and reliable measure of educational achievement and to devise techniques for measuring those important aspects of the student's growth that cannot be measured by written examinations."6

The present system of examination cannot be altogether done away with. However, certain steps have to be taken to minimise its undesirable effects. The International Commission on Mathematical Instruction had surveyed the process of assessing students' achievement in different countries of the world. According to the report:

"The course in an upper secondary school is in almost all countries completed by an assessment of the students' performance, in the form of a mark or grade, which may have considerable influence on his future career. Frequently this assessment is based solely on an examination, set and marked at a national level, in which the student is asked to apply his knowledge to the solution of a number of exercises without reference to books or notes. This examination may take the form either of a multiple choice test or of a number of longer open-ended questions, or a
mixture of both. The student may also be asked to reproduce proofs and definitions which they have been taught, but this is less common. In some countries, other forms of assessment are used, either instead of or supplementary to the examination: these may be based on tests and other assignments done by the student during the course and marked by the teacher, on an oral examination or occasionally (but rarely) on projects carried out by the student in his own time.

The importance to students of the results of his assessment has the effect that most teachers and students put their main emphasis during the course on those attributes which contribute to it — usually the acquisition of knowledge and skills, and the ability to apply these in given situations. Other goals whose achievement is less easily evaluated by tests of this kind — the encouragement of creativity, perseverence, the ability to learn from books, the devising and interpretation of mathematical models — receive correspondingly less attention from teachers and students."

Taking all these facts into consideration the National Curriculum opined:

"Evaluation as carried out today is limited in scope, purpose and utility. Objectives of education are expressed in terms of total development of the child. The curriculum provides guidelines for organisation and systematisation of experiences which would lead to social, emotional and cognitive growth of the child. However, more often than not, only the knowledge of some facts and a superficial expression of the desired attitudes and values are evaluated.

To the extent, transaction of curriculum remains confined to cognitive development, evaluation can hardly go beyond it. In the new curriculum framework, a great deal of emphasis is being laid on the overall development of the learner."
Dr. Kenneth Boulding, Director of the Institution of Behavioural Sciences and Professor of Economics at the University of Colorado had stated in the light of his own experience:

"If our students cannot read or write today, the blame must be squarely laid on the objective examinations, for this is what they prepare for - that which is not reward-ed is not done. If a student is not reward-ed for clear and legible statements, there is very little incentive to do so in our educational system."^9

Therefore, the present system of examination in our country more specifically in Orissa should be replaced by evaluation. Qualitative judgements must be taken into consideration. Only the year-end examinations should not be given importance to judge the entire learning performance of the students for promotion to the next higher class.

The researcher wanted to probe into this much maligned area of examination as applied to mathematics. The responses to the questions on the topic have been analysed and presented in the following pages.

Time of Classroom Tests:

Generally, teachers in mathematics are interested in testing the learning of the pupils after the completion of a topic. Therefore, a question was asked to the teachers on the use of class-room tests.
It was found that 136 teachers out of 220 (61.8%), used tests after the completion of each topic in order to assess the quantum of learning of the pupils. 42 teachers did not give any test; and 42 teachers did not bother to opine. However, it was observed that nearly 38.2% of the teachers were not using class-room tests after the completion of each topic.

With regard to weekly tests, 86 teachers i.e., nearly 39.1% of the teachers were in the habit of giving weekly tests to their students whereas 81 teachers did not use such tests, and 53 teachers did not respond to the question.

Half-yearly and Annual Examinations were conducted in all the schools as they were more or less mandatory. No school had dared to dispense with these examinations by a judicious and careful introduction of the formative evaluation.

Weightage to Class Examinations:

The teachers' opinions were sought to assess the importance accorded to the class examinations. As many as 200 teachers opined that the class-examinations were effective as feed-back, and the teachers would keep a watch over the progress of the students. So teachers did not consider the class-tests to be in anyway important rather they were viewed as an additional botheration.
Type of Test items to be included:

As regards the test items included in the written examinations, the teachers were requested to opine. Their opinions have been presented in Table 8.1.

<table>
<thead>
<tr>
<th>Types of test items</th>
<th>Percentage of Questions</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Long Answer Type</td>
<td>33.636</td>
<td>34</td>
</tr>
<tr>
<td>Short Answer Type</td>
<td>32.750</td>
<td>33</td>
</tr>
<tr>
<td>Objective Type</td>
<td>33.613</td>
<td>33</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>99.999</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

(Vide Question No.3 in the 'Examination' section of the Teachers' Questionnaire).

Type of Questions liked:

Opinions of the students about the relative appreciation of long answer-type questions and objective-type questions were elicited. Out of 556 students, 372 students were in favour of objective-type questions, and 184 students favoured long answer type questions.
Pattern of Questions:

174 teachers agreed the statement that the test questions meant for school examination were set at par with the questions set by the Board of Secondary Education, Orissa. But 46 teachers did not subscribe to this view.

Almost 80% of the schools conformed to the procrustean standards set by the Board of Secondary Education, Orissa.

Use of Examination Results:

The most important and major function of the examination results was in helping the teachers in deciding promotions to the next higher class. In this regard, all the teachers were unanimous. 95 teachers considered the marks to be useful for mounting remedial education. The marks and achievement hardly influenced the process of curriculum development. 58 teachers stated that evaluation provided the feedback for improvement of instructional methods. Only six teachers had suggested the following uses of the examination results.

1. Detection of the weaknesses of the students.
2. Issue of certificates of accreditation.
3. Fostering a competitive mentality.
4. Fulfilling job requirement.
Satisfaction at the type of Examination:

Nearly 59% (59.09) of the teachers were not satisfied with the type of examination conducted by the Board of Secondary Education, Orissa. 90 teachers (i.e. 40.9%) were satisfied. The experts and outstanding teachers of mathematics also confirmed that the examination conducted by the B.S.E., Orissa was not at all satisfactory and needed to be reformed.

Weightage to Content Areas:

In setting questions, 78.18% of the teachers gave appropriate weightage to different content areas. But 21.82% of them did not accord such weightage.

Failure in Examinations:

The high failure rate in Mathematics was not ascribable to defective questions but to defective instruction. This was the opinion of as many as 99% of the teachers.

Reason for Failure:

The high rate of failure in Mathematics was due to the reason depicted in Table 8.2.
<table>
<thead>
<tr>
<th>Causes of failure</th>
<th>No. of teachers subscribing to the opinion</th>
</tr>
</thead>
<tbody>
<tr>
<td>(A) Curriculum, Methods and Examination.</td>
<td></td>
</tr>
<tr>
<td>i) The procedure of promotion at the M.E. stage is defective (i.e. on the basis of aggregate marks).</td>
<td>163</td>
</tr>
<tr>
<td>ii) Lack of practice and drill in mathematics.</td>
<td>117</td>
</tr>
<tr>
<td>iii) Question setters are not aware of the standard of the students.</td>
<td>103</td>
</tr>
<tr>
<td>iv) There must be a minimum pass park in mathematics at the M.E. Common Examination for promotion.</td>
<td>102</td>
</tr>
<tr>
<td>v) Defective system of examination at M.E. School stage.</td>
<td>102</td>
</tr>
<tr>
<td>vi) No clear objectives of teaching Mathematics have been stated.</td>
<td>98</td>
</tr>
<tr>
<td>vii) Lack of Teaching aids and equipments.</td>
<td>76</td>
</tr>
<tr>
<td>viii) Lack of fairness in the examination hall.</td>
<td>74</td>
</tr>
<tr>
<td>ix) Inclusion of difficult chapters.</td>
<td>72</td>
</tr>
<tr>
<td>(B) Teachers and Teaching.</td>
<td></td>
</tr>
<tr>
<td>i) Negligence of teachers at the Primary and M.E. School stage.</td>
<td>147</td>
</tr>
</tbody>
</table>
ii) Lack of effective teaching 122

iii) Lack of guidance from the teachers and the teaching facilities. 84

iv) Lack of Orientation of teachers from time to time. 79

v) Lack of interest of the teachers due to their low salary and service conditions. 52

(C) Students and Learning

i) Students are weak from the lower stages and do not understand the fundamental principles of mathematics. 169

ii) The students were not serious and desired promotions through easy means. 86

iii) Students have low I.Q. 83

iv) Students want less labour and the course is heavy. 63

v) In rural areas students get less time to prepare their lessons because they help their parents in their occupations. 51

vi) Due to poverty, students are deprived of learning facilities. 49
(D) Parents and Society.

i) Bad influence of society and immediate environment of the students. 138

ii) Guardians are not careful about the education of their children. 118

(Vide Question No. 10 in the 'Examination' section of the Teachers' Questionnaire).

Items of the Tests

59.54% of the teachers stated that the problems included in the tests, conducted by the B.S.E., Orissa were taken directly from the textbooks. But 40.46% of the teachers differed in this regard.

The investigator along with four expert teachers in mathematics analysed the questions of four years set by the B.S.E., Orissa. It became obvious that nearly 80% of the items of the test were taken directly from the textbooks.
Fear of Examination:

It was seen that out of 556 students, 252 i.e. 45.3% of the students had developed a fear-complex before the commencement of the examination in mathematics. But 304 students did not fear such examinations.

Researches on state anxiety and trait-anxiety ought to be undertaken with special reference to examinations of mathematics.

Attitude of Students to the items of the Test in Mathematics:

Attitudes of the students towards the items of the test in mathematics were invited. Their responses have been shown in Table 8.3.

**Table 8.3**

<table>
<thead>
<tr>
<th>Attitude of the students</th>
<th>f</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Barring a few items of the test in mathematics, other items appeared to be easy.</td>
<td>282</td>
</tr>
<tr>
<td>ii) 50% of the items of the test in mathematics appeared to be easy and 50% difficult.</td>
<td>101</td>
</tr>
<tr>
<td>iii) A few items were easy and all the rest appeared to be difficult.</td>
<td>86</td>
</tr>
</tbody>
</table>
iv) Almost all the items appeared to be easy.

v) All the items of the test appeared to be difficult.

(Vide Question No. 24 of the students' Questionnaire)

Perception of the difficulty-level of the various items of the mathematics tests depended largely on the ability, aptitude and achievement of the students in the field.

Marks Secured in the Examinations:

The students were requested to mention the marks obtained at the half-yearly and annual examinations. Their marks were tabulated separately both for half-yearly and annual examinations.

| TABLE 8.4 |
| STUDENTS IN THE MARK-RANGE |

<table>
<thead>
<tr>
<th>Range of marks</th>
<th>No. of students in Half-yearly Exam.</th>
<th>No. of students in the Annual Exam.</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 - 99</td>
<td>31</td>
<td>6</td>
</tr>
<tr>
<td>80 - 89</td>
<td>13</td>
<td>24</td>
</tr>
</tbody>
</table>
The marks conformed broadly to the principles of normal distribution. More students were in the higher ranges during the half-yearly examinations, but this situation underwent a change in the annual examination. This was due to the traditional stricter evaluation at the annual examination.

**Valuation:**

The system of scoring, which is otherwise known as valuation in this state, is done centrally for the H.S.C. Examinations. Some centres are fixed in different schools preferably situated at the district headquarters and sub-divisional
headquarters. The answer scripts of the candidates are sent to the centres and the teachers are appointed examiners for the centres. Such centres are known as valuation centres.

Some questions were asked to the teachers on the system of valuation of the answer scripts of the candidates appearing at the High School Certificate Examinations. Their opinions have been analysed as under:

**Satisfaction at Central Valuation:**

All the 220 teachers of mathematics expressed their dissatisfaction with the system of the central valuation adopted by the Board of Secondary Education, Orissa.

Therefore, the system of central valuation should be modified.

**Reasons for Dissatisfaction with Central Valuation:**

Some reasons were suggested in the teachers' questionnaire indicating the defects of the central valuation. The opinions of the teachers were arranged in order of their choice.

**Table 8.5**

<table>
<thead>
<tr>
<th>Reasons of defective valuation</th>
<th>No. of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>i) Valuation is hurried and the teachers superficially go through the answer books. Justice hurried is justice buried.</td>
<td>193</td>
</tr>
<tr>
<td>ii) Some teachers award marks liberally while others are strict.</td>
<td>166</td>
</tr>
<tr>
<td>iii) Concentration on valuation can't be maintained during some fixed hours.</td>
<td>147</td>
</tr>
<tr>
<td>iv) Valuation differs from Centre to centre. 144</td>
<td></td>
</tr>
<tr>
<td>v) Some non-mathematics teachers sometimes value the answer scripts. 127</td>
<td></td>
</tr>
<tr>
<td>vi) Some teachers do not read the answer books but award marks erratically. 123</td>
<td></td>
</tr>
</tbody>
</table>

(Vide Question No.2 in the 'Valuation' section of the Teachers' Questionnaire).

The teachers stated that the credibility of the central valuation was at stake due to:

1) Some inefficient teachers valuing the answer scripts.
2) The old and experienced teachers not being well-acquainted with new mathematics.
3) Valuation being affected by regional feelings.
4) Valuation differs from chief examiner to chief examiner.
5) The appointment of examiners being faulty.
6) Manipulation at valuation centres by officials of the Board of Secondary Education, Orissa in collaboration with chief examiners.

7) Inflated marking due to the canvassing of the guardians and students.

8) Time-bound valuation causing strain to the examiners.

9) Some examiners adopting a liberal attitude in marking the answer scripts of their home districts and relatives.

**Step Marking:**

191 teachers favoured step marking of the answer scripts of mathematics whereas only 29 teachers were of the opinion that marks should be awarded on the answer as a whole.

The 29 teachers who refused to award step marking agreed that marks should be awarded as a whole on the basis of understanding of the pupils.

**Negative Marking:**

Opinion of the teachers was invited on negative marking for incorrect answers in mathematics.
116 teachers out of 220 opined against negative marking for incorrect answers. Only 54 teachers were in favour of negative marking. Others did not opined.

**Performance of the Candidates:**

An attempt was made by the researcher to know the performances of the candidates at the Annual High School Certificate Examinations conducted by the Board of Secondary Education, Orissa for a period of three successive years. To this effect, a question was included in the questionnaire for the teachers to mention the performances of the candidates according to the table provided in the questionnaire. Their responses have been analysed and presented in the Table 8.6, on the basis of the average of performances of 220 schools.

**Table 8.6**

PERCENTAGE OF STUDENTS IN DIFFERENT MARK-RANGE

<table>
<thead>
<tr>
<th>YEAR</th>
<th>Percentage of candidates failed i.e. securing 30 or below (on average)</th>
<th>Securing 31 - 44 marks (on average)</th>
<th>Securing 45 - 74 marks (on average)</th>
<th>Above 75 (on average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>27.2%</td>
<td>30.5%</td>
<td>34.6%</td>
<td>7.7%</td>
</tr>
<tr>
<td>1985</td>
<td>39.6%</td>
<td>29.3%</td>
<td>24%</td>
<td>7.1%</td>
</tr>
<tr>
<td>1984</td>
<td>30.1%</td>
<td>30.6%</td>
<td>31.4%</td>
<td>7.9%</td>
</tr>
</tbody>
</table>

(Vide Question No. 15 in the ‘General Information' section of the Teachers' Questionnaire).
It was revealed that only in mathematics (compulsory), the percentage of failure ranged from 27.2% to 39.6% at the H.S.C. Examination.

National Talent Search Examination:

A competitive examination, known as National Talent Search Examination is being held each year for the students who have already passed the M.E. Examination in order to identify the talented students. The selected students are provided with facilities for their higher education. The researcher desired to know the number of students who had qualified in the N.T.S. Examinations. It was found that only seven students from five schools had qualified in the said examination with mathematics as one of the subjects.

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