

Baseline Study of Primary Schools in Nandurbar

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Forward

Sir Ratan Tata Trust is one of the oldest Indian grant making foundations. The Trust supports initiatives in the development sector in the thematic areas of Education, Health, Rural Livelihoods and Communities, Arts & Culture and Civil Society & Governance.

The District Education Initiative is a regional initiative of Elementary Education portfolio which works towards demonstrating models for quality education in some of the most under developed districts for children from 3-16 age group. Districts selected by the Trust include Nandurbar in Maharashtra, Khunti in Jharkhand, Yadgir and Chamrajanagar in Karnataka. Objective is to make visible impact on quality of education available to some of the most marginalised communities in the district with the view to inform policy and action at a larger scale.

The District Education Initiative was launched in Nandurbar in 2008 by undertaking a baseline study and select pilots in the area elementary education and Early Childhood Education. Baseline study was designed by the Trust partner, Quality Education Support Trust (QUEST) while field work and coding was done by Dr. Hedagewar Seva Samiti, Nandurbar. Data collection for the baseline was done in July 2008 and March 2009 while writing was done by Mr Nilesh Nimkar, a senior educationist and key resource person of the Trust for the Nandurbar Initiative. Mr Balaji Chirade, Programme Associate of the Trust supported the process.

The baseline study was conducted in order for the Trust to understand the ground reality and plan interventions to address key gaps. We hope that the report and its insights would also be helpful for teacher educators, policy maker and those interested in elementary education in order to understand issues pertaining to student and teacher performance in order to work towards improving classroom transactions in primary schools. The Trust would be happy to share the baseline tests developed and used in Nandurbar with others interested in doing similar work. You can write to us on srtt@tata.com for the same.

Sir Ratan Tata Trust

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The Design of the Baseline Study

1.1 Background, Scope and Objectives of the Study

This chapter will discuss in brief the background of the project under which this study was conducted. It will give some idea of the terrain and socio-economic realities of the project area. It will also specify the details of the scope and the rationale for the same. Towards the end of the chapter, broad objectives of the study are outlined.

The Background

This survey was done for the District Education Initiative launched by the Sir Ratan Tata Trust and the Navajbai Ratan Tata Trust (*here after referred as the Trust*) in the Nandurbar district of Maharashtra. The survey was done by Dr. Hedagewar Seva Samiti, Nandurbar (*here after referred as HSS*) with resource support from Quality Education Support Trust, Thane (*here after referred as Quest*). The District of Nandurbar was carved out of Dhule district in northern Maharashtra in 1998 with over 65% tribal population. Nandurbar consists of six blocks, Navapur, Nandurbar, Shahada, Taloda, Dhadgao and Akkalkuwa. There are 5 main tribes in the district namely Bhil, Pawara, Dhanka, Mavachi and Kokani. The district is low on various socio-economic and educational indicators. The district ranks as the lowest out of the 35 districts in the state on literacy and Human Development Index as per Maharashtra Human Development Report 2002 & Census 2001. As per the Annual Status of Education Report (ASER) conducted by non profit organisation, Pratham and other surveys, the district's status on enrolment, retention and achievement levels is also among lowest in the state. These are some of the main reasons to start the district specific work in Nandurbar.

There are 1235 Zilla Parishad (Z.P.) schools and 126 Ashram Schools divided into two Integrated Tribal Development Projects having head quarters in Nandurbar and Taloda, respectively. Apart from these schools there are a few Municipal schools and private aided and non aided schools in towns like Nandurbar.

Table 1.1 shows block and type wise schools in the district¹

Table 1.1 : Block and type of schools in Nandurbar district

| Sr.No. | Name of the block | Z.P. schools | Ashram Schools | Other | Total |
|--------|-------------------|--------------|----------------|-------|-------------|
| 1 | Akkalkua | 207 | 26 | 47 | 233 |
| 2 | Dhadagaon | 289 | 26 | | 315 |
| 3. | Nandurbar | 171 | 29 | | 189 |
| 4. | Navapur | 253 | 18 | | 282 |
| 5. | Shahada | 178 | 16 | | 194 |
| 6. | Taloda | 137 | 11 | | 148 |
| | Total | 1235 | 126 | | 1361 |

Nandurbar can be broadly divided into 2 geographic regions the plains of Tapi river and hilly region of Satpuda mountains. Akkalkua and Dhadagaon blocks are located in hilly terrain of Satpuda mountains and have large pockets that are inaccessible. While rest of the four blocks are in the plains and the accessibility is not an issue. In the hilly region most of the children are enrolled the Ashram Schools while Z.P. schools provide access to majority of students in the plains.

Table 1.2 Shows School-type wise enrolment of students up to grade 4 in Akkalkuwa and Dhadagaon block in the year 2009-10.

Table 1.2 : School-type wise enrolment in Akkalkua and Dhadagaon block in the year 2009-10

| Block | Ashram Schools | Z.P. Schools | Total |
|--------------|----------------|---------------|---------------|
| Akkalkua | 4,526 | 15,254 | 19,780 |
| Dhadgaon | 5,062 | 16,599 | 21,661 |
| Total | 9,588 | 31,853 | 41,441 |

Taking into account the situation and available resources, the Trust decided to work in Dhadagaon block that comes under the jurisdiction of Taloda Tribal development Project, from the hilly region and Nandurbar block from the plains, as a first step towards the district level work. It was also decided that Ashram schools in Dhadagaon Block and Z.P. schools in Nandurbar Block will be the focus of intervention in the beginning, in order to work in two diverse settings and types of schools.

The problem of education in the district is complex and has several external factors, which have an adverse impact on the enrolment, retention and achievement levels of the students in elementary grades. Problems like seasonal migration of tribal families to Gujarat is prominent in the plains while poor access, lack of basic infrastructure facilities like electricity, drinking water, medical facilities have severe impact

¹ As per the data provided by the Project Officer, Tribal Development Department of Education, Nandurbar

on education in the hilly region. Often social problems like early marriages of girls, lack of support from the parents largely due to perceived lack of relevance of schooling contributes current educational scenario.

Along with these external factors internal factors within the system like shortage of teachers, non availability of adequate and appropriate teaching-learning resources, poor quality of classroom interaction have a negative impact on the achievement of large number of students who are enrolled in schools and attend school regularly.

The Scope and Objectives of the Study

The focus of the present district level work is to improve the quality of classroom interaction resulting into the improvement of achievement level of the children in primary schools. Before starting the actual work it was necessary to establish a baseline of achievement levels of students that would help in assessing the progress and impact of the work. This was the basic purpose of this study.

The curriculum at lower primary level can be divided into 2 stages i.e. up to grade 2, a stage when children are acquiring basic literacy skills and grade 3 onwards, a stage when children use the basic literacy skills to learn other curricular subjects. In Maharashtra grade 4 is considered to be the end of the lower primary school (though according to national curriculum, grade 5 is the end of lower primary school). This is mainly an administrative division and most of the Z.P. schools have classes up to grade 4 and thereafter children attend middle schools where grade 5 is attached to the upper primary. Considering this peculiar division of classes it was decided to conduct tests at the end of grade 2 and 4. It was also decided that Language and Mathematics being the foundational subjects at lower primary it will be important to establish a baseline of achievement of students in these two subjects.

Teachers' content knowledge and understanding of pedagogy plays crucial role in effective teaching-learning process. If these 2 factors are weak they would have a strong impact on the classroom interaction and would result into low achievement levels. So it was decided that the survey will cover a study of teachers' content-knowledge and pedagogic understanding with limited sample of teachers as a pilot.

In the Ashram Schools, normally there are around 35 to 50 students in one class and many times more. Ideally there is one teacher per class and thus average teacher student ratio works out to be around 1: 40. In Z.P. schools on other hand the number of students per class varies from 5 to 40. Obviously there is a multi-grade situation (*a situation where a single teacher has to handle more than one grade at the same time*) in most of the Z.P. school. These factors also have a close relation with the quality of classroom interaction and thereby with the achievement levels of the students. Any intervention related to classroom interaction will thus have to consider these parameters for effective implementation of the programmes. So it was decided that the information related to teacher student ratio, multi-grade classrooms will also be collected at the time of the survey and already available information from other sources related to this will be verified.

Thus the broad objectives of the study were set as follows:

1. To study the achievement levels of students in first language and mathematics at the end of grade 2 and 4.

2. To study the teachers' content knowledge and pedagogic understanding of elementary mathematics and language.
3. To collect and verify the information related to teacher availability, teacher student ratio, multi-grade classrooms from the intervention area.

1.2 Selection of the schools

All the Z.P. schools from Nandurbar Block (160) & Ashram schools in the jurisdiction of the Taloda Tribal Development Project (87) were considered as the 'population' for the study as this was going to be the area of intervention for the District Education Initiative of the Trust in the coming years.

A sample of 48 Z.P. schools & 25 Ashram schools was selected in following manner.

1. There are in all 14 educational clusters in the Nandurbar block. During sampling, it was ensured that there is at least one school from each cluster. This assured representation of entire geographic spread of the block.
2. While selecting a village within a cluster the proximity of the schools to the block or cluster head quarter was considered as one of the selection criteria. It is presumed that the children from the remote schools will have less exposure as compared to those in the schools near to head quarters and this will have some impact on the achievement levels. Also overall functioning of schools could vary based on accessibility.
3. Another criteria for selection of the schools was composition of various social groups in the village. In Nandurbar block here are some villages which show a strong presence of tribal communities (Kokani, Bhils, Banjaras) while in other villages there is a mixed populace of Tribal and non tribal communities like Gujar-Patil, Kunabi-Patil etc. Care was taken that both types of villages get adequate representation in the sample.
4. There are 4 blocks of the district which come under the jurisdiction of Taloda Tribal project. It was ensured that there are Ashram schools from all the blocks to cover the entire geographic area.
5. The intervention was going to focus on Ashram Schools in Dhadagaon block. So all the 13 Ashram schools selected for intervention were covered in the sample.
6. It was decided that all the children from grade 2 and 4 present on the day of testing would be a part of sample.

Around 4,000 students from 73 schools were covered in the sample. Table 1.3 and 1.4 give the details for the same:

Table 1.3: Number of Schools Covered

| | ZP schools | Ashram Schools | Total |
|--|---------------|----------------|-----------|
| Nandurbar block | 48 out of 162 | — | 48 |
| Taloda Project jurisdiction (4 blocks) | — | 25 out of 87 | 25 |
| Total | 162 | 87 | 73 |

Table 1.4: Number of Students Covered

| | | ZP schools | Ashram schools | Total |
|----------|----------|-------------------|-----------------------|--------------|
| Grade II | Language | 850 | 732 | 1,582 |
| | Math | 998 | 812 | 1,810 |
| Grade IV | Language | 1,718 | 807 | 2,525 |
| | Math | 1,841 | 904 | 2,745 |

The number of students per school in Z.P. schools is far less than the Ashram Schools. So normally a multi-grade situation is common in Z.P. schools. However, it is also observed in the field that due to the backlog of teacher appointment in some of the Ashram Schools, multi-grade situation exists even in those schools. The situation in multi-grade Ashram Schools is much worst since the teacher needs to cater to around 100 children from 2 different grades at a time and Ashram Schools being residential, teachers also have additional responsibilities.

1.3 Development and Nature of the Tools and Tests

The test for students and the questionnaire for teachers was developed by Quality Education Support Trust (QUEST), a non profit organization from Thane working in the field of Education. This section of the chapter will describe in brief the process, nature and rational behind the tools and tests developed for the survey. It will also discuss some of the limitations of these tools.

The achievement tests for the students

All the schools in the survey follow the state curriculum developed by the Maharashtra State Council for Educational Research and Training (*here after referred as SCERT*) and text books developed by the textbook bureau of the state government. It was decided that the test will adhere to the level of achievement expected in the state curriculum but it will be independent of the text books. The tests were developed to assess the attainment expected by the text books of grade 2 or 4 respectively. Yet the content from the text book was not used directly for designing the questions.

Looking at the large sample size the test was developed in such a way that it could be administered to the entire class at a time. This brought in some limitations i.e. competencies like ‘reading with proper intonations’ were not tested. However, a supplementary study done by Quest has tested these things on a smaller sample.

Development of tests for language

Following competencies were selected for the test.

1. Knowing Devnagari Script
2. Dictation
3. Reading with understanding
4. Listening with understanding
5. Expressing through written language
6. Working knowledge of grammar
7. Vocabulary

Table 1.5 shows the grade-wise scope of these competencies in the tests

Table 1.5 Grade-wise scope of these competencies in the tests

| Areas | Grade 2 | Grade 4 |
|--|---|---|
| Knowing Devnagari script | <ol style="list-style-type: none"> 1. Vowels 2. Consonants 3. Words with abbreviated vowel signs (Matras) 4. Conjunct consonants (Jodakshare) | NA |
| Dictation | <ol style="list-style-type: none"> 1. Dictation of Sentences 2. Dictation of a paragraph of 24 words | Dictation of a paragraph of about 36 words |
| Reading with understanding | <ol style="list-style-type: none"> 1. Read a paragraph of 3 to 4 sentences and answer questions based on it. 2. Arrange sentences describing an event in a proper sequence. | <ol style="list-style-type: none"> 1. Reading a paragraph and answering the Questions based on it. 2. Reading a poem and answering the Questions based on it. 3. Reading an advertisement & answering the Questions based on it. 4. Reading a dialogue and answering the Questions based on it. |
| Listening with understanding | <ol style="list-style-type: none"> 1. Writing the answers of questions by listening to a paragraph of 3 to 4 sentences | <ol style="list-style-type: none"> 1. Writing the answers of questions by listening to a paragraph of 3 to 4 sentences |
| Expression through written language | <ol style="list-style-type: none"> 1. Describing a picture in one or two sentences 2. Developing a short story from about 4 connected clue-words. | <ol style="list-style-type: none"> 1. Completing the story when the beginning of the story is given. 2. Framing the questions on the given theme |
| Grammar | N A | <ol style="list-style-type: none"> 1. Noun 2. Pro-noun 3. Adjectives 4. Tenses 5. Gender 6. Singular-plural 7. Conjunctions |
| Vocabulary | Antonyms | <ol style="list-style-type: none"> 1. Synonyms 2. Collective nouns 3. Words describing different sounds 4. Phrases |

For each grade the test was developed in 2 parts, to be administered on 2 consecutive days. The test for grade 2 had 15 questions and that for grade 4 has 14 questions. The students in grade 2 were expected to solve each part in 75 minutes and the students in grade 4 were expected to solve each part in about 90 minutes. However this timing was flexible. The tests had questions with multiple choices or short answer questions where ever possible, for the administrative ease in light of the sample size and to

maintain objectivity. For language tests, it was necessary to include some questions of descriptive nature as the skills like writing cannot be tested with a multiple choice type of questions.

Table 1.6 Shows the Question-type wise distribution of marks in the Test. For multiple choice type questions, one mark was granted for every right answer. For descriptive type of questions a special marking scheme was designed (see annexure 1)

Table 1.6: Question-type wise distribution of marks.

| | Multiple choice | Short Answers (in one or two words) | Small answers | Descriptive | Total marks |
|----------------|-----------------|--|---------------|-------------|-------------|
| Grade 2 | 13 | 29 | 9 | 14 | 65 |
| Grade 4 | 29 | 18 | 4 | 14 | 65 |

Development of tests for mathematics

In most government schools, textbook is the main tool of learning mathematics. The tests are based on the topics of the textbook. However no direct content from the textbook has been used for the development of tests.

For each grade the test is developed in 2 parts, to be administered on 2 consecutive days. The test for grade 2 has 39 questions and the test for grade 4 has 40 questions. The students in grade 2 were expected to solve each part in 75 minutes and the students in grade 4 were expected to solve in 90 minutes. The test time can be extended as per the requirement of the student.

Table 1.7 shows the Topic-wise distribution of the marks in the test.

Table 1.7 Topic-wise distribution of marks in the test

| The Topics incorporated in the Tests | Grade 2 | Grade 4 |
|---|-----------|-----------|
| A. The questions related to calculation procedures | | |
| 1. Addition | 12 | 1 |
| 2. Subtraction | 12 | 7 |
| 3. Multiplication | 1 | 8 |
| 4. Division | - | 8 |
| Total A | 25 | 24 |
| B. The questions related to concept clarity | | |
| 1. Number concept | 14 | 5 |
| 2. Application of basic operations in a everyday situation | - | 4 |
| 3. Estimation and measurement | 2 | 6 |
| 4. Spatial and geometric understanding | 4 | 6 |
| 5. Understanding concept of Fractions and its application - | 13 | |
| 6. Decimal fractions and metric measures | - | 7 |
| Total B | 20 | 41 |
| Total A+B | 45 | 65 |

From the table it's clear that at grade 2 level where children are expected to learn basic operations and the emphasis on the procedural skills is more as compared to grade 4 where children learn many more new concepts.

Development of the tool for the teachers

The content knowledge of the teachers and the teaching method affects the learning of the children to a great extent. The test developed for teachers is to evaluate their subject knowledge as well as their pedagogic understanding. At the elementary level, many times the teacher has to teach all the subjects and its possible that one may not possess the required level of content knowledge to teach a particular topic. Hence its useful to know about the extent of teachers' content knowledge while planning an intervention.

Teachers' questionnaire includes questions regarding beginning reading-writing and basic mathematics at the elementary level. The questioner for mathematics was designed in a form of answer papers of 4 different students which teachers are suppose to correct. During the exercise the content clarity of the teacher becomes evident automatically.

Pilot testing

Pilot testing was done in Dahindule Z.P.school in Nandurbar and in Bilgaon Ashram school in Dhadgaon by experts who had developed the tests. Minor changes were made in the tests based on the piloting.

1.4 Training of Investigators, Moderators and Data Collection

The training of investigators was done in 2 phases, in phase 1 for the administration of the test for Grade 2 and in phase 2 for the administration of the test in Grade 4. Each phase of the training programme was of 4 days long and 76 investigators participated in both set of trainings. The answer papers from the pilot study were used as a sample for the training exercise. The participants were the trainee teachers from the D.Ed. (Diploma in Education) colleges in the district. A detailed programme for the training can be seen in Annexure 1.

The data was collected in two phases. The first phase was conducted in July 2008 when the test for grade 2 was administered to grade 3. (July being the beginning of the academic year children had just completed grade 2 before the summer vacation). The second phase of testing was conducted in March 2009 when grade 4 test was administered to grade 4 students (March being almost the end of the academic year children had completed the grade 4 at the time of the tests.

Overall Status of Achievement Levels of the Students

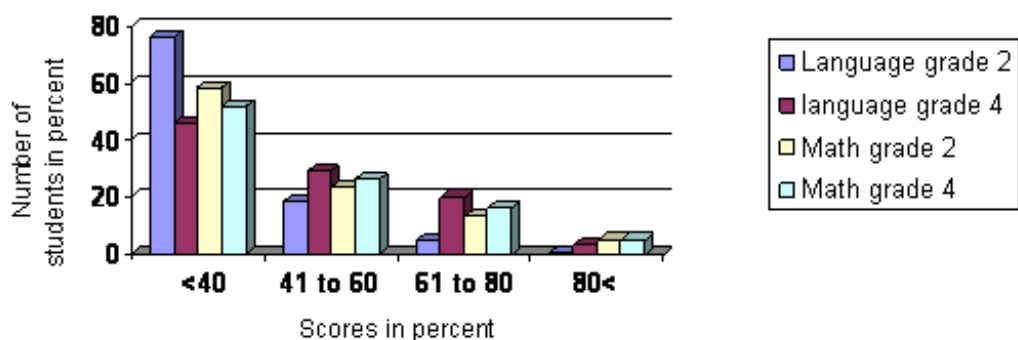
Achievement level of students, is an important parameter to assess the quality of the schools. In this survey, we have used this as the indicator to establish the baseline because this is probably an easily quantifiable parameter related to the quality of Schools. This absolutely does not mean that other parameters like classroom environment, classroom organization and processes, appropriate planning are less important. But at this scale of a survey, it would have been difficult to collect data related to these parameters, objectively. Probably a small scale study in these areas would be of great help. The actual intervention will be planned around improving all these parameters which presumably have impact on the achievement of students.

2.1 The issue of low achievements and its implications

2.1: Distribution of children in percentage based on the scores in the tests

| Scores | Grade 2 language (N :1,582) | Grade 4 language (N :1,718) | Grade 2 mathematics (N:1,810) | Grade 4 mathematics (N:1,841) |
|------------|--------------------------------|--------------------------------|----------------------------------|-----------------------------------|
| below 40% | 76 % | 46 % | 58% | 52 % |
| 41% to 60% | 18% | 29 % | 23% | 26 % |
| 61% to 80% | 4.8 % | 20 % | 13% | 16 % |
| Above 80% | 0.1% | 3 % | 5% | 5% |

Graph 2.1 : Distribution of children in percent based on the scores in the tests



It is clear from the Table 2.1 that maximum children fall in the category of percentage below 40. Looking at the fact, the need for the work in the area of classroom transaction (teaching learning of foundational skills) gets established beyond doubt. The language and mathematical skills acquired in the early grades are foundational. If a large number of students, as in the case of the project area, are weak in these skills there is every possibility that they may not cope with the middle school studies and drop out early. Even if they continue to attend school their performance will be low even in other subjects.

The worst performance of the students as observed in this study is in language at grade two. This could be because of the fact that most of the tribal children do not have exposure to Marathi at home and two years of schooling is probably not sufficient to bridge the gap between the local tribal language and the medium of instruction (in this case Marathi). In depth study in this direction will be required to probe into the matter further.

Another possible explanation for the fact is that the poor performance at the end of grade 2 in language is related to the method of teaching beginning reading and writing. Prof. Krishna Kumar in his book 'What is worth teaching?' relates the elimination (dropping out) of children in early grades to environment and pedagogy in the primary school rather than socio-economic reasons like financial necessities of the poor families. The worst performance at the end of grade 2 probably indicates the poor quality of methodology in the schools.

No study has yet explained why the child's labour value changes dramatically between grade one and two where the elimination rate is highest. As the enrolment data given earlier indicate, 39 out of the 66 children (per 100) who stop attending school between grades one and five do so within grade I. In other words, nearly 61% of the 'drop out' children belong to the youngest age group attending school. Most likely, these children are five to seven years old. Now if these children are leaving school due to the economic necessity of their families, there ought to be a sudden jump in the children's labour value between grades one and two, roughly age six to seven. Surely we need a medical explanation for this sudden jump. Otherwise why would a parent send his child to grade one but withdraw him before grade two? The question takes the bottom out of the theory that early elimination has a satisfactory economic explanation in our conditions in the late twentieth century. Krishna Kumar (1992)

T Test between ZP and Asharam shala :Marathi

| | | N | Mean | Std. Deviation | Std. Error Mean |
|-------|---------|------|---------|----------------|-----------------|
| TOTAL | ZP | 1199 | 23.4299 | 16.7742 | .4844 |
| | Asharam | 1119 | 19.7954 | 16.1941 | .4841 |

t =5.301

df=2316

t > 1.96 and t > 2.58.

So there is significant difference between the means of two groups with the schools from the plains showing better performance.

T Test : ZP and Asharam shala students for : Mathematics:

T Test between ZP and Asharam Schools: Mathematics

| | | N | Mean | Std. Deviation | Std. Error Mean |
|-------|---------|------|---------|----------------|-----------------|
| TOTAL | ZP | 1197 | 24.3542 | 17.4232 | .5036 |
| | Asharam | 1117 | 17.7350 | 15.1679 | .4538 |

t =9.718

df=2312

t > 1.96 and t > 2.58.

So there is significant difference between the means of two groups with the schools from the plains showing better performance.

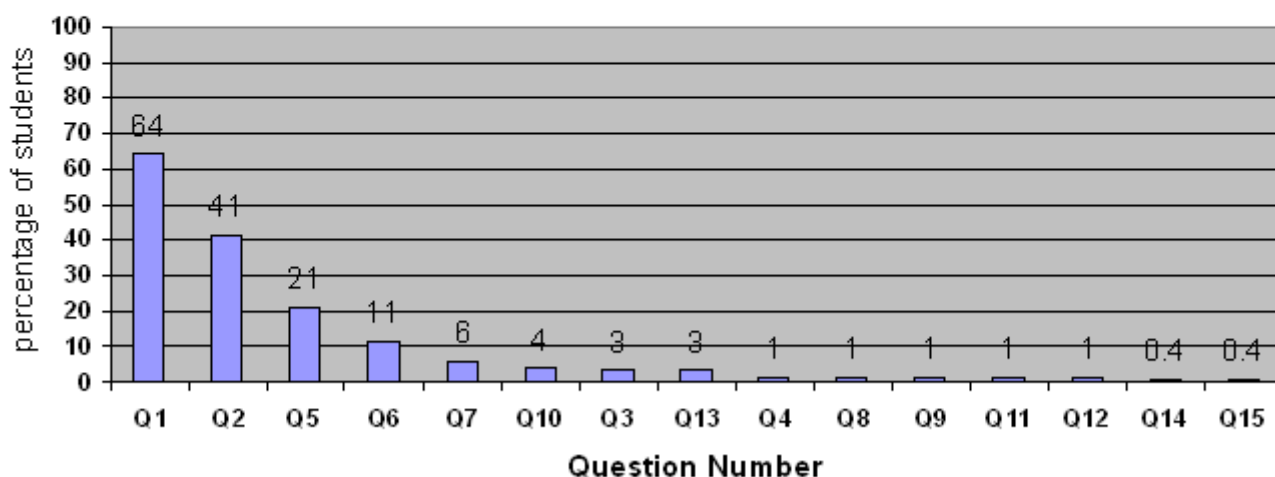
Though it's clear that the Schools in the interiors are performing less than their counterparts in the plains in both the subjects, it's not possible to find the exact reasons at this based on the current survey. Apart from lack of exposure, the actual input received in terms of time and quality would also play a crucial role in this situation. A more in-depth study based on relevant data in this multi- parametric situation will be required. It's also worth exploring if this difference persists even after required improvement in the input within the classroom.

Another fact worth considering is that if the schools showed any correlation in student performance in mathematics and language. Normally at lower primary levels all the subjects are taught by the same teacher. If there is a high positive correlation in the scores of mathematics and language, as its seen in this case ($r= 0.716$), we can broadly categorise schools as generally better performing or poor performing looking at any one of the two scores.

One of the important objectives of the survey was to identify weak curricular areas so that focused input could be planned to improve the achievement of students in the areas which are weak at the time of base line. The areas in which less than 60% children have given correct or acceptable answers is considered to be weak. Actually it was found that there was hardly any area in which 60 or more percent students were at acceptable level.

The graph 2.2 is showing the question wise percentage of students giving correct or acceptable answer in the language test for grade 2.

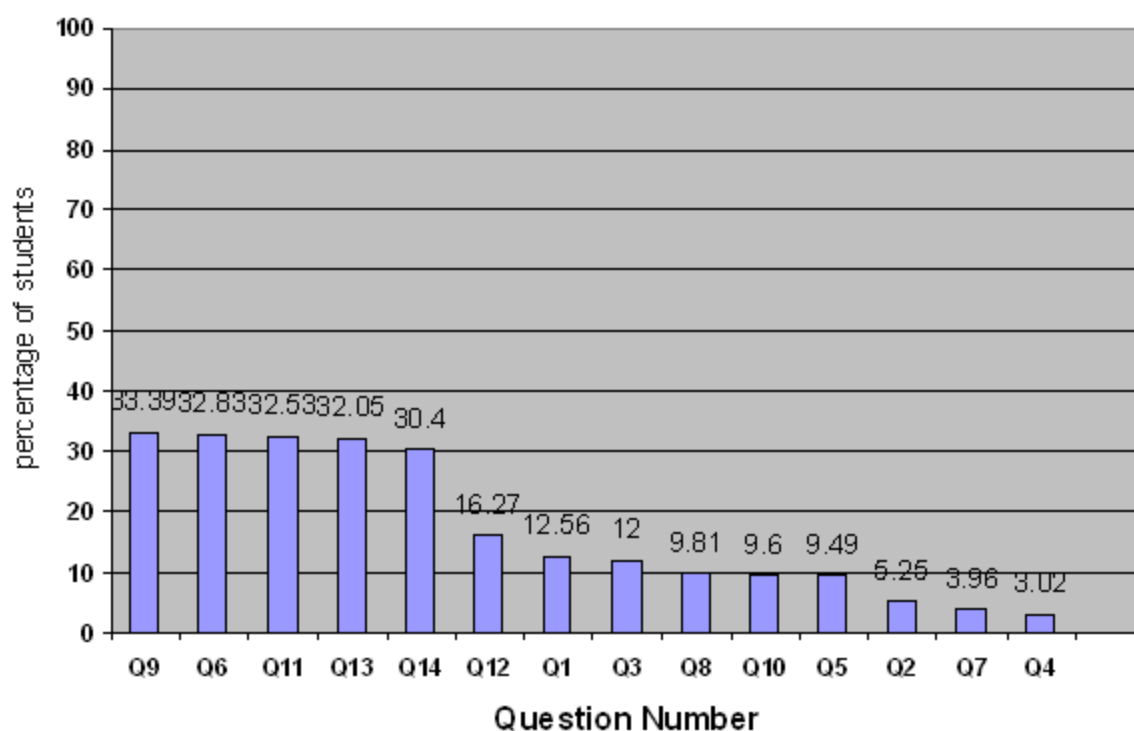
Graph 2.2: Students giving Correct Answers in Grade 2 Language Test



The graph shows that there is only one question to which more than 60% students have given acceptable answer. This Question was related to recognition of Devnagari alphabets. Obviously, most of the students are able to answer this correctly at the end of the grade 2. But this level of literacy skills is not really going to help at this stage. Amongst the lowest are the questions related to dictation, written expression and reading with understanding.

The graph 2.3 is showing the question wise percentage of students giving correct or acceptable answer in the language test for grade 4.

Graph 2.3: Students giving correct or acceptable answers in grade 4 language test



It is clear from the graph that there is not a single question from the test in which more than 60% students have given correct or acceptable answers. It's obvious that all the curricular areas need equal attention. Amongst the slightly better 3, are the questions related to comprehension by reading, vocabulary and conjunctions (grammar). But amongst the last 3 are the question related to phrases, dictation and written expression.

It is noteworthy that the questions related to dictation and written expression are among the weakest in both the grades. Actually in the questions related to dictation, spellings, punctuations were expected to be written as per the standards, while in the questions related to written expression these things were completely overlooked. But it was observed that children are generally weak in writing. This particular finding matches with the survey done by School of Political Economy in Pune Municipal Corporation Schools (Arthabodh, Unpublished).

There were in all 39 questions in the test for mathematics in Grade 2. There are only 3 questions to which more than 60% students have given correct answers. Table no 2.2 gives the details of Questions showing better and poor performance in mathematics test.

Table 2.2: Grade 2 Questions showing better performance of students

| Question Number | Description of the Question | Percentage of students giving correct answers |
|--|---|---|
| 16 | Identifying the longest pencil from given 3 | 75% |
| 18 | Drawing using concept of above and below | 67% |
| 35 | Measuring length using nonstandard unit | 64% |
| Grade 2 Questions in which the majority of students have shown poor performance | | |
| 11 | Subtraction with disintegration | 8% |
| 22 | Identifying simple pattern in a number series | 11% |
| 38 | Identifying a number when no of units and tens are given. | 13% |

The nature of questions, where children have shown better performance is such that most of the children would answer these questions just because of age maturity and life experience. The role of systematic instruction on the part of the teacher is relatively limited in these cases. At grade 2 level these questions were read out by the investigators to the children. It is clear that by and large children were able to comprehend oral instructions in Marathi given by the investigators related to these questions.

Table 2.3: Grade 4 Questions showing better performance of students

Table 2.2: Grade 2 Questions showing better performance of students

| Question Number | Description of the Question | Percentage of students giving correct answers |
|--|---|---|
| 10 | Identifying half of a discreet quantity | 67.54 % |
| 17 | Plotting the numbers on number line | 65.8% |
| 02 | 4 digit addition with carry over | 63.38% |
| Grade 4 Questions in which the majority of students have shown poor performance | | |
| 36 | Arrange the unit fractions in ascending order | 22.99% |
| 40 | Dividing 3 digit number by a single digit | 19.74% |
| 22 | Subtraction of decimal fractions | 15.80% |

In the question related to identification of half of a discreet quantity, a few boxes containing black and white dots were shown to the children. Children were asked to identify a box where number of black dots was exactly half of the total number of dots in the box. 67.54% children have solved this question correctly. This shows a strong intuitive understanding of fractional numbers. However, only 22.9% students were able to solve the question related to fractions in the form of formal representation (e.g. Question no. 36). It is a common observation that children intuitively develop sense of several concepts with the age maturity but fail when it comes to generalization or while handling a formal representation. Actually a good math education programme should start from the intuitive understanding and help the child to formalize the concept. In such a case math instruction in school plays a crucial role. Possibly the strengthening of math instruction in these schools would facilitate this transition.

Another question where students have shown better performance was related to a number on number line. On a number line divided into equal length of segments number 0 and 3 were shown and number to be plotted was 7. 65.8% students have answered this question correctly. This again shows strong intuitive number sense children have developed from their life experience. Plotting a number on number line is not a part of grade 4 syllabus, still majority of the children are able to solve the problem correctly.

Another better performing area is addition with carry over. This particular basic operation is taught from grade 1. The concept of carry over is introduced in grade 2 and in grade 3 and 4 only the magnitude of the numbers to be added increases. Children probably get a prolonged period for consolidation of this basic operation which has probably resulted into better achievement. This trend was also observed in a study done Arthabodh, Pune.

Division, subtraction and decimal fractions are considered to be hard spots in elementary mathematics. Profound understanding of concepts and procedures related to these topics is often weak among the students even in so called 'good schools'. It is not surprise that these are among the competencies where the achievement is low in schools surveyed in Nandurbar.

In this chapter an overview of student's achievement level given is discussed. For the detail question wise achievement data for grade 4, kindly refer to the table given in annexure 2.

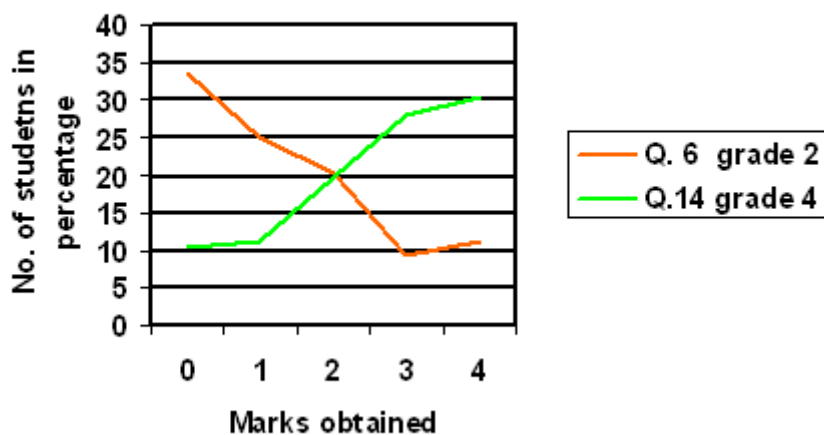
Status of Achievement Levels in Language

3.1 The Issue of Transition from Local Language to School Language

In the tribal dominant district of Nandurbar Bhil, Pawara, Kokani, Mavachi are major tribes. All the tribes speak their indigenous languages. These languages are spoken in nature. Recently a few attempts were made to write them in Devnagari script. Some books like '*Aksaran olakhan*' '*Amra kanya*' were written in Pawari for children by Rewa Jeevan Shala. '*Adibharat*', a set of textbooks for grade 1 and 2 was published in Bhili by Maharashtra Rajya Shaikshanik Sanshodhan Prashikshan Parishad, Pune. In addition to this, some dictionaries and teachers' handbooks are also available in these languages. The observation is that none of these books were really extensively used. However, the medium of instruction in the school is Marathi the state language. Children from the plains of Tapi have slightly better exposure to spoken Marathi as compare to the children from interiors of Satpuda. Still the transition from the indigenous language to Marathi is an issue that needs to be studied. How long would it typically take to get reasonable command over Marathi, what are the factors which facilitate this transition, to what extent this transition affects children's performance, what kind of difficulties do children face during this period are some questions which need to be answered through in depth research.

The test tried to check to what extent can children comprehend spoken Marathi both in grade 2 and grade 4. A short passage was read out to children and they were asked to answer the question by listening to the text. The questions were given to the children before the text was read out.

Graph 3.1 : Comprehension by listening



The graph 3.1 shows the status of achievement in these questions. In grade 2 around 10% of children have achieved the acceptable level of 3 and 4 marks while almost 35% have scored zero. This result could be a combined outcome of following factors:

1. Children do not have enough exposure to the language or to spoken Marathi
2. Because of the poor reading abilities they were not able to locate the answer in the multiple choice question

At grade 4 almost 60% children have achieved acceptable level in this question and only a small minority of 10% has scored zero. It seems that they are able to cope with spoken Marathi to much better extent as compare to grade 2. Prolonged exposure of Marathi for the 4 years probably help children to achieve this. The factor of having a slightly better grade of literacy in grade 4 may also have contributed to this result.

Experiment in more controlled conditions and collecting the data related to qualitative change that children undergo during this transition would give a better insight about this issue.

3.2 Introduction to Script and Reading Abilities

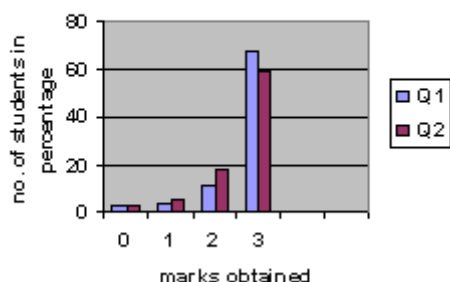
As per the state curriculum in Maharashtra children are expected to decode all the alphabets, alphabets with vowel signs, some commonly used conjunct consonants (*jodakshara*) by the end of grade 1. By the end of grade 2 the introduction to all the characters in Devnagari script is almost over. As far as reading is concerned children are expected to read words and simple sentences by the end of grade 1 and they are expected to comprehend a text of about 4-5 sentences independently.

The following table gives the details of questions in the test related to the reading competencies.

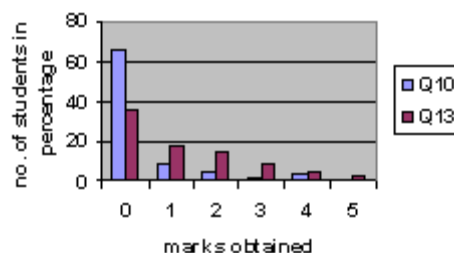
Table 3.1 :Questions related to reading competencies

| Question No. | Objective of the question |
|--------------|--|
| 1-2 | To identify of Devnagari alphabets |
| 10 | To read and comprehend words and small sentences |
| 13 | To read a passage with comprehension |

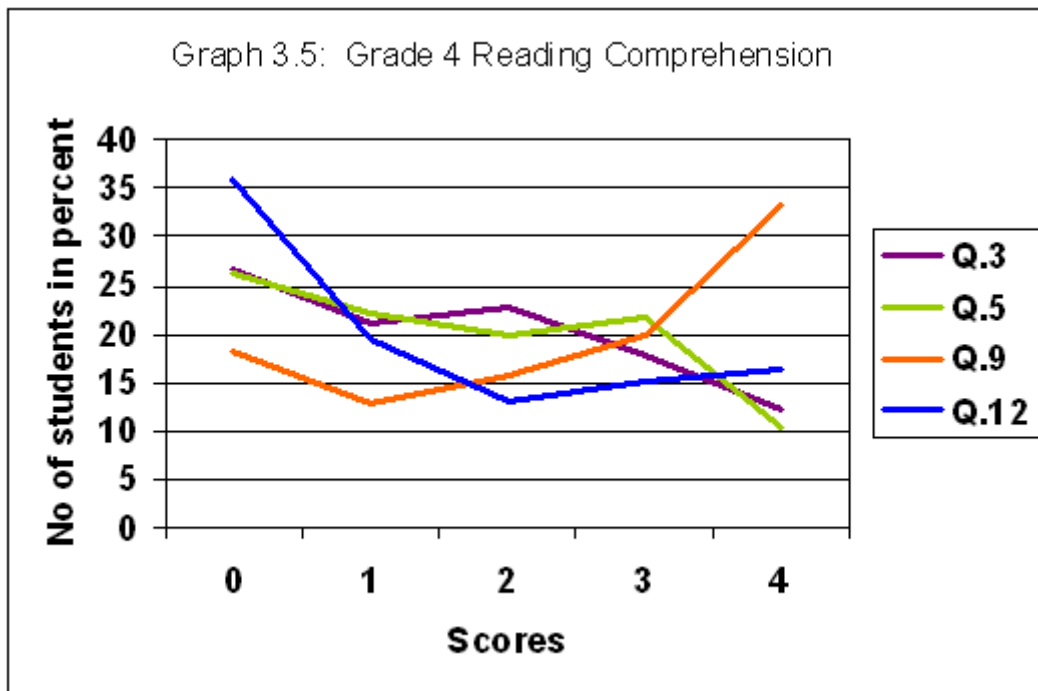
Graph 3.2: Identification of alphabets (grade 2)



Graph 3.4 Reading comprehension words/sentences (grade 2)



The graphs 3.2 and 3.3 show children's performance on the questions related to reading competence. Question no. 1 and 2 were related to recognition of Devnagari alphabets. It is clear that majority (around 60% scoring 3 i.e. 100% marks in these questions) of the students have mastered this competency at the end of grade 2. However, graph 3.5 shows that competence in reading sentences and continuous text is mastered by only a small minority (around 3% students scoring 100% marks). The fact that even after knowing Devnagari alphabets children are not able to read and comprehend points to pedagogic problems. Actually these kinds of problems arise due to rote learning of varnamala for a prolonged period of time where, reading is equated with decoding, instead of meaning.



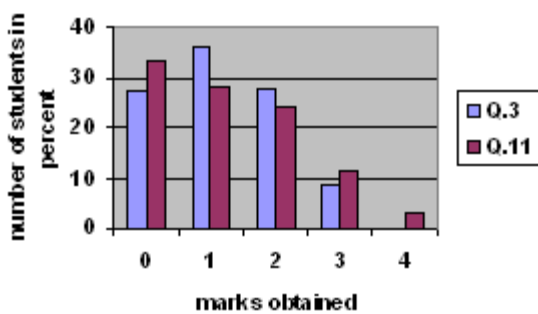
Graph 3.4 clearly shows that in none of the questions related to reading comprehension more than 60% students have achieved the required acceptable level (which in these cases was scoring 3 or 4 marks). All the questions were asked in the multiple choice form so there was no question of deducting marks for mistakes while writing. Generally one can say that the reading is weak even at grade 4 level.

Question no. 3, 5 and 12 show that only a small minority (less than 25%) could achieve the acceptable level in these questions whereas Question no. 9 slightly a better percentage of students have achieved the acceptable level. This is mainly due to the nature of the text given for reading. Question no. 3 was related to comprehension of a dialogue between 2 persons, question no. 5 was small rhyme related to maize (the known crop in the area), while the question no. 12 was related an advertisement of a book exhibition children probably do not have enough exposure to these kind of reading comprehension exercises. Question no. 9 where children have shown a little better performance was prose text similar to what is given normally in text books. By the end of grade 4 children are expected to be independent readers. Reading being one of the important basic tools to learn other subjects, this issue needs to be addressed immediately.

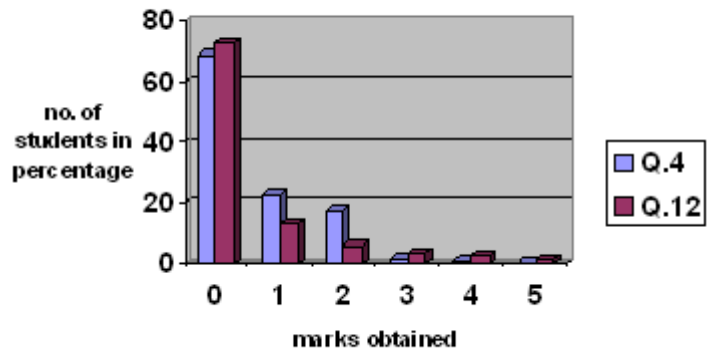
3.3 Writing and Expression through Written Language

The writing competency was tested mainly on 2 components. One was dictation and another was expression through written language. The first component focused on accuracy in writing i.e. spelling, punctuations etc. In second component, these factors were completely overlooked and imagination, choice of words, length of expression was given importance. Writing competency found to be weakest areas as per this study.

Graph 3.6: Dictation- words with abbreviated vowel signs (grade 2)

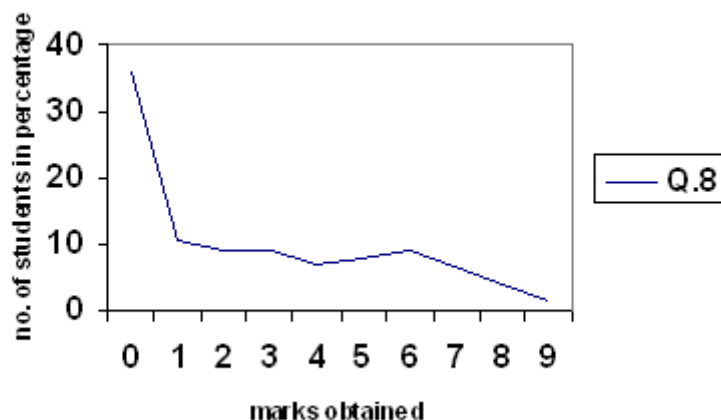


Graph 3.7: Dictation-words with conjunct consonants (grade 2)



Writing words with vowel signs when dictated is expected to be mastered at the end of grade 1 and the words with conjunct consonants at the end of grade 2. The transition from mere identification of letters to writing meaningful words needs to be achieved right in first few months of grade 1. The graphs clearly show that only a small minority is able to move ahead of the basic step of letter identification at the end of grade 2. This could be mainly due to the lacunas in the pedagogy of beginning reading. It is clear that majority of students get stuck at the very first step of letter identification even after 2 years of schooling. It will be worth undertaking small intensive study based on observation of classroom interaction to document the lacuna in the teaching methodology.

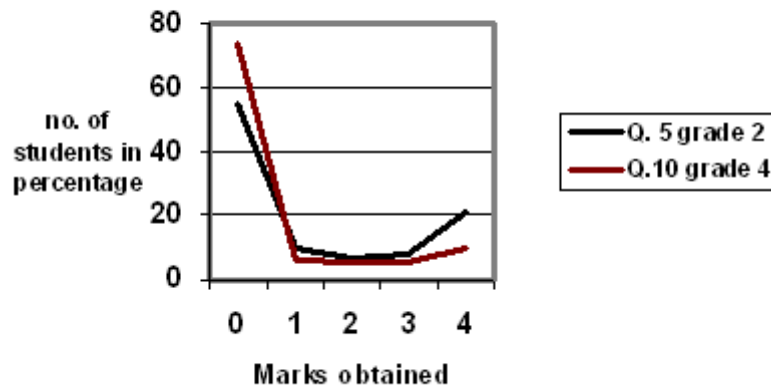
Graph 3.8: Dictation- sentences (grade 2)



Graph 3.7 is showing the status of ability to write sentences when dictated. It is obvious that around 35% students have scored zero in this ability one can not expect a better performance here when children have not mastered writing isolated words.

The graph above shows the status of writing a short passage in grade 2 and 4. Though the number of students getting zero scored is slightly reduced in grade 4 as compared to grade 2, the overall performance is poor in both the grades. Marginal improvement is seen in the number of children achieving mastery in this question at grade 4. It will be useful to do some case studies of the children to find out the factors which may have produced such result since inability to write undermines the very purpose of acquiring literacy skills.

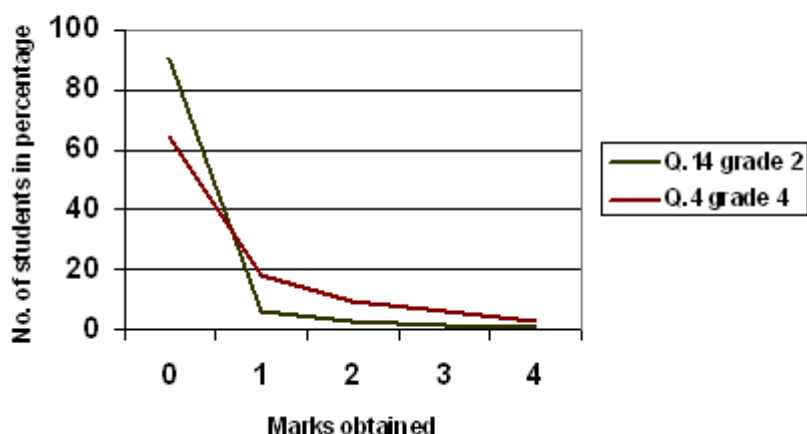
Graph 3.10 : Expression in written language (grade 2)



The above graph (5-10) shows status of expression in written language at grade 2 and 4. In the question for grade 2 pictures of individuals were given and children were asked to describe the action shown in the picture. At grade 4 level a picture of rural vegetable vendor was given and children were supposed to ask few questions to the vendor about her work in writing. The accuracy of spelling and punctuation was completely overlooked as children may prefer to write in their local language instead of standard Marathi. It was observed during the field testing that some consonants from standard Marathi do not exist in the local tribal language hence a consonant having close sound is used by children. For ex: instead of 'chh' consonant 'sa' is used. Considering these facts accuracy of script or grammar was not included as a criterion in the marking scheme.

Very high percentage of students scored zero in both the questions. Writing becomes meaningful if children use this skill to express themselves. Unfortunately children even after 4 year of schooling seem to be completely unaware of this aspect of literacy. A common observation shared by the investigators was that children always try to copy something from the neighbors or from the question papers itself during the test. The notion of writing for children seems to be copying letters or words from somewhere, many a times devoid of meaning. This reflects how teaching of reading writing in primary schools focuses entirely on decoding and copying. Deriving and constructing meaning and self expression which is at the core of learning to become literate is totally undermined. It is necessary to work on these issues while designing the programme for the schools.

Graph 3.11 : Written expression story writing

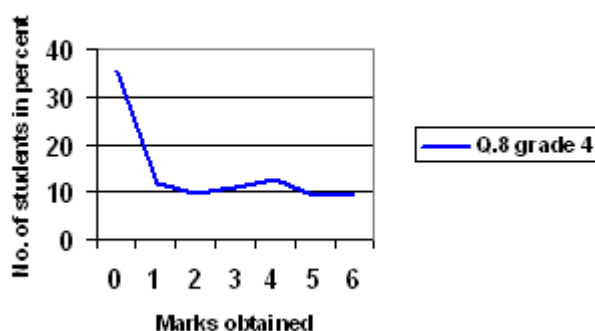


The next level of expression in grade 2 was to construct a story from given 4 words and in grade 4 to complete a story when beginning is given. To maintain maximum possible objectivity in the evaluation of these questions a five point scale was carefully designed. Almost 90% students from grade 2 and 64% students from grade 4 scored zero in these questions. Around 17% students from grade 4 tried to write something related to the given plot of the story. However, they failed to express themselves in complete sentences. 10% students could write one or two sentences related to the theme of the story but their expression was short and they could not develop the story further. 6% students could take the story logically to the end that they thought was appropriate. Only 3% students could develop the characters in the story they added dialogue of their own in to the story and showed a strong sense of expression.

3.4 Some Other Aspects related to Language Education

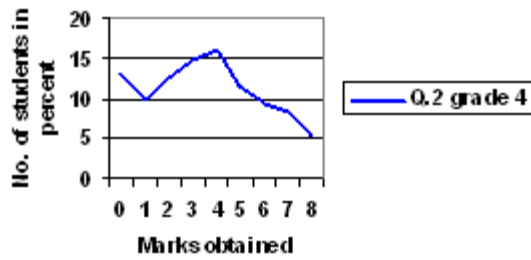
As per the state syllabus children are expected to learn the rules of grammar formally in grade 4. It is presumed that children have already developed these rules intuitively through the usage of language. In grade 4 they are expected to explicitly verbalize these rules. Terms like tense, gender, noun, adjective are formally introduced in grade 4. From this grade onwards children are expected to look at the language as a symbolic system that operates with a set of rules. The test tried to assess to what extent children are familiar with these terms and formal rules of grammar. Looking at the overall performance of the language it is not surprising that almost (35%) students have scored zero on this. What one needs to look at is how 10% of students could score complete marks in this question.

Graph 3.12 : Grammar- grade 4

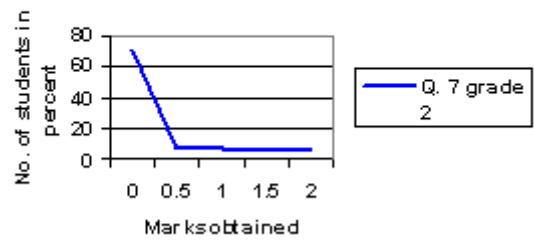


Vocabulary was another area covered in the test. These questions were directly selected from the textbook presuming that children would be familiar with the words and phrases from the text book. In grade 2 almost 70% children were scored zero in the question related to vocabulary. In grade 4 though the number of children scoring zero is a little larger (12%) rest of the distribution is close to normal. It again points out to the issue of exposure to Marathi. Prolonged exposure seems to be helping children in coping with language better at grade 4. The pedagogic question is that to what extent can one reduce the time taken by these children to cope with the language.

Graph 3.13 : Vocabulary-phrases



Graph 3.14 : Vocabulary- Antonym grade 2



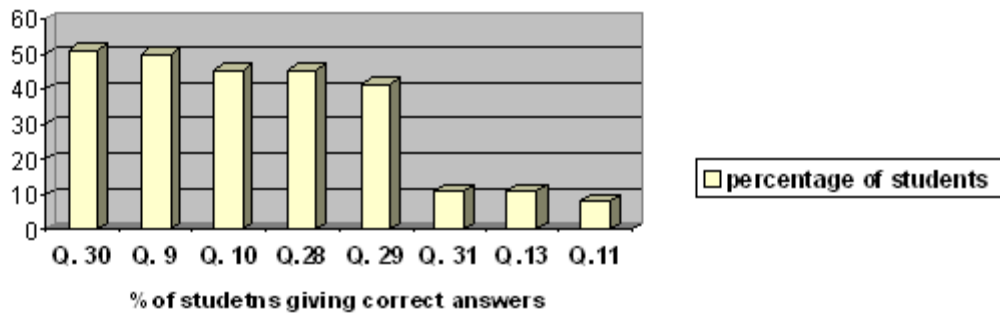
Status of Achievement Levels in Elementary Mathematics

Basic operations:

The competencies related to addition, subtraction, multiplication were evaluated both in grade 2 and 4. While competencies related to division were evaluated only in grade 4. Separate questions were asked to assess the mastery on algorithm (procedural understanding) and the word problems. In the questions related to the word problems children were expected to choose the right operation to find out the answer but they were not expected to actually do the calculations.

Addition is the most basic operation that children learn from almost the beginning of their schooling. By the end of the grade 2 as per the state curriculum children are expected to master the procedure of 2 digit addition 'with carry over'. Question No. 4, 23, 24, 5 were related to addition 'without carry over'. The performance of the students in these questions is better as compare to the question no. 6 and 25 which were related to the procedure of addition 'with carry over'. It is a common observation that children find 'carry over' procedure difficult. The reason is many a times basic concept of place value is not clear to children. The low performance in question no. 7 and 26 is pointing towards the fact that the understanding of the place value is weak. In these questions simple addition sums ($85+3$ and $56+2$), which children could have solved orally, were given. However, they were expected to solve the sums rearranging the numbers vertically in the given table. In the table the place of units and tens was shown clearly. Most of the children were not able to place single digit number in unit's column. The same was observed with subtraction problems given in Question no. 12 and 32. In grade 4 there was only one question related to addition of 4 digit numbers which included the procedure for the 'carry over'. 63% students have solved the problem correctly. Children learn addition over 4 years. They are taught the concept of carry over at the end of grade 2 and no new concepts related to addition is introduced thereafter. Only the procedure is extended to the larger numbers. In the process children get enough time to practice addition over 2 years this probably results in better performance at grade 4.

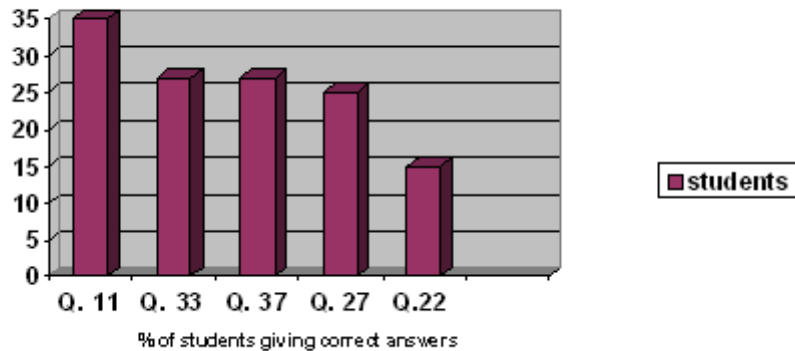
4.2 :Subtraction Algorithm grade 2



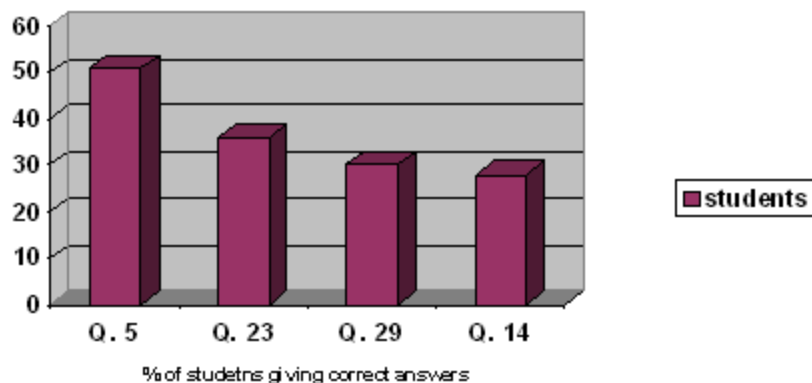
The performance in Question no. 30, 9, 10, 28 and 29 is better as compared to Question no. 31, 13, 11. The questions in which performance is low are related to subtraction with disintegration. At grade 4, all the questions asked are related to ‘subtraction with disintegration’ the performance of children in these questions is poor. The question (Q. no. 22), where the achievement is the lowest is related to subtraction of decimal numbers. This again points out the fact that the children are weak in basic concept of place value. The places on the right hand side of the decimal point are often not explicitly explained to the children. As a result their knowledge of decimal numbers remains weak.

Subtraction procedure is a well research area in mathematics pedagogy. Several ‘procedural bugs’ (mistakes done while carrying out the procedure) have been documented by the researchers. As per the theory these mistakes are not random but they occur when children try to fill up the gap in their logic. It will be worth explore the error pattern in these questions and find out the common procedural bugs. This can give insight for designing the teacher training.

4.3 :Subtraction Algorithm Grade 4

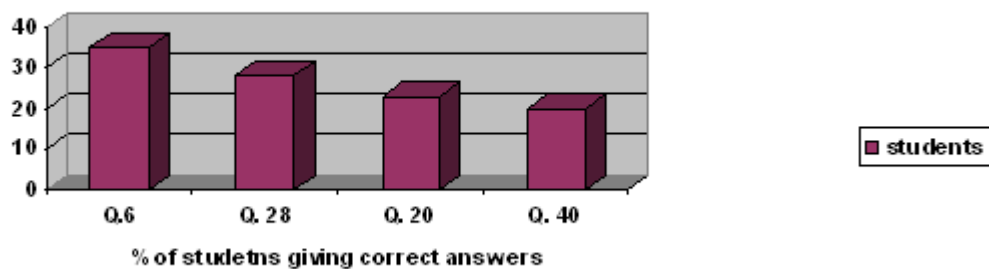


4.4 : Multiplication Algorithm Grade 4



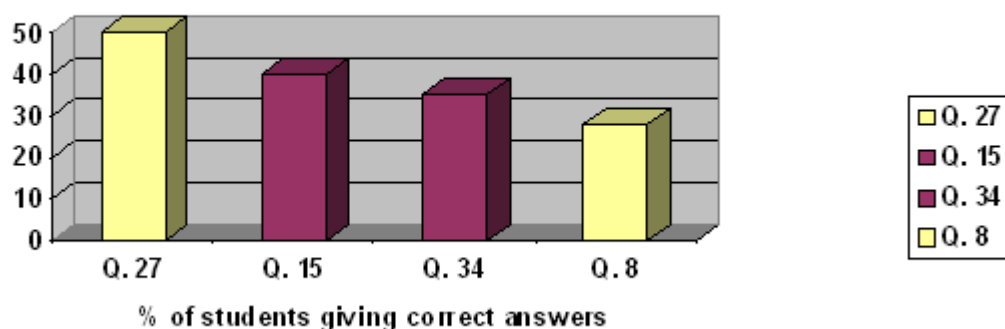
The performance in questions related to multiplication algorithm is weak in both grades 4 and 2. Only one question, related to algorithm of multiplication was asked in grade 2. This was pertaining to multiplying a single digit number by a single digit number. Only 41% children gave the correct answer (Q. no. 39). In grade 4 question were related to multiplying a multi digit number by a single digit number. From 4 given questions only one was answered correctly by more than 51% students. The weak procedural understanding of multiplication procedures could be a result of several factors and needs further probing.

4.5 :Division Algorithm grade 4



It is clear from the graph that the performance in questions related to divisional algorithm is poor a compare to other basic operations. In Question no. 6 and 28 children were expected to divide a double digit number by a single digit number. However in Question no. 6 the dividend was completely divisible by the divisor in both units and tens place, in Question no. 28 a problem remainder was asked. In Question no. 20 and 40 children were expected to divide a 3 digit number by a single digit number. Each question related to algorithm needed a different strategy to solve. The question in which children showed worst performance, there was a zero in tens place. These different strategies need to be taught in a graded manner so that children achieve mastery on the procedures and can select a suitable procedure looking at the given problem. A systematic input needs to be given to teachers during the training programmes.

4.6 :Word Problem: Grade 2

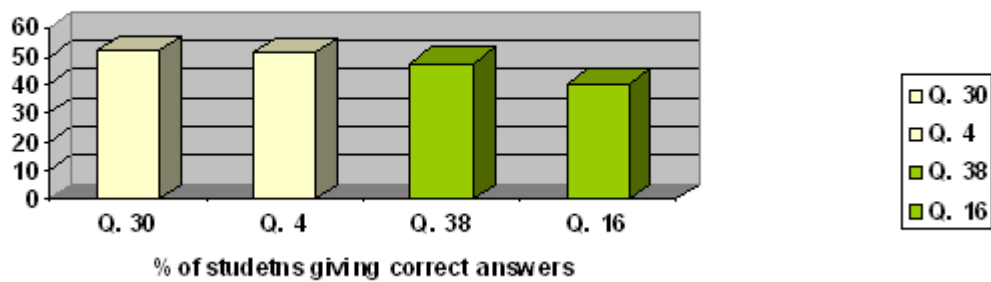


Graph no. 4.6 is showing the status of achievement in questions related to word problems. Question no. 27 and 8 were related to addition while Q. no. 15 and 34 were related to subtraction. Question no. 27 represented actual physical addition of objects while Question no. 8 represented addition by counting 2 sets together. The difference in the performance in these two questions needs to be analyzed further.

Question no. 15 was depicting ‘take away’ meaning of subtraction and Question no. 34 was related to the ‘difference meaning’ of subtraction. It’s a common observation that children understand ‘take away’ meaning better due to extensive practice as compare to the ‘difference meaning’.

The overall performance related to word problems is low. At grade 2 level, the questions were read out to children so there is a little possibility that children could not solve the question due to their poor reading skills. It is often observed that children arrive at answer, if the magnitude of number is small with, using their intuitive understanding of basic operations. However, they are not able to relate it to formal representation of an operation. This gap can be easily bridged by implementing appropriate strategy to teach basic operations in the classroom.

4.7 :Word Problem grade 4

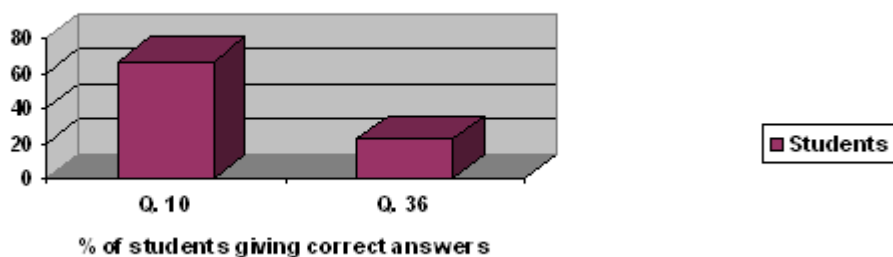


Question no. 30 and 4 were related to row and column model and repeated addition model of multiplication respectively. Question no. 38 and 16 were related to equal distribution and equal grouping meaning of division respectively. Division is considered as one of the hard spot in elementary arithmetic and the low achievement in these questions is not very unexpected. Interpreting the word problem and selecting an appropriate basic operation to solve it is a complex process. It demands conceptual clarity, a fair degree of command on reading skills, vocabulary and visualization. There is ample research available on how to teach word problems and the same needs to be used while developing the teacher training.

Fraction:

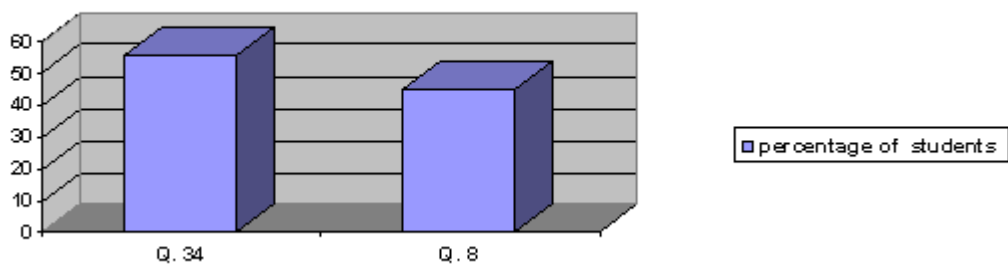
Fraction is an important area in the grade 4 curriculum in Maharashtra and several concepts related to fractions are introduced in grade 4 for the first time. The test tried to evaluate understanding related to basic concepts, representation of fractions and operations of fractional numbers.

4.8 :Fractions



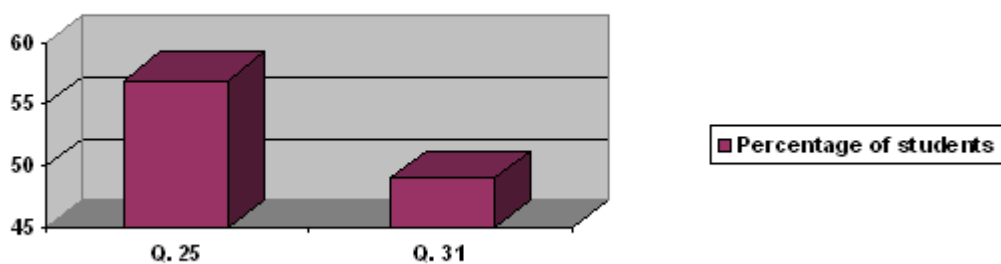
Children have shown the best performance in question no. 10 among questions related to fraction. This question was actually based on children’s intuitive understanding of fractional numbers where children were shown some sets of black and white dots and they were asked in which set the number of black dots was exactly the half of the total number of dots in the set. Almost 60% students have answered this correctly. At grade 4 level children develop this understanding because of age maturity and their increased life experience. Question no. 36, in which children have shown worst performance was based on formal mathematical understanding of fractional numbers. Children were expected to arrange the given unit fractions in ascending order. As compare to Question no. 10 this question demands a lot of mathematical understanding of the concepts like magnitude of the fractional numbers, ascending order. It is necessary that the intuitive understanding shown by children in answering Question no. 10 is formalized to develop mathematical understanding.

4.9: Fractions - Grade 4 Performance



Question no. 34 and 8 were related to identifying a fraction corresponding to the shaded part of the paper. Question no. 34 was a figure from the text book of grade 4 while in question no. 8 the shaded part was shown in an uncommon way. The lower achievement in question no. 8 as compared to Question no. 34 shows the problem of stereotype examples. Presuming that the children giving correct answers have understood the concept, one can say that not all of them are able to apply it to solve an uncommon problem.

4.10 : Fraction



Q. no. 25 and 31 were related to addition and subtraction of fractions respectively. Both the problems content fractions with equal denominators. Actually cognitively there is no significant difference in the concept of addition and subtraction of fractional numbers. So further investigation is needed in this area to explain this difference in performance.

Teacher's Content Knowledge and Pedagogic Understanding

A test was designed to assess subject matter knowledge (SMK) and pedagogic knowledge (PK) of elementary mathematics and first language. The test was of 25 marks. The following table shows the division of marks.

Table 5.1: Distribution of marks

| | |
|---------------------------------------|-----------------|
| Pedagogic knowledge | 11 marks |
| Subject matter knowledge: Mathematics | 10 marks |
| Subject matter knowledge: Language | 4 marks |
| Total | 25 marks |

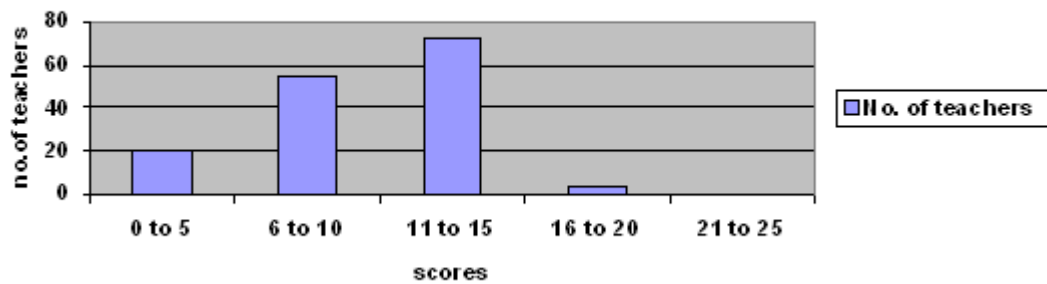
The test was administered to all the teachers teaching in grade 1 to 4 from the schools in the sample. In all 135 teachers were given the test. All of these teachers were D. Ed. and 36 out of 135 were from tribal community (26.66%). Out of 136 forty one (30.37%) were male teachers and 94 (69.62%) female teachers. The following table shows the age wise distribution of teachers.

Table 5.2 : Teachers' age group

| Age group | teachers |
|--------------|------------|
| Up to 25 | 11 |
| 26-35 | 64 |
| 36 to 45 | 39 |
| Above 45 | 21 |
| Total | 135 |

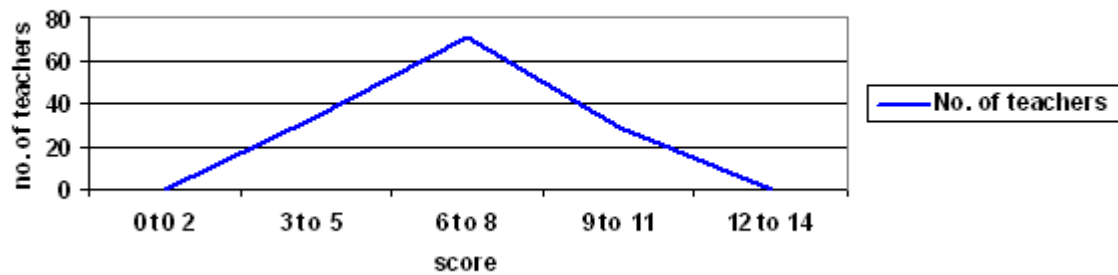
As seen above, almost half of the teachers were in the age group 26 to 45.

Graph 5.1 : Teachers overall performance on the test

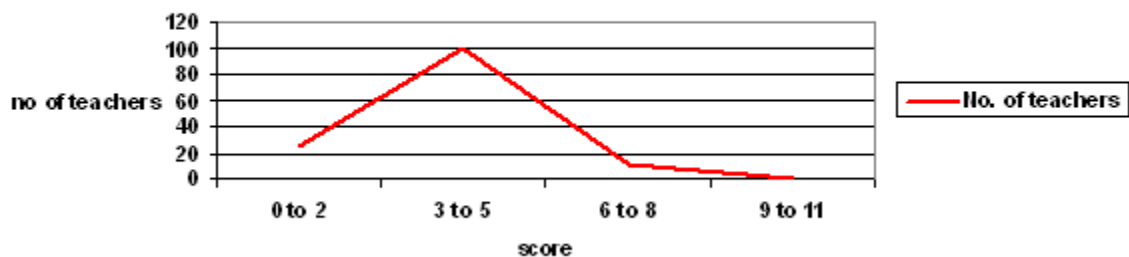


The Graph 5.1 shows overall status of teachers’ performance on the test. Actually the test was based on the content up to grade 5 and pedagogic knowledge required for teaching in primary grades. Naturally one can expect at least 80% teachers get 80% or more score on the test. But there is no teacher who has got score more than 80%. Maximum teachers could score between 20 to 60% and there are about 20% teachers who scored even less than 20%. It’s clear that planning a teacher training programme is going to be a challenge in this case.

Graph 5.2 : Subject Matter Knowledge



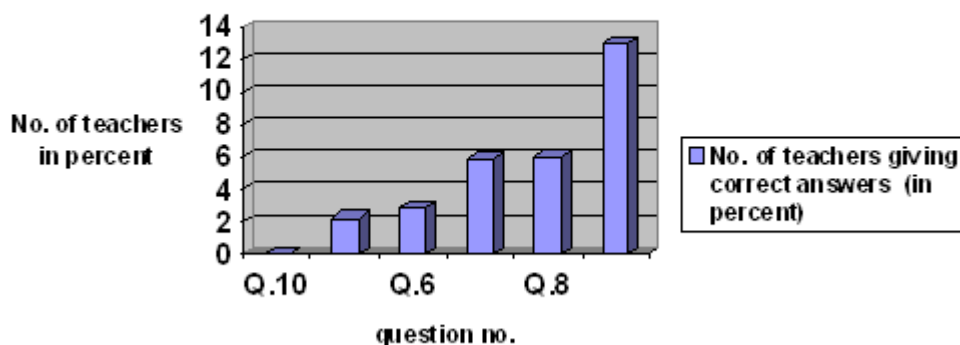
Graph 5.3 : Pedagogic Knowledge



Graph no. 5.2 and 5.3 are showing status of subject matter knowledge and pedagogic knowledge respectively. Considering that the content selected for testing SMK was only up to grade 5, teachers should have shown mastery on the content. Actually very few teachers have scored 80% or more marks in the questions related to SMK. So while planning the teacher training one can not presume that teachers possess the SMK and adequate time needs to be spent for improving SMK of teachers during the training.

As far as pedagogic knowledge is concerned a huge majority (almost 90%) has scored below 50%. This underlines the need of inputs in this area.

Graph 5.4: Where do teachers need maximum support?



Graph 5.4 shows the questions where maximum teachers could not give a correct answer. Out of the 6 lowest achieving questions, Q. No. 8, 9, 10 were related to teachers' SMK of mathematics. Question no. 6 was related to teachers' SMK of language. Question no. 5 and 7 were related to the pedagogic knowledge of the teachers. In none of these questions even 20% teachers could give the right answer.

Point to be noted is that all the 3 questions related to SMK of mathematics were about the fractional numbers. Q. No. 10, to which no teacher could give a completely correct answer, was about different representations of the fraction two upon three. Three from four given representations were correct and one was obviously wrong. The first correct representation was that of number line, the second of a pie diagram and in the third representation two upon three was shown as four upon six (equivalent fraction) on a strip divided into 6 equal parts. The wrong representation was a nonsense diagram. Teachers who were able to identify all the correct representations and also point out the wrong representation were given the mark for this question.

The following table shows the details of the responses given by the teachers.

Table 5.3 :Details of the response given by the teachers

| No. | Representation | No of teachers stating that the representation is correct. | No of teachers that stating that representation is incorrect | Not attempted | Total |
|-----|---------------------|--|--|---------------|-------|
| 1 | Nonsense figure | 0 | 113 (83.70%) | 22 (16.29%) | 135 |
| 2 | Number line | 19 (14.07%) | 94 (69.62%) | 22 | 135 |
| 3 | Pie diagram | 103 (76.29%) | 10 (7.40%) | 22 | 135 |
| 4 | Equivalent fraction | 08 (5.92%) | 105 (78.51%) | 22 | 135 |

Around 16% teachers have not attempted this question. All those who have attempted (around 84%) the question were able to identify the nonsense figure and mark it wrong. The majority (76%) of the teachers have stated that the pie diagram represents the fraction correctly and only a small percentage (14%) has accepted the 'number line' representation to be correct. The percentage of accepting equivalent

fraction as correct representation is still less (around 6%). These figures highlight the problem of stereotype examples. Often while teaching fractions circular objects like bhakari, chapatti, cake are used as an example. Many a times circle being the easiest diagram to divide into equal number of parts teachers use this representation often while teaching. Obviously maximum number of teachers have accepted pie diagram as the correct representation. However, repetitive use of circular representation makes it difficult to extend the concept of fraction to other representations. The fact that most of the times circular figures are used for the representation of the fractions by the teachers matches with an observations in a cross cultural study by a Chinese educator Liping Ma. in her book 'Knowing and Teaching Elementary Mathematics' she has pointed out that most of the American teachers in her sample tried to model a fraction using a circular object. Accepting an equivalent fraction as a representation of the given fraction shows a better degree of mathematical understanding. Many a times the representations are interpreted only using direct information they reveal. Only a small minority of teachers tried to apply there mathematical knowledge to interpret the given representations. Its clear that while planning trainings in Mathematics both the SMK and pedagogic understanding needs to be strengthen to a great extend.

Question no. 8 dealt with representation of an improper fraction 8 upon 5. Two rectangles were shown to the teachers and 8 upon 5 parts were shaded. It was clearly mentioned in the question that one rectangle represents the whole. The options given for the question and the

response given by the teachers in table no. 5.4

Table 5.4 : Teachers response to fraction related questions

| No. | Options | No of teachers choosing this answer | % |
|-----|-----------------------|-------------------------------------|------------|
| 1 | 8 upon 5 | 7 | 5.18 |
| 2 | 10 upon 8 | 9 | 6.66 |
| 3 | 8 upon 2 | 29 | 21.48 |
| 4 | 8 upon 10 | 83 | 61.48 |
| 5 | More than one options | 4 | 3 |
| 6 | Not attempted | 3 | 2 |
| | Total | 135 | 100 |

Fractions are to be understood and represented in relation with whole. Almost 61% of teachers have failed to interpret the fractional numbers in the context of the whole. There answer was 8 upon 10. Obviously they have counted total number of parts in given two wholes and have concluded that shaded part is 8 upon 10. This mistake might have arisen from the basic argument done at the time of introduction of fractions. Fractions are normally introduced as parts 'taken' from the equal parts of the whole. Teachers have overlooked the representation of the whole while giving the answer 8 upon 10.

Another common mistake is to interpret the fraction as 8 upon 2. Here the teachers who chose this option may have considered 2 wholes as separate entity and interpreted them as the denominator. This interpretation might be due to the fact that the 8 shaded equal parts are spread over 2 wholes. Here

the notion that the shaded parts are to be represented at the numerator seems to be strong. The gap in the logic arising from the representation of 2 different wholes seems to have been patched by showing two as the denominator.

Another possible explanation of this mistake could be that the teachers have shown 8 shaded parts as the numerator in the fraction and 2 un shaded parts as denominators. Further probing is really needed to achieve better clarity about these misconceptions among the teachers.

Question no. 9 was related to numeric representation of mix numbers. Number 3 integer 1 upon 5 was shown to teachers. Teachers were asked to choose another representation which showed the same mixed fraction from the given 4 options. The table No. 5.5 shows the response of the teachers to this question.

Table 5.5 : Response to numeric representation

| No. | Options | No of teachers choosing this answer | % |
|-----|---------------------------|-------------------------------------|------|
| 1 | 3 multiplied by 1 upon 5 | 87 | 64.4 |
| 2 | 8 upon 5 | 7 | 5.1 |
| 3 | 3 plus 1 upon 5 | 18 | 13.3 |
| 4 | 31 upon 5 | 10 | 7.4 |
| 5 | Not attempted | 8 | 5.9 |
| 6 | Opting more than 1 option | 5 | 3.7 |
| | Total | 135 | |

Maximum number of teachers (around 65%) have selected the option 3 multiplied by 1 upon 5. Actually a mixed number is an addition of the integer and the fractional number. However teachers have interpreted the mixed number as a multiplication of integer and fractional numbers. This misconception may be due to the algorithm followed for converting the mixed number into an improper fraction. Generally the procedure followed to find the numerator of the improper fraction is to take product of the denominator of the fractional numbers and integer in the mixed number and add the numerator to the product.

This multiplication operation is probably wrongly applied in this interpretation.

Q. no. 5 was designed to check pedagogic knowledge of teachers related to the concept of teaching aid and Q. no. 7 was related to the steps to introduce Devnagari script.

In Q. no. 5 description of teaching aid was given to the teachers and they were asked if they would like to buy this teaching aid. They were also asked to justify their decision. The hypothetical salesman of this teaching aid claimed that it helps children learning the concept of addition. Actually the teaching aid did not contribute meaningfully to the learning in any way. Table no. 5.6 shows the response of the teachers to the questions.

5.6 : Response to pedagogic knowledge

| No. | Options | No of teachers choosing this answer | % |
|-----|--|-------------------------------------|-------|
| 1 | I will buy the teaching aid as it would help children in learning the concept of addition. It is durable and will add fun to the learning. | 62 | 45.92 |
| 2 | I wont buy the aid as it does not contribute any in any way to learning addition. | 04 | 2.96 |
| 3 | I will not buy this teaching aid as I would be able to make it using simple material like cardboard. | 67 | 49.62 |
| 4 | Not attempted | 01 | .74 |
| 5 | Attempted more than one answer | 01 | .74 |
| | Total | 135 | |

94% teachers could not make it out that the teaching aid shown to them will not contribute to the learning process meaningfully. 49% teachers decided not to buy the teaching aid as they thought that they will make it from card board.

Actually the aid was too clumsy to be home made. The teachers did not opting for making it themselves did not think about the time they would have spent to make the teaching aid in comparison to the utility. Use of teaching aids is an important aspect of methodology in elementary education. There is a provision of Rs. 500 per annum for every government teacher to make, purchase and hire teaching aids. To make judicious and effective use of this grant teacher need to strengthen their understanding about the teaching learning material. The training programme for the teachers needs to address this issue.

5.7 : Response to Question no. 6 related to interpretation of the poem

| Options | Yes | No | Not attempted |
|---------|-------------|-------------|---------------|
| 1 | 97 (71.85%) | 16 (11.85%) | 22 (16.29) |
| 2 | 99 (73.33) | 13 (9.62%) | 23 (17) |
| 3 | 72 (53.35%) | 32 (23.70%) | 31 (22.96) |

The state textbooks of Maharashtra have at least 1 poem from old Marathi literature at grade 3 or grade 4 level. It's debatable if such a piece of literature could be really understood at that level. But it's obvious that teachers have been teaching these types of poems ever since they have been included in the textbooks. The language as well as subject discussed in these types of poems is not very familiar to both the teachers and the students. In Question no. 6 poems from grade four state text book for language was given and teachers were asked to interpret it. Three options were given as possible interpretations. Actually none of the option was a correct interpretation. One out of three was obviously a wrong option while other 2 were based on popular similes in Marathi.

It is clear from table no 5.7 that the teachers are completely failed to interpret the poem. Even the obviously wrong option was interpreted as correct option by 53% teachers.

In Q. No. 7 some activities were given to introduce Devnagari script teachers were asked to sequence these activities in such a way that it will be a proper programme of introduction to Devnagari script. Teaching reading and writing is an integral part of teachers day today work. The question tried to assess the strategy used by teachers for introducing literacy to young children.

It was observed from the data that there is know any particular pattern of sequencing the activities. Its noticeable that almost 31% teachers preferred to stick to the old method of introducing varnamala in an alphabetical order.

One more fact that one needs to investigate is that if there is a correlation in the overall language ability and the ability to solve the word problems in mathematics.

It will be interesting to check if the ability to solve word problems shows a stronger correlation.

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ANNEXURE:

List of D.Ed. Colleges from where student participated for conducting field work

| | |
|---|----|
| 1. Pu. Sane Guruji Vidya Prasarak Adhyapak Vidyalay, Shahada | 26 |
| 2. Adivasi Yuvak Krida Vikas Mandal's Adhyapak Vidyalay, Kodhli | 12 |
| 3. Krishnarao Ramji gavit Adhyapak Vidyalay, Natavad | 12 |
| 4. Krishnarao Ramji gavit Adhyapak Vidyalay, Pathrai | 12 |
| 5. Govardhanji Adhyapak Vidyalay, Chaupale | 12 |
| 6. Prahlad Sham Patil Tantrik Shikshan's Adhyapak Vidyalay, Korit | 12 |

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