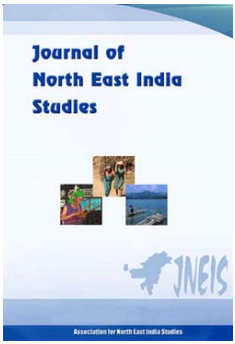

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Mathematics Achievement of Class V Students: A Study of North Eastern States

Satya Bhushan & Santosh Kumar

More than years of schooling, it is learning or the acquisition of cognitive skills that improve individual's overall life productivity. It is demonstrated by many researchers that a solid foundation in mathematics and language is necessary for primary school children to navigate the information in technological age. Students with strong grasp in mathematics have an advantage in academics as well as in the job markets. The paper has raised many issues that have serious implication for quality improvement in mathematics education at primary stage in the North eastern States. There is huge number of students in the States whose achievement in mathematics is at lower side of the scale. Those achieving mastery level competencies constituted a small fraction of the total students.

Keywords: Mathematics , Achievement, Class V Students, North Eastern States

It is a well established fact that education imparts knowledge and skills that enable people to realize their full potential and so it becomes a catalyst for the achievement of other development goals. Education reduces poverty, increases job opportunities and foster economic prosperity. It also increases people's chances of leading a healthy life, deepens the foundations of democracy and changes attitudes to protect the environment and empower women. To unlock the wider benefits of education, it needs to be equitable and the schooling that children receive need to be of good quality so that they learn the basics.

The National Policy on Education, as revised in 1992, had emphasized the need for a substantial improvement in quality of education to achieve essential levels of learning. Sarva Shiksha Abhiyan (SSA) aims at providing useful and relevant elementary education to all children in the age group of 6-14 years. It is an effort to universalize quality elementary education for all children. The National Curriculum Framework 2005 has also strongly articulated the need for a substantial improvement in the quality of education.

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In August 2009, Parliament has passed the historic Right of Children to Free and Compulsory Education (RTE) Act, 2009. It provides a justifiable legal framework that entitles all children between the ages of 6-14 years to an education of reasonable quality, based on principles of equity and non-discrimination.

Measuring student learning outcomes is increasingly recognized as necessary not only for monitoring a school system's success but also for improving education quality. Student achievement information may be used to improve education policy in a wide variety including the design and implementation of programme to improve teaching and learning in classrooms, the identification of learning gaps among the students so that they can get the support they need.

National Achievement Survey (NAS) conducted by NCERT under flagship programme of SSA provides a good basis for tracking learning outcomes and is an attempt to assess the health of education system.

The North Eastern States have some common characteristics like tribal concentration, hilly areas, highly rural, predominance of agriculture, industrial backwardness etc. Like many states in the country, North Eastern States literacy rate have grown manifold over the period. The performance of Mizoram is best among the North Eastern States and also it is placed third position in the country. The increase in literacy empowered the people of NE states to send their children to school besides, efforts made in under SSA and other schemes of Government, resulted in approaching towards universalisation of elementary education in North Eastern States.

Review of Literature

A number of efforts have been made,in the past to study the achievement of children at primary stage. The first major study on mathematics achievement by Kulkarnai (1970) revealed that boys achieved higher than girls, privately managed schools provided better teaching-learning situation. The study by Dave (1988) found large differences in mathematics and language achievement between states. Shukla (1994) found that over states, the difference between the mean achievement of boys and girls did not have the same direction. In all the states Scheduled Caste (SC)/Scheduled Ttribe (ST) students performed lower than non-SC/ST students.

Jangira (1994) analysed the Base Line Survey (BAS) under DPEP states of India and found that students performed low in reading as well as in mathematics. There was significant difference in achievement across schools as well as states. Later on the study of Singh and Saxena (1995) revealed wide variation in the result of BAS data due to diversity in socio economic and cultural aspects. Rath and Saxena (1995) found that parent involvement reduces the SC/ST achievement gap of the eight states. In the same year Jain and Arora (1995) found while analyzing the BAS data that teacher qualification, percentage of female teacher, teacher commitment, and head teacher as leader reduce the gender achievement gap.

Similar studies were conducted using BAS data of DPEP by Aggarwal (1995) found that a significant difference among schools belonging to different management agencies and Verghese (1994) found that the level of school infrastructure and variations in the availability of teaching-learning materials is not clearly related to

learning achievement. A study by Aggarwal (2000) on learning achievement for primary schools in Delhi covering all types of schools wherein the achievement levels in language and mathematics were assessed.

In the year 2000, the programme of National Achievement Survey (NAS), originally conceived by NCERT as an independent project, was incorporated into the Government's flagship project Sarva Siksha Abhiyan (SSA). Under SSA initially three cycles of NAS were planned. Each cycle was to cover three key grades: class III, Class V and Class VIII. The first cycle conducted in the period 2001-04 was named as Baseline Achievement Survey (BAS). The second cycle, conducted during 2005-08 was the mid-term Achievement Survey (MAS). The third planned cycle was originally named as Terminal Achievement Survey during and is now known as "cycle 3". For class V assessment is carried in three subjects: mathematics, language and EVS. In this study Item Response Theory was used and which enable to state what student know and can do to in different subjects besides the results over the cycle may be composed to measure the growth over the NAS is being conducted in government and government aided schools across the states. There is no exclusive study which throws light on mathematics achievement of students of North Eastern States.

Data

The data for the study have been taken from the "National Achievement Survey Class V (NAS Class V)" conducted by NCERT during November 2010 and March 2011. The subjects covered were Language (including reading comprehension), Mathematics and Environment Science (EVS). Manipur and Arunachal Pradesh have not participated in the class V (cycle 3) survey.

Methodology: The NAS class V is a sample survey study and samples are selected applying the Probability Proportional to Size (PPS) sampling technique at different levels. The results are reported using 'Scale Score' calculated by using Item Response Theory (IRT) and for this a scale of 0 to 500 having average score at 250 with Standard deviation 50. For additional information i.e. item mapping we analysed the raw data pertaining to the North Eastern States which throw light on what student of the state can do in sub-domains of mathematics.

For the purpose of Reporting the results, the Survey classifies the participating States/UTs into three different groups according to their population coverage and the class tested i.e. Goup-1(G1) where 80% or more population covered, Group-2(G2) where less than 80% population covered and Group- 3(G3) where test is conducted on start of class VI.

Achievement in Mathematics

There were three test booklets, each containing 40 items covering mathematical domains such as number system, basic operations, measurement, geometry, and pattern. In addition to the content domains listed above, items were constructed to test a range of cognitive process or skills in variety of context.

The table-1depicts the average scale scores of the five states and group average

scale scores along with the Standard errors in the parenthesis. It is found that there is no significant difference between average score and group average score in case of Meghalaya and Nagaland while for the remaining three States the difference is significant. Further, in case of Assam and Meghalaya, Group average scores are better than that of both States. But in case of Tripura, the State average score are better than group average score in Mathematics. The State of Nagaland has the maximum variations amongst the scores of the students followed by Tripura.

Table 1: Average Mathematics Scores in Class V in North Eastern States

States	Average Score(S.E)	Group Average(S.E)	Significant Difference	Population Group
Assam	241 (2.3)	250 (1.6)	Yes	G2
Meghalaya	244 (2.9)	246 (1.1)	No	G3
Mizoram	233 (1.0)	246 (1.1)	Yes	G3
Nagaland	251 (3.5)	246 (1.1)	No	G3
Tripura	260 (3.0)	251 (0.7)	Yes	G1

Percentile Score

The table -2 shows the range of scores between 25th and 75th percentiles (inter- quartile range) and 10th and 90th. The range between 25th and 75th percentiles represents the performance of the middle 50% of the students. The table reveals that the inter-quartile range is highly variable as Mizoram has an inter-quartile range of 27 whilst Nagaland has 62 in the same group. The values in Mizoram and Meghalaya suggest that the class V population is far more homogeneous than that of other states of NE. Besides, a maximum heterogeneity is observed in case of Tripura. Further, the range between 10-90 percentiles clearly indicates, in most of the cases which is almost same barring in case of Tripura, that there is high variability of scores between low achievers and high achievers in Tripura.

Table 2: Percentiles Scores in Mathematics in Class V in North Eastern States

States	Range 75-25 (Group Score)	Range 90-10 (Group Score)	Population Group
Assam	62 (60)	130 (113)	G2
Meghalaya	50 (51)	117 (112)	G3
Mizoram	27 (51)	76 (112)	G3
Nagaland	62 (51)	138 (112)	G3
Tripura	80 (64)	151 (125)	G1

Area-Wise Achievement

Table-3 depicts the average scores in rural and urban area in mathematics. Interestingly, rural students are doing significantly better than urban students in Nagaland and Tripura whereas as there is no significant difference in the average scores of rural and urban students of Assam, Meghalaya and Mizoram.

Table-3 Area wise Average Scores in Mathematics in North Eastern States

States	Average Score(S.E)		Significant Difference	Population Group
	Rural	Urban		
Assam	241(2.3)	250(1.6)	No	G2
Meghalaya	244(2.9)	246(1.1)	No	G3
Mizoram	233(1.0)	246(1.1)	No	G3
Nagaland	251(3.5)	246(1.1)	Yes	G3
Tripura	260(3.0)	251(0.7)	Yes	G1

Sub-domain Analysis

The table-4 below is having information on proportion of students responded correctly. Three items (easy, average, and difficult) are selected in three domains namely Number System, Computation and Geometry. It is found that proportion of correct answer in third item is low as compared to other two items in general and implies that students are facing difficulty in solving items which have application part. In general, students in all states found Geometry difficult as compared to Number system and Computations. Therefore, States need to give more emphasis on geometry in their teachers training programme.

Table-4: The proportion of students selecting the correct option in each of the nine sample items

States	Number System			Computation			Geometry		
	i71	i3	i49	i44	i45	i28	i42	i48	i8
Assam	48	42	36	67	39	29	54	36	29
Meghalaya	66	32	34	77	44	29	42	38	36
Mizoram	51	26	34	83	45	24	37	38	31
Nagaland	54	50	35	75	39	35	55	45	40
Tripura	64	47	44	79	48	41	75	49	30
National	61	45	40	76	45	34	68	43	36

i = item

Table-5 is having mean percentage scores in four domains in mathematics i.e. Op-

erations, Geometry, Measurement, Number System. Except Tripura, all other four States have less mean percent score as compared to overall scores in all four testing domains except in operations in mathematics and this varies up to 7 percent points. Further, if looked at the spread of the mean scores Tripura has more spread of scores as compared to other states in NE states.

Table-5: Distribution of students in different domains of Mathematics

States		Operations	Geometry	Measurement	Number System
Assam	Mean(%)	49	49	44	44
	SD	23.8	24.2	23.6	24.8
Meghalaya	Mean(%)	54	47	43	48
	SD	22.7	22.5	22.4	22.3
Mizoram	Mean(%)	46	45	37	44
	SD	19.2	18.4	16.0	19.2
Nagaland	Mean(%)	54	51	48	52
	SD	25.0	26.4	24.3	25.6
Tripura	Mean(%)	57	54	53	56
	SD	27.1	27.0	27.2	27.5
Overall	Mean(%)	54	52	47	51
	SD	24.5	25.2	24.5	25.3

Table-6 provides the information about the proportion of students in different range of scores obtained and their social category. It may be observed that majority of the students belonging to SC and ST categories are lying in the range of below 50. Hence it can be concluded that SC and ST are performing well below the general and OBC category students in all states except Tripura. Students belonging to ST category in all States except Nagaland are at the bottom in range of above 50 score. This implies that States need to revisit teachers training and to come up with effective mathematics classroom teaching strategies.

Mizoram is having maximum (above ¾) number of SC/ST students in the range of 0-50. This warns us to look further for finding out the reason why such kind of trend is emerging.

Item Analysis

Now looking more specifically, items in the domain of Number System is analyzed. In the survey a total of 26 items were included in the domain of Number System of different skills and difficulty. The mean scores of top 25% and bottom top 25% students in NE states are nearly the same as that of the National main scores of top and bottom 25% students.

Table-6: Distribution of students in different range of scores in Mathematics and Social Category

States		0-25	26-50	51-75	Above 75	0-50	Above 50
Assam	SC	19.6	52.6	21.8	6.0	72.2	27.8
	ST	21.0	54.0	18.6	6.4	75	25
	OBC	12.9	49.6	27.8	9.6	62.5	37.4
	General	13.7	41.1	30.3	14.9	54.8	45.2
Meghalaya	SC	14.7	45.6	35.3	4.4	60.3	39.7
	ST	9.2	54.6	25.9	10.2	63.8	36.1
	OBC	15.7	54.9	25.5	3.9	70.6	29.4
	General	4.5	40.9	43.2	11.4	45.4	54.6
Mizoram	SC	4.8	75	20.2	0	79.8	20.2
	ST	8.7	67.4	22.9	1.1	76.1	24
	OBC	5.3	42.1	52.6	0	47.4	52.6
	General	8.2	68.9	21.3	1.6	77.1	22.9
Nagaland	SC	22.9	37.1	31.4	8.6	60	40
	ST	13.5	41	29.1	16.4	54.5	45.5
	OBC	8.8	59.6	26.3	5.3	68.4	31.6
	General	9.6	45.8	20.5	24.1	55.4	44.6
Tripura	SC	11	29.9	37.5	21.6	40.9	59.1
	ST	19.2	31.8	29.2	19.8	51	49
	OBC	10.2	30.9	40.4	18.5	41.1	58.9
	General	6.6	27	32.8	33.6	33.6	66.4
Overall	SC	13.6	42.5	29.5	14.4	56.1	43.9
	ST	12.8	50.5	26.9	9.8	63.3	36.7
	OBC	11.4	40.1	31.2	17.3	51.5	48.5
	General	10	41.2	32.5	16.3	51.2	48.8

The performance on the geometry item (27) of the top 25% performing students is below the national average in case of all states. The performance of Mizoram is poorest followed by Meghalaya and Tripura.

Table 9: Performance on Number System [26 items] across States

	Average Scores (top 25%)		**Average Scores (bottom 25%)**	
	Mean	**SD**	**Mean**	**SD**
Nagaland	81	13.4	25	12.6
Tripura	81	13.5	21	14.8
Meghalaya	78	12.2	26	13.0
Mizoram	78	11.3	27	12.4
Assam	77	13.5	21	12.2
National	80	13.3	24	13

Table 10: Performance of Top and Bottom 25% students across the States

Geometry Item No. 27 Computation of Diameter of a circle given the radius		
States	Average Top 25%	Average Bottom 25%
Nagaland	76.0%	19.1%
Assam	75.5%	21.3%
Tripura	73.3%	16.7%
Meghalaya	71.6%	15.7%
Mizoram	63.4%	18.4%
National Average	**80.1%**	**18.9%**

Conclusion

The number of students in the range of 0-50 achievement is very high in classes V. Those achieving mastery level competencies constituted a small fraction of the total students. Assuming that there should be 80 per cent of children able to learn 80 per cent competencies, there is miles to go. Looking at the performance of the students, it is important to evaluate the mathematics curriculum and related instructional materials. The focus should be upgrading curriculum periodically, integrating technology and high quality instructional materials to help students in learning the applications of mathematics in real life. Teachers should be encouraged to develop and use locally relevant instructional materials.

Review of the professional development strategies for the teachers and head teachers stressing both subject matter expertise and pedagogical mastery is found to be necessary.

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