Learning Achievement in Mathematics and Hindi Language in Municipal Corporation Schools of Delhi

Rashmi Diwan *

Abstract

The research paper is an outcome of an exploratory study to assess learning levels of children in Mathematics and Hindi as a language in Municipal Corporation schools of Delhi. The two tests were administered on 1668 pupils of Grades II, III and IV across 16 corporation schools in the West District of Delhi. The study brings out evidences to show that in almost all corporation schools, 95 per cent pupils in Grades II, III and IV obtained a percentage between 43.85 and 68.43 in Mathematics. Overall Grade IV pupils in all schools needed improvement as the average performance came to 46.72 per cent with 95 per cent scoring between 43.40 per cent and 50.05 per cent. The school and grade wise analysis in Hindi language test reveals that the learners in Grades II, III and IV performed well in Hindi. The study found girls to be showing better performance than boys in both the subjects. The study also revealed that performance of pupils is largely dependent on family size and occupation of parents than the distance travelled to school. Few schools showing low performance in both or a single subject were also identified. The recommendations in the paper centre on building enabling conditions in primary schools to facilitate improved performance of pupils.

* *Professor and Head,* National Centre for School Leadership, National University of Educational Planning and Administration, 17-B, Sri Aurobindo Marg, New Delhi110016.

Introduction

A large quantum of research produced in the western world largely centers around standards and benchmarking student performance. Most empirical studies in India focus on determinants of learning achievement in measurable terms relating to school, student and family background characteristics. The research base on determinants of learning spans a broad range of content grade levels and research methodologies. Indian concern are high about incidences of silent exclusion or children who are in school, but do not learn enough. But there are no concerted efforts of research to understand the dynamics of school, push out factors or children and family characteristics, the pull-out factors that have led to such situations.

Overall the studies indicate to the poor learning levels in Mathematics and languages at primary stages, though the research base spans a broad range of content, grade levels and methodologies. This study gives an insight into the achievement levels of learners in Mathematics and Hindi as a language in Municipal Corporation schools in urban Delhi, the capital of India.

Related studies

Substantial studies in India have been focusing on instruction, curriculum, textbook analysis, instructional time devoted, teaching methodology, and problem solving teaching strategies, clarification of basic concepts and a range of factors associated with levels of learning of Mathematics education.

Studies on Mathematics and Science

Despite research studies in Mathematics education over the past three decades has increased dramatically (Kilpatrick, 1992), the scope of research on learning levels of Mathematics in government schools is limited.

Husen T (1967) conducted the first International Study on Mathematics in 1967. The teachers were asked to rate the extent of student exposure to particular mathematical concepts and skills. Strong correlations were found between students 'opportunity to learn' (OTL) scores and mean student achievement scores in Mathematics, with high OTL scores associated with high achievement. The link between outcomes in students Mathematics and opportunity to learn was also found in subsequent international studies, such as the Second International Mathematics Study (McKnight et al., 1987) and the Third International Mathematics and Science Study (TIMSS) (Schmidt, McKnight & Raizen, 1997). There is also a positive relationship between total time allocated to Mathematics and general Mathematics achievement. Suarez et al. (1991), in a review of research on instructional time, found strong support for the link between allocated instructional time and student performance. A

set of studies have shown that the extent of the students' opportunity to learn Mathematics content bears directly and decisively on students' Mathematics achievement. If the teachers allocate sufficient time for Mathematics instruction at every grade level, student attainment goes up. Short class periods in Mathematics say for 35-40 minutes being implemented generally hardly leave impact. Studies by Grouws and Cabula (UNESCO, 2000) also suggest that textbooks address little new content each year, and therefore, should be avoided, or their use should be heavily supplemented in appropriate ways. Teachers should not use textbooks as a single instructional tool. Internationally, Keeves (1976) in his paper "Curriculum factors influencing school learning", found a significant relationship across Australian States between achievement in Mathematics and total curriculum time spent on Mathematics.

The studies by Brownwell (1945) have consistently emphasized on meaningful teaching as having positive effects on student learning, specifically in high-poverty areas. Few research studies have also drawn inferences to show that learners can learn both concepts and skills by solving problems. Heid's research (1988) showed that the procedural skills taught to learners through conceptual understanding significantly outperformed those taught through a traditional approach.

Mack (1990) demonstrated that learners' rote (and frequently faulty) knowledge often interfered with their informal (and usually correct) knowledge about fractions. She successfully used learners' informal knowledge to help them understand symbols for fractions and develop algorithms for operations.

Fawcett's research as early as in 1938 with geometry learners suggests that learners can learn basic concepts, skills and the structure of geometry through problem-solving. In the classrooms, researches point out that there is evidence that students can learn new skills and concepts while they are working out solutions to problems.

Qualitative investigations have shown that other important and often unmeasured outcomes beyond improved general achievement can result from small group work. In one such investigation in 1991, Yackel, Cobb and Wood studied a small group of second-grade pupils to examine problem solving strategies in Mathematics. They reported that small-group problem solving followed by whole-class discussion was the primary instructional strategy for the entire school year. They found that this approach created many learning opportunities that do not typically occur in traditional classrooms, including opportunities for collaborative dialogue and resolution of conflicting points of view. Slavin's research (1990) showed positive effects of small group work

on cross-ethnic relations and student attitudes towards school.

Another set of studies indicate that whole-class constructive discussion on each other's ideas and reasoning, following individual and group work, leads to improvement in student achievements when carefully managed by the teacher. Wood (1999) found that it works best when discussion expectations are clearly understood. Learning enhances as the arrangement becomes more like a collaborative problem-solving exercise by working together to resolve differences in thinking or confusions in reasoning.

Teaching Mathematics with a focus on number sense encourages learners to become problem solvers in a wide variety of situations, and to view Mathematics as a discipline in which thinking is important. Markovits and Sowder (1994) studied seventh-grade classrooms to understand number sense in Grade VII where special units on number magnitude, mental computation and computational estimation were taught. They determined that after this special instruction, learners were more likely to use strategies that reflected sound number sense, and that this was a long-lasting change.

Cobb and other associated researchers (1991) developed a variety of strategies to involve students of Grade II as problem solvers to a wide range of problems, with a focus on number sense. It was found that the treatment group demonstrated a greater autonomy, conceptual understanding of place value, and ability to do estimation and mental computation, than did students in comparison classrooms.

Studies on Mathematics education and languages are limited in Indian school contexts. A set of studies indicate differences in types of schools that influence learning levels of children in different subjects. Empirical evidences show that schools under different managements, government, and private-aided or private-unaided are significant predictors of educational outcomes. Khadi and Sunitha (2006) refer to the study of Kundu (1977) quite often which revealed that home learning environment, school learning environment and academic outcomes are influenced by socio-economic status and cultural patterns of the family. Parents have become the most potent force in shaping the overall personality of children in such studies. Looking at different social strata, Dreze and Kingdon (2001), Aggarwal (2000) and Filmer et al. (1997) have found that boys and children belonging to the upper castes perform better.

Studies focusing on learning achievement levels in mother tongue, mostly in Hindi are limited to Indian school contexts. One such study by Shukla (1974) on achievement levels of Indian students in mother tongue, Hindi and Science, brings to the fore that privileged children in private high fee charging institutions did

better in both Hindi and Science, than the regular Indian International Association for Evaluation of Educational Achievement. Sample, Yadav and Mandal quote the work of Srivastava et al. (1986) on the comparative aspect of mother tongue and English as medium on subjects of study and attainment of learners longitudinally. The study concludes that among the different factors responsible for better achievement, English medium improves mother tongue too because of better teaching methods, materials in English and media the students are exposed to.

Anand (1985) indicated that it was the quality of instruction which accounted for spelling errors by Class V students of Hindi medium schools of Delhi. The study revealed that the largest number of mistakes were made in the use of *matras* due to inadequate mastery of the most basic tasks in the process of spelling, the sound-letter associations required for correct spelling and the absence of oral-aural-visual and motor experience. Goyal (2007), in the survey conducted on approximately 6000 students in 200 schools in three tests – two language tests (Reading Comprehension and Word Meaning) and one test in Mathematics in Grades IV and V of government private-aided and private-unaided schools in Orissa showed that overall learning levels were low absolutely and relatively in government schools. The average percentage of correct scores in government schools ranged from 30 to 40 percentage points, half or a third below the average scores in private-unaided schools.

The study of Tooley Dixon (2005) draws a comparative picture on pupil outcomes in primary government and private schools using tests in English and Mathematics. The results showed that children in unrecognized private schools on an average scored 72 per cent higher in Mathematics, 83 per cent higher in Hindi and 246 per cent higher in English than government school students. Wessels (2011) compared and analyzed examination results of Grades V and VII in recognized and unrecognized schools of Punjab in 2005. The study revealed significant differences in learning levels of private-unaided school children, who had excelled private-aided school children. Kingdon (2007) examined 902 students of Grade VIII in 30 schools from government, private-aided and private-unaided schools in urban Lucknow. The results revealed that private-unaided schools scored almost twice as high as the government and private-aided schools in both Mathematics and reading. With scores additionally corrected to account for social and personal factors, private-unaided schools still triumphed with a 27 per cent higher teaching success rate in Mathematics than government and private-aided schools.

The Present Study

The present study attempts to examine achievements in Hindi, the mother

tongue of most children in Delhi, and Mathematics for Grades III, IV and V in the Municipal Corporation schools of Delhi.

These children belong to low income families; most of them are first generation learners and whose parents work as vendors or domestic help in houses or shops (Diwan,1995). The parents do not have high aspirations for their children, but do value minimum education for them.

Description and Administration of Tests

Two sets of tests, Hindi Language and Mathematics were developed by the investigator for Grades II, III and IV in Municipal Corporation schools of Delhi. The validity of the tests were assessed by organizing a one-day workshop for select group of Municipal Corporation schools in June, 2011. The description of test items grade-wise in each of the tests is as follows:

Table 1
Number of items in Hindi Language and Mathematics Test

Stream	Grade II	Grade III	Grade IV
Hindi Language Test	9	8	9
Mathematics Test	16	14	15

Two sets of schools were taken as the unit of study. The sets of schools, on the basis of proximity, were divided into two Sites. Site 1 consisted of three schools and Site 2 of 13 schools. The details of administration of the two tests on the number of pupils in Grades II, III and IV are as follows:

Table 2
Total Scores in Hindi Language and Mathematics Test

Stream	Grade II	Grade III	Grade IV
Hindi Language Test	9	8	9
Mathematics/ Numerical Ability Test	16	14	15

Table 3
Administration of Two Tests

Stream	Grade II	Grade III	Grade IV
Site 1	84	104	124
Site II	424	457	475
Total	508	561	599

Presentation of Data and Interpretation

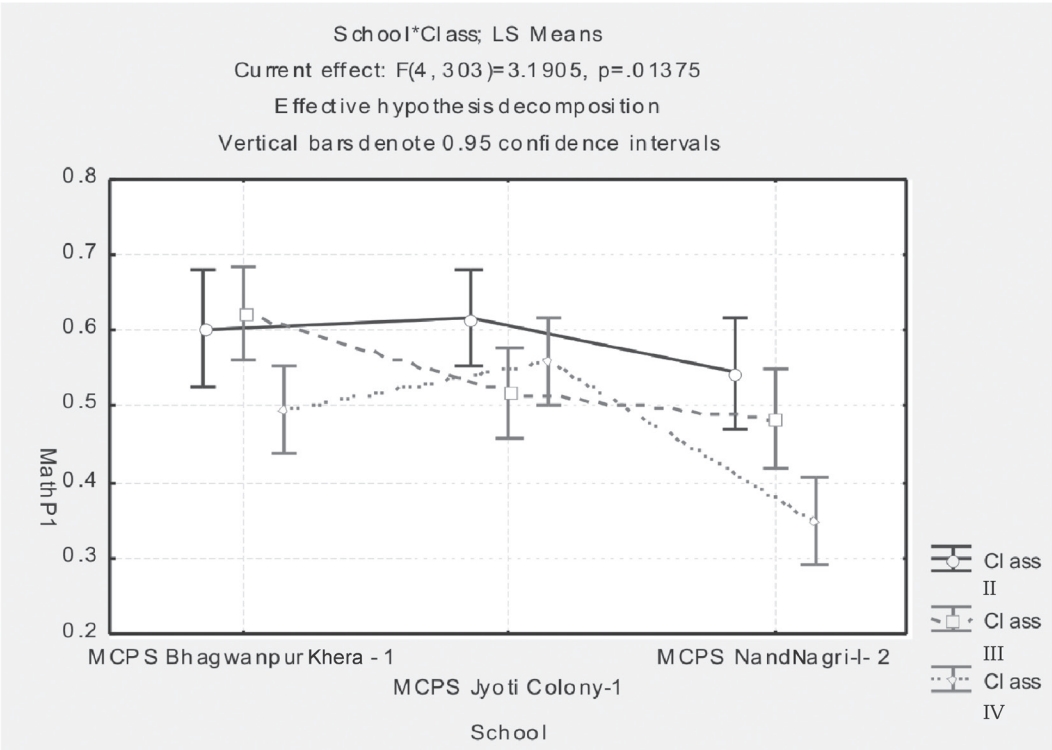
The study presents a comparative performance between schools and grades, and the interactions between schools and grades using the Analysis of Variance technique, besides studying the average level of performance using means and percentages. The related confidence interval of per cent performance was obtained school and grade-wise and also interactions between the two. Correlation of performance in Mathematics and Hindi with factors like gender, number of family members (NOFM), distance from

school (DIST) and parents occupation (OCCUP) were examined. A regression model, depicting linear relationship between performance as dependent variable and gender, number of family members, distance from school and parents occupation as independent variables was also obtained. A graphical display of performance is also shown.

Learning Achievement in Mathematics in Site 1 Schools

In order to test the significance of difference among schools and grades in Site 1 schools, ANOVA reveals significant difference in the performance of Mathematics between three Site 1 schools and also between Grades II, III and IV.

Examining school and grade-wise mean per cent performance and 95 per cent confidence intervals, the school that has shown poorest performance has achieved average per cent marks of 0.3482 (34.82%), 0.4827 (48.27%), 0.5432 (54.32%) in Grade IV, Grade III , Grade II, respectively, and 95 per cent of its learners of Grade IV scoring between 28.97 per cent and 40.67 per cent in Mathematics. The learners of other schools in Site 1



Graph 1: School-wise and Grade-wise Comparative Performance in Mathematics in SITE 1

Table 4
Differences in the Performance in Mathematics in Site 1

	SS	Degree of Freedom	MS	F	p
Intercept	84.51091	1	84.51091	2390.403	0.000000
School	0.78098	2	0.39049	11.045	0.000023
Grade	0.74873	2	0.37437	10.589	0.000036
School*Grade	0.45120	4	0.11280	3.191	0.013746
Error	10.71234	303	0.03535		

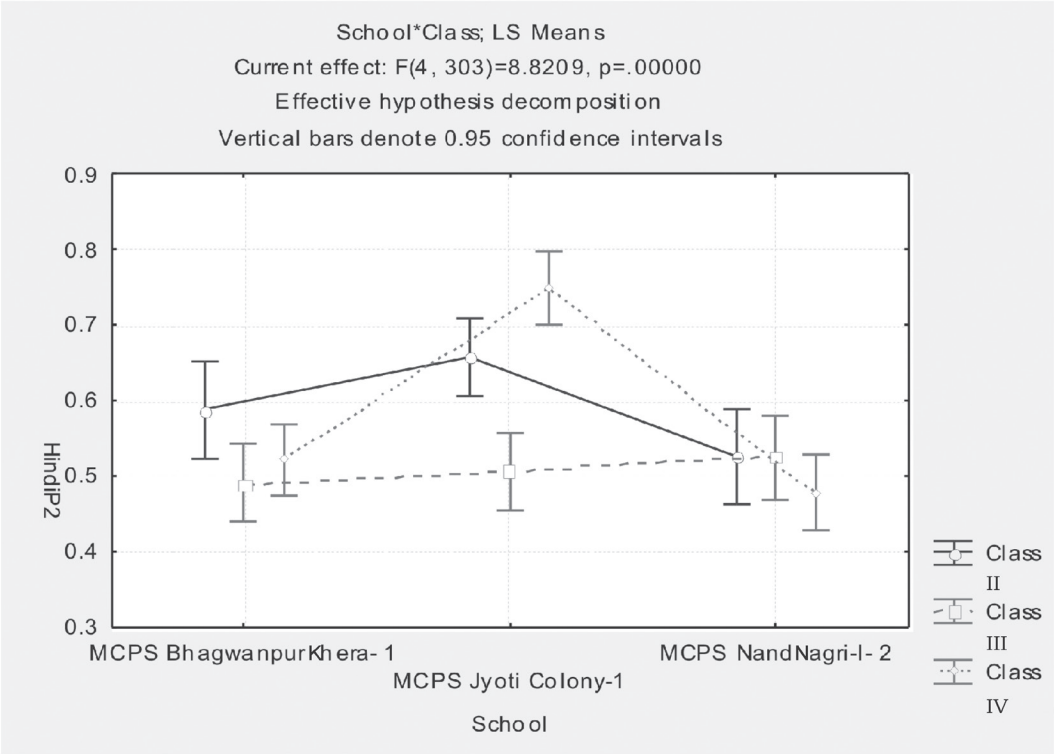
have performed better with average per cent performance of 60.17 – 61.61 for Grade II, 51.69- 62.22 for Grade III and 49.48 – 55.86 for Grade IV. 95 per cent of the students in Grades II, III and IV have obtained a percentage between 43.85 and 68.43 in Mathematics, except one poor school wherein performance is much below the required standards. School wise analysis also reveals that overall this school is a borderline case in Mathematics as pupils have secured 45.80 per cent on the average and 95 per cent of them have scored between 41.96 per cent and 49.65 per cent. The other two schools are performing satisfactorily with an average score more than 56 per cent with 95 per cent of learners scoring between percentages 52.92 and 61.10 in Mathematics.

The grade-wise analysis reveals that students in general need improvement in Mathematics as the average performance of Grade IV students is 46.72 per cent with 95 per cent scoring between 43.40 per cent and 50.05 per cent. Overall Grade II and III students have performed better with 58.70 per cent and 54.08 per cent, respectively. 95 per cent of learners of Grade II have scored between 54.58 per cent and 62.81 per cent, while 95 per cent learners of Grade III have scored between 50.44 per cent and 57.77 per cent.

(ii) Learning Achievement in Hindi Language in Site 1

The analysis of variance proves that there is a highly significant difference in performance in Hindi language between the grade interactions, and also among schools. The school and grade-wise analysis reveal average per cent score or schools in all grades between 47.79 per cent and 74.90 per cent, with 95 per cent learners scoring between 43.83 per cent and 79.76 per cent.

An overall grade-wise analysis of schools reveals the performance in Hindi as satisfactory as the average performance for all grades between 50.68 per cent and 59.03 per cent. Moreover, confidence intervals shows that 95 per cent of the learners have scored between 47.62 per cent and 62.49 per cent in Hindi which is also quite satisfactory. The overall



Graph 2: School and Grade-wise Comparative Performance in Hindi in Site 1

Table 5
Differences in Performance in Hindi Language in Site 1

	SS	Degree of Freedom	MS	F	p
Intercept	93.77552	1	93.77552	3753.421	0.000000
School	0.97397	2	0.48699	19.492	0.000000
Grade	0.43197	2	0.21598	8.645	0.000223
School*Grade	0.88153	4	0.22038	8.821	0.000001
Error	7.57016	303	0.02498		

school-wise performance in Hindi shows satisfactory performance as the average scores for all the schools is above 50.94 per cent. Moreover 95 per cent of the learners in these schools are scoring between 47.77 per cent and 66.64 per cent in Hindi.

The family size does matter in the performance of learners. The table highlights a significant

Table 6
Significance of Correlation between Number of Family Members and Distance Travelled to School in Site 1

Correlations in Site 1 Schools Marked correlations are significant at p<.05000, N=303					
	NOFM	**DIST**	**Grade**	**Math P1**	**Hindi P2**
No. of Family Members (NOFM)	1.00	-0.37	0.47	0.15	0.28
Distance travelled to school	-0.37	1.00	-0.43	0.05	0.17
Grade	0.47	-0.43	1.00	-0.24	-0.01
Math P1	0.15	0.05	-0.24	1.00	0.46
Hindi P2	0.28	0.17	-0.01	0.46	1.00

Table 7
Factors Affecting Performance in Mathematics in Site 1

Regression Summary for Dependent Variable: Mathematics						
	Beta	**Std. Error.**	**B**	**Std. Error**	**t (298)**	**p-level**
Intercept			13.32969	3.331743	4.00082	0.000080
Gender	-0.320573	0.072086	-0.14048	0.031590	-4.44710	0.000012
NOFM	0.085083	0.064072	0.00680	0.005122	1.32793	0.185219
Distance travelled to school	0.089426	0.061249	0.01120	0.007669	1.46003	0.145334
Occupation	0.126005	0.070090	0.00221	0.001227	1.79777	0.073226

positive correlation between number of family members and performance in Mathematics and Hindi language. On the other hand, a significant negative correlation was seen between the number of family members and distance travelled to school. Therefore, it may be interpreted that distance travelled to school does not matter, but large families do. Rest of the correlations was insignificant or unimportant.

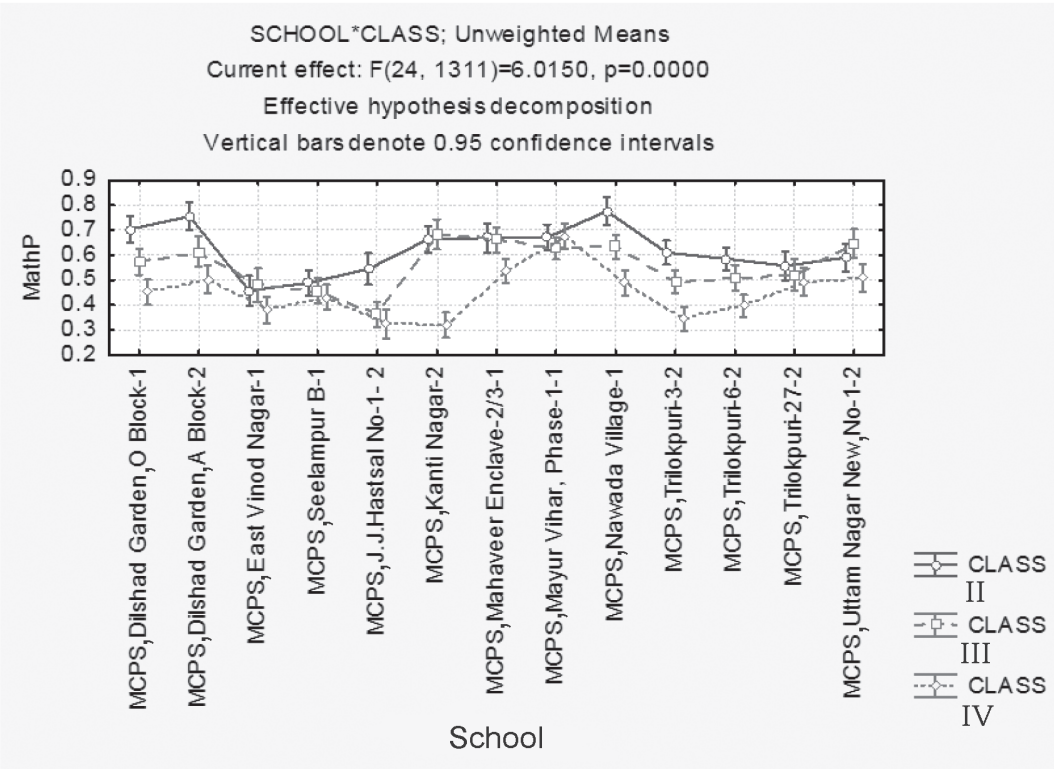
Gender appears to be the most dominant factor to show differences in performance of boys and girls in Site 1. The table shows that girls have performed better than boys in Mathematics. Through regression analysis, it may be interpreted that looking at other factors, there is no significant impact of number of family members, distance from school and occupation of parents on performance in Mathematics, but performance depended more on gender, where girls have excelled boys.

The table highlights that all factors - gender, number of family members, and the distance travelled

Table 8

Factors Affecting Performance in Hindi Language in Site 1

Regression Summary for Dependent Variable: Hindi						
	Beta	**Std. Error**	**B**	**Std. Error**	**t(298)**	**p-level**
Intercept			3.087815	2.817210	1.09605	0.273940
Gender	-0.158681	0.068542	-0.061840	0.026712	-2.31510	0.021286
NOFM	0.346944	0.060922	0.024664	0.004331	5.69492	0.000000
Distance travelled to school	0.306262	0.058238	0.034103	0.006485	5.25882	0.000000
Occupation	0.067233	0.066644	0.001047	0.001037	1.00884	0.313869



Graph 3: School-wise and Grade-wise Comparative Performance in Mathematics in Site 2

Table 9
Differences in Performance in Mathematics in Site 2 Schools

	SS	Degree of freedom	MS	F	P
Intercept	381.4619	1	381.4619	15328.76	0.00
SCHOOL	7.8926	12	0.6577	26.43	0.00
GRADE	6.6024	2	3.3012	132.66	0.00
SCHOOL*GRADE	3.5924	24	0.1497	6.01	0.00
Error	32.6247	1311	0.0249		

to school does make a difference in the performance in Hindi. The regression analysis through all the variables shows significant dependence of gender, number of family members and distance from school on Hindi performance. One common strong finding seen in both the tables is that girls are performing better in Hindi and Mathematics, irrespective of all other factors that may affect performance of both boys and girls.

(iii) Learning Achievement in Mathematics in Site 2 Schools

There exists a significant difference in the performance of students in Mathematics in thirteen schools of Site 2. ANOVA performed to test the significance of difference in the performance in Mathematics between schools and grades II, III and IV, and interaction between the two proves that there is a significant difference in the performance (p =0.00) between schools and between grades (p= 0.00) and between schools and Grade interaction (p=0.00) in the same Site. The analysis of school and grade-wise mean per cent performance and 95 per cent confidence interval suggests the average score of low performing schools as significantly below 40 per cent , wherein 95 per cent of the learners score between 26.76 per cent and 44.04 per cent. Other students of these schools perform satisfactorily with students of Grade II in one school that tops the list with average performance score of 77.60 per cent in Mathematics.

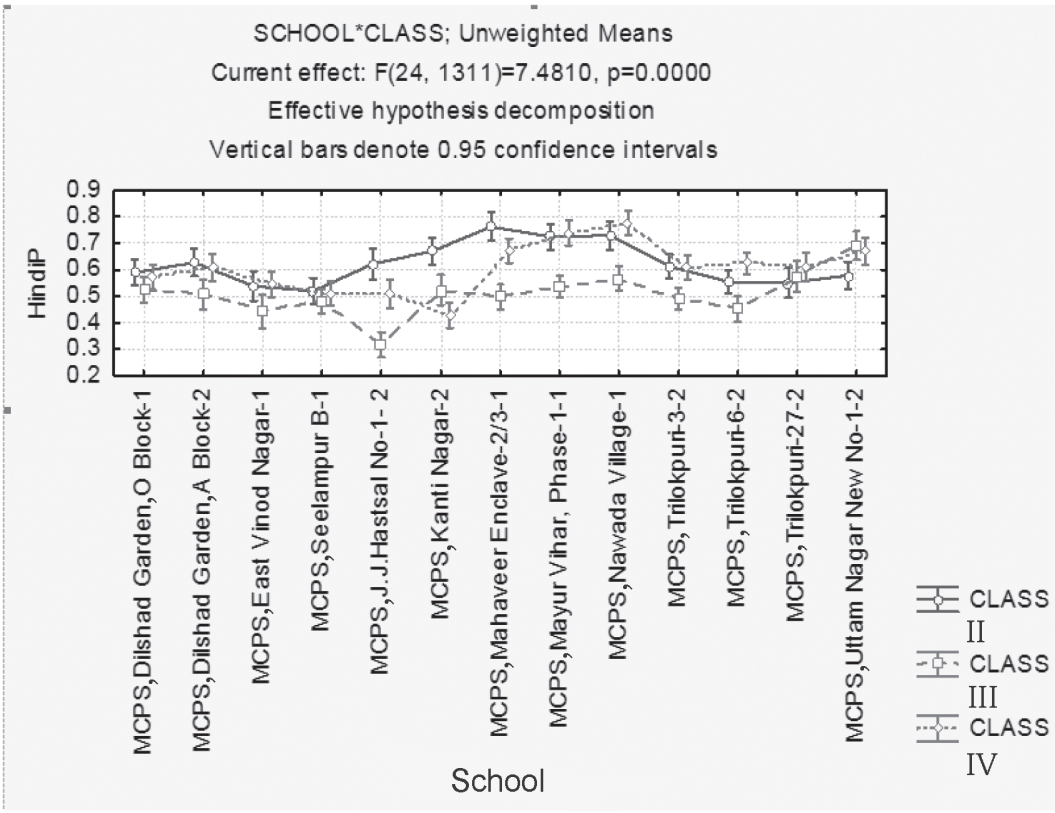
For overall performance in Mathematics, the border line school shows average score for all the grades as 40.99 per cent and 95 per cent of its learners who have secured a percentage between 37.69 and 44.29. Other schools still show a better performance with scoring at least 43.84 per cent in Mathematics. The school that has shown the best performance shows overall average of 63.21 per cent.

Overall performance of all grades seems satisfactory with Grade IV learners (44.96%) performing poorer than Grade II (55.81%) and Grade III (62.05%) under study. Moreover,

95 per cent confidence interval for marks reveal best performance by Grade II students and performance dips as level of grade increased.

(iv) Hindi Language in Site 2 Schools

A highly significant difference is seen in the achievement levels in



Graph 4: School and Grade-wise Comparative Performance in Hindi in Site 2 Schools

Table 10
Differences in Performance in Hindi in Site 2

	SS	Degree of Freedom	MS	F	p
Intercept	432.4563	1	432.4563	19991.26	0.00
School	5.2862	12	0.4405	20.36	0.00
Grade	3.2063	2	1.6032	74.11	0.00
School*Grade	3.8840	24	0.1618	7.48	0.00
Error	28.3599	1311	0.0216		

Hindi in Site 2 schools. The table depicts a marked difference through ANOVA between the schools and grades and between school and grade interactions. One may also however contend from school and grade-wise mean per cent performance and 95 per cent confidence intervals that on an average, the schools are performing well in Hindi.

The low performing school in Hindi has attained the average score of 31.68 per cent, and 95 per cent of the learners have obtained between 27 and 36.36 per cent, which may be attributed as unsatisfactory. Overall performance score in better performing schools is above 50 per cent, wherein 95 per cent of the learners are scoring between 50 per cent and 60 per cent in Hindi.

The grade-wise comparison in the performance in Hindi for all the schools in Site 2 shows a good performance on an average, scoring more than 50 per cent and 95 per cent learners obtaining between 49.34 per cent and 63.51 per cent.

An examination of the correlation of performance with number of family members, distance from schools, occupation depicted in Table 11 shows a significant positive correlation (0.42) between

Table 11

Comparison of Performance with other correlates in Site 2

Marked correlations are significant at p < .05000 N=1342 (Case-wise deletion of missing data)					
	NOFM	**DFS**	**OCCUP**	**Math M**	**Hindi M**
NOFM	1.00	0.07	0.02	-0.05	-0.02
Distance from school	0.07	1.00	0.02	-0.15	-0.04
Occupation	0.02	0.02	1.00	0.02	-0.07
Mathematics	-0.05	-0.15	0.02	1.00	0.42
Hindi	-0.02	-0.04	-0.07	0.42	1.00

Table 12

Factors Affecting Performance in Mathematics in Site 2

Regression Summary for Dependent Variable: Mathematics						
	Beta	**Std. Error**	**B**	**Std. Error**	**t (1337)**	**p-level**
Intercept			4.445110	1.151125	3.86154	0.000118
Gender	-0.089653	0.029744	-0.034888	0.011575	-3.01416	0.002625
NOFM	-0.071325	0.028038	-0.006623	0.002603	-2.54390	0.011074
DFS	-0.143827	0.028807	-0.003527	0.000706	-4.99286	0.000001
OCCUP	0.091928	0.026685	0.000406	0.000118	3.44494	0.000589

Mathematics and Hindi performance in Site 2 group of schools. In fact, the negative significant correlation (0.15) indicates that performance in both the subjects do not, however, get affected by distance travelled to school. Rest of the correlations were insignificant.

performance of students in Site 1 schools when compared with students in Site 2 schools.

4. Performance of children is greatly influenced by the number of members in the family, while distance travelled to school does not matter much to them.

Table 13
Factors Affecting Performance in Hindi in Site 2

Regression Summary for Dependent Variable: Hindi						
	Beta	**Std. Error**	**B**	**Std. Error**	**t(1337)**	**p-level**
Intercept			144.3129	37.71392	3.82652	0.000136
Gender	-0.099696	0.030276	-1.2487	0.37921	-3.29287	0.001018
NOFM	-0.041169	0.028540	-0.1230	0.08529	-1.44253	0.149388
DFS	-0.002130	0.029322	-0.0017	0.02314	-0.07262	0.942116
OCCUP	-0.064806	0.027163	-0.0092	0.00386	-2.38585	0.017178

There is a significant degree of dependence of gender and occupation of parents on performance in Mathematics and Hindi. The difference in performance between boys and girl students was significant with girls performing better.

Major Findings

Site 1 Schools

1. The school showing the poorest performance needs support for provision of remedial teaching sessions at least in Mathematics.
2. Students of Grade IV need special attention in Mathematics.
3. While school-wise and grade-wise performance in Hindi is satisfactory, there is visibly a marked difference in the overall
5. The performance of girls in Mathematics was found to be much better than that of boys.

Site 2 Schools

1. A significant difference in the performance was noticed between grades and schools among the group of Site 2 schools
2. Overall, the achievement level of Grade IV has been seen to be poor as compared to Grade III.
3. The low performance in Hindi and Mathematics necessitates remedial teaching and extra time by the teacher for improving attainment levels of its students.

A significant dependence of gender, number of family members, distance from the school and occupation of

parents was found on the performance in Mathematics and Hindi language.

Improving Learning Achievements: Practical Tips for School Practitioners

The most current debate on how to improve learning levels has become a major concern in India. Learning achievements in Site 1 and Site 2 schools suggest that there is a need to address this vital issue seriously. The situation calls for a review of four major domains in the schools: (i) classroom interaction (ii) utilization of teaching-learning materials (TLM), (iii) curriculum transaction and (iv) creation of an environment conducive to learning. This move makes it imperative to develop an understanding on design and development of textbooks, curriculum review and quality of in-service teacher training (Sheshagiri, 2009). This raises a pertinent question: What can be done to schools and classroom processes to ensure that they perform better? Research suggests that much would depend on the professional judgment of school heads working on strategies in accordance to the teaching resources available. Therefore, it is more a question of context-specific reform strategies. The present study draws few guidelines to facilitate the teachers and school heads to chalk out workable teaching plans for improving the learning levels of children.

(i) Rethinking Mathematics Education at the Primary Level

National Policy on Education 1986 visualizes Mathematics as the vehicle to prepare a child to think, reason, analyze and articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning. The National Curriculum Framework for School Education (NCF, 2005) echoes Mathematics education to be accorded importance than any other content discipline. Mathematics education relies very heavily on the preparation that the teacher has, in her own understanding of Mathematics and the nature of pedagogic techniques in its transaction. Textbook-centered pedagogy dulls the teacher's own Mathematics activity. Most teachers at this stage assume that they know all the Mathematics needed, and in the absence of any specific pedagogic training, simply try and uncritically reproduce the techniques they experienced in their school days. Compartmentalization of the teacher has added to another systemic flaw. There is total absence or very little communication between primary and high school teachers of Mathematics, and none at all between high school and college teachers of Mathematics. Most school teachers have never even seen, let alone interacted with or consulted, research mathematicians. Those involved in teacher education are again typically outside the realm

of college or research Mathematics. Often this ends up with perpetuating problems of resonating Mathematics pedagogy with the findings of children's psychology. Any curriculum for primary Mathematics must incorporate the progression from the concrete to the abstract and subsequently a need to appreciate the importance of abstraction in Mathematics. In the lowest classes, especially, it is important that activities with concrete objects form the first step in the classroom to enable the child to understand the connections between the logical functioning of their everyday lives to that of mathematical thinking. Mathematical games, puzzles and stories involving numbers are useful to enable learners to make these connections and to build upon their everyday understanding. Games and play can become a part of soliciting non-didactic teaching and feedback mechanism with a minimum amount of teacher intervention. Certainly emphasis needs to be attached to factual knowledge, procedural fluency and conceptual clarity and understanding. New knowledge is to be constructed from experiential learning and prior knowledge using conceptual elements. The core areas of concern for promotion of Mathematics education that needs immediate attention include (i) overcoming fear of failure, (ii) introducing curriculum catering to both talented and non-participating learners, (iii) more sophisticated assessment methods beyond mechanical computation, and (iv) teacher preparation and support in the teaching of Mathematics.

(ii) Improving Classroom Instruction

Student – enhanced outcomes is completely reliant on the ability of the teacher to change conventional teaching-learning practices in classrooms. Some of the strategies for the teacher to follow are:

- Take out material that is not important for understanding certain concepts. Here, it becomes important for a teacher as articulated in NCF (2005) to sift knowledge from a large pool of information available on the internet and other sources.
- Take out words that repeat information.
- Replace a list of things with the word that describes the things in the list
- Find or invent a sentence as per capability and comprehension of children and as per the grade and age–specific understanding.
- Summarizing of teaching notes is important to help retention of concepts in Mathematics to enhance numerical abilities of learners and the content taught to them in all subjects, including Hindi language.

A teacher in such an arrangement is more likely to work as a facilitator to give maximum opportunities to learners to examine, explore and understand concepts from a variety

of teaching-learning materials (TLMs). During teaching sessions, a shift from teacher-led to student-talk has worked well in bringing verbal fluency and confidence among children, which in turn, has also enhanced learning among them. One of the propositions is that for every ten minutes of teacher–centered talk, there must be two minutes of student talk. Next important point to be kept in mind is that teaching that trains the mind to think creatively, reinforces the will to learn, and this is what gives positive results in return.

(iii) Building Teaching Teams

Building teams of teachers teaching the same subjects in schools located in the neighborhood or the school head teacher forming school-based teams to discuss the ways of improving classroom instructions to create understanding on what works best in what situations. The team plans and shares the workable teaching strategies, content and pedagogical approaches to address diversity among students, their learning needs, potentials and interests. These teams make important contributions to school culture, learning environment and other priority issues. They meet almost every day, and concern themselves with practical ways to improve teaching and learning. The strongest possibility of improving student-learning emerges where schools implement multiple changes in the teaching and learning activities in daily school life. There is a collective responsibility for the learning of all students by examining competencies the students are required to master, planning more effective lessons, critiquing student work, and solving the common problems of teaching. Together when these ideas are shaped, classroom instructions and the core elements for improving student learning will get reinforced. There is a need to address every aspect of the school, encompassing all grades and key subjects (primarily English, Hindi and Mathematics curricula and instructional practices) including assessment, classroom management and processes, and parental involvement that enables a child to learn.

The success stories drawn from such experiences will be a rich resource. There is also a need for recognizing the necessity of joint responsibility of school heads and systemic administrators to allow autonomy to schools for replicating successful experiments, particularly in the municipal corporation schools that have a large network in the capital.

The Final Word

It is for the teacher to review the classroom routine, and adapt tactics leading to improved learning, as children are made to proceed through the beginnings and endings of syllabus. This is the stage of reflection and resolving issues to fill

up learning gaps often found in our schools.

Maintain momentum in sustaining learning climate and bring life in schools leading to improved learning outcomes.

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