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Research Paper

Effect of Gender, Participation in Extracurricular Activities, Location of Schools and School Resources on Mathematics Achievement of Secondary School Students

Education

KEYWORDS : Mathematics Achievement, Gender, Participation in Extracurricular Activities, Location of Schools, School Resources

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ABSTRACT

This study explored the effects of gender, participation in extracurricular activities, location of schools, school resources on mathematics achievement. A convenience sample of 1944 students, 975 males and 969 female from thirty six schools of South-East Bihar (India) was used for study. The Mathematics Achievement Test, personal background assessment questionnaire and An Institutional Background Assessment Questionnaire were used for data collection, while t-test, F-test followed by Duncan's Mean Test and correlation techniques were used for statistical analysis. The results revealed that there was a significant difference between mathematics achievement of boys and girls. The result of analysis showed that participation in extracurricular activities has significant effect on mathematics achievement. Moreover the students of urban schools had the highest mathematics achievement and semi-urban students had higher mathematics achievement than rural students. Further the study showed positive effect of school resources on mathematics achievement.

Education is fundamental to all round development of human Potential -material and spiritual. It refines sensibility and perceptions that contribute to national cohesion, a scientific temperament and independence of mind and spirit. Thus furthering goal of socialism, secularism and democracy enshrined in our constitution. Educations develop manpower for different levels of economy and empower the poor masses to become self-reliant enough to participate in the process of national development. Education is thus an instrument for developing an economically prosperous society and for ensuring equity and social justice through enriching the knowledge.

Education is the key to all processes of development especially-human development. Catalytic action of education in this complex and dynamic growth process needs to be planned meticulously and executed with great sensibility.

Subjects like science and mathematics have found a significant place in the curricula of primary and secondary school education. Mathematics has become a substantial and integral part of an organized society. In today's world no one can live without mathematics for a single day.

Mathematics has played a decisive role in building up our civilization. But in doing so, it has also made itself essential for the existence and progress of modern world. In modern world we have to be more and more exact, we make larger use of quantitative terms. We have to be accurate to a split of second. All this requires large calculations and minute mathematical understanding.

Mathematical thinking is important for all members of a modern society as a habit of mind for its use in the work place, business and finance; and for personal decisions making. Mathematics is fundamental to national prosperity in providing tools for understanding science, engineering technology and economics. It is essential in public decision making and for participation in the knowledge economy.

Mathematics equips pupils with uniquely powerful ways to describe, analyze and change the world. It can stimulate moments of pleasure and wonder for all pupils when they solve a problem for the first time, discover a more elegant solution or notice hidden connections. Pupils who are functional in Mathematics and financially capable are able to think independently in applied and abstract ways and can reasons, solve problem and assess risk.

Mathematics is a creative discipline; the language of mathematics is international. The subject transcends cultural boundaries and its importance is universally recognized. Mathematics has developed over time as a means of solving problems and also for its own sake.

In the present social set-up, mathematics is more important for the common man. In this age of taxes, insurance premium savings and interests, rents and propaganda, a person only with good mathematical background can be reasonably sure that he is getting his due.

A little reflection will show what predominant role mathematics plays in our everyday life and how it has become an indispensable factor for the progress of our present day world. It is the pivot of all civilization. Each individual is required to compute his or her income and balance, his family budget irrespective of having any formal education of mathematics. This is the subject which undisputed forms the very basis of entire world's commercial system. It is a contributory factor in the prosperity of human race. There is no science, no art and no profession, where mathematics does not held a key position. The accuracy and exactness of a science is determined to a major extent by the amount of mathematics utilized in it. Even social sciences like economics, psychology, geography etc. make abundant use of mathematics. The gigantic work of construction of dams, bridges, building of ships, airplanes, bombs etc. are possible only because of the quantitative science. Even in medical sciences mathematics is used to measure the doses, the blood pressure, the rate of the pulse, the body temperature etc. Most of the natural sciences and philosophy are to be studied on mathematical lines and without the study of mathematics there would be no improvement in them.

Even nature also embraces mathematics completely. The sun rises and sets at specified moment. The stars appear at fixed time. Mathematics runs in the veins of natural sciences like Physics and Astronomy. This subject is inextricably incorporated with world and the natural phenomena.

Arithmetic is the language of commercial activity, algebra gives the idea of functional dependence and generalization, geometry teaches logical thinking and natural design. All these combine to produce a very valuable literature of interpretation, control and progress. We understand the world better. Graphical representation of numbers is becoming very common. Mathematics in home decoration designs, measurement and construction in banking and business, in protection of life and property in painting and art is playing a vital role.

A well grounded understanding of mathematics is an essential for everyday life as for higher study in the fields of science & technology. Mathematics holds a unique place in every society today. People accept the fact that mathematics is vital to the continued

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growth of the nation, both for expanding internal advancement and maintenance of leading role in the world community. Mathematics aids man in his understanding of the world, he lives and in turn, modifies the worlds and his needs as he continues to develop. It has played a decisive role in building civilization of a nation.

Mathematics is an important component of school education in the modern world. It is used in almost every phases of human life. A strong background in mathematics is crucial for many career & job opportunities in today's increasingly technological society. There can be no true schooling without mathematics.

One of the aims of teaching mathematics in schools is to inculcate the skills of quantification of experiences around the learners towards this carrying out experiments with numbers and forms of geometry, framing hypotheses, verifying these with further observations from inherent part of mathematics learning. Mathematics helps in the process of decision making through its application to real life situations in familiar as well as non familiar situations. It contributes in the development of precision, rational and analytical thinking, reasoning, positive attitudes and aesthetic sense. Apart from being a distinct area of learning, it helps enormously in the development of other disciplines which involves analysis, reasoning, and quantification of ideas. Study of mathematics also provides ample opportunities for making conjectures, testing and building arguments about their validity and also in asking new questions, understanding of the basic structure of mathematics leads to a much better appreciation of the scope and power of mathematics. NPE (1986) Mathematics should be visualized as the vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject, it should be treated as a concomitant to any subject involving analysis and reasoning.

Let us find out the position of mathematics in our school curriculum in the last two or three decades. Most of the boards of secondary education in India prescribed two types of mathematics syllabuses for the students of 10-years schools, one being elementary or general mathematics which was an additional mathematics course for the student having special aptitude and interest in mathematics. The Central Board of Secondary Education had of course two different syllabuses in mathematics one at A level and another at B level. The student should choose any one of the two syllabuses. The Central Board has dispensed with the dual syllabi from the examination year 1986 and has prescribed only one syllabus irrespective of attitude, ability and aptitude of the students.

The purpose of this study was to examine the relationship of mathematics achievement (dependent variable) with gender, participation in extracurricular activities (NCC/NSS), location of schools and school resources (independent variables) of secondary school students of South-East Bihar (India).

The research questions for this study include the following:

1. Do genders explain differences in the mathematics achievement?
2. Do the categories of extracurricular activity influence the mathematics achievement?
3. Does the location of schools affect the mathematics achievement?
4. Do the school resources explain differences in the mathematics achievement?

Method: The present work is a descriptive study investigating if students' mathematics achievement differed significantly to a group of variables such as gender, time spent on internet browsing, participation in sports activities and medium of instructions . The sample consisted of 1944 students of class IX, selected from 36 schools of South-Bihar (India) in which 975 were male and 969 were female students. In this study, schools were categorized on the basis of their locations eg. Urban schools, Semi-urban schools and rural schools

Tools Used:

Mathematics Achievement Test

The achievement test in mathematics for class IX students that is used in the present study was constructed by the investigator. This is a very comprehensive test based on 12 common chapters of class VIII mathematics text book (NCERT, New Delhi and Bihar State Education Board, Patna). The test consists of 70 items of multiple choice type representing achievement at various areas of mathematics such as 27 items in arithmetic, 21 items in algebra and 06 items in geometry, 12 items in menstruation and 4 item in statistics. The total score on the test as a whole was used as a measure of achievement in mathematics. All the items in the test were arranged in order of difficulty, the easy items being placed in the beginning and this was done to motivate the students. The difficulty values of items in the test between the range of 0.25 to 0.85 similarly, each item had a discriminating power greater than 0.30. The test was based on the latest syllabus prescribed by the NCERT, New Delhi and Bihar State Education Board, Patna. This test had a fairly high content validity and its reliability is found to be 0.90.

A Personal Background Assessment Questionnaire

The personal information sheet is prepared by the investigator. This sheet contains such questions requiring the subjects to give information on their medium of instruction in the school as well as students' involvement in internet browsing as well as participation in sports activities etc.

An Institutional Background Assessment Questionnaire:

This questionnaire is used to gather information's regarding the schools like qualification of the teachers, teachers training, teachers experience, school type and location of the school, etc.

Table 1 Comparison of mean mathematics achievement scores of male and female students

Gender	N	Mean	SD	df	t-value	Sig./Not sig.
Male	975	45.81	14.71	1942	2.40*	Sig. at 0.05 level
Female	969	44.19	15.13			

* Significant at 0.05 level

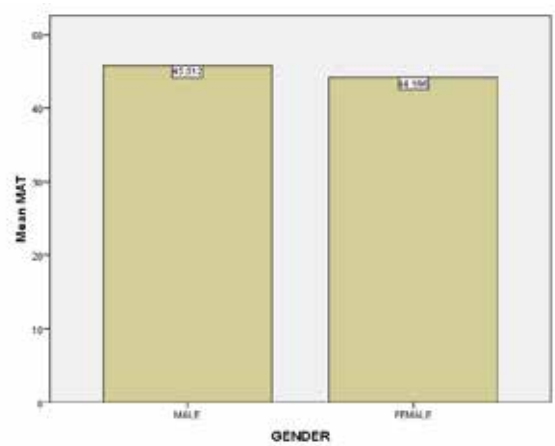


Fig. 1 Gender wise graphical presentation of mean mathematics achievement score

The total numbers of male and female students were 975 & 969 respectively as indicated by the table 1. Out of 70 scores, the mean achievement scores in mathematics of male student is 45.81 and standard deviation (SD=17.41), in case of female students, the mean mathematics achievement score is 44.19 and standard deviation (SD=15.13). The statistically calculated t-value is 2.40; which is significant at 0.05 level with 1942 df. The result clearly indicates that there is significant difference between mean mathematics achievement score of male and female secondary school students. Both are not equally good they differ in their mathematics achievement. Thus the first hypothesis stating that "Male and female students do not differ significantly on mathematics achievement" is rejected at 0.05 level of confidence. The graphical presentation of mean mathematics achievement scores of both sexes is given in fig. 1

Table 2 Comparison of mathematics achievement scores among the three categories of extracurricular activities like NCC/NSS (N_1= Never, N_2= Sometimes, N_3= Always) of secondary school students -Duncan's Mean test

Never N_1 (N=788)		Sometimes N_2 (N=826)		Always N_3 (N=330)		Significant pairs (*)	F- value
Mean	SD	Mean	SD	Mean	SD		
43.15	16.10	46.36	14.25	46.02	13.22	N_1 Vs N_2 N_1 Vs N_3	10.29**

** Significant at 0.01 level

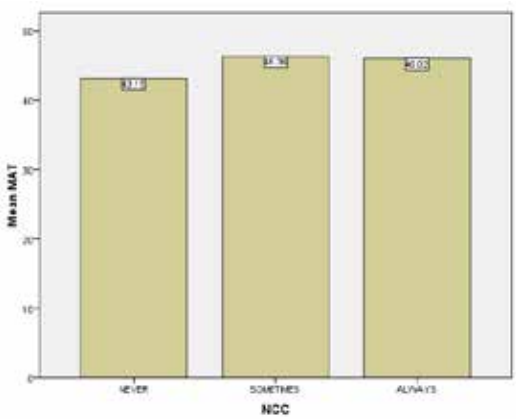


Fig. 2 Graphical presentation of mean mathematics achievement score on the basis of categories of NCC/NSS activities

The analysis of variance was employed to find out the influence of extracurricular activities of students on mathematics achievement. The total sample were categorized into three groups i.e. never, sometimes and always on the basis of participations of students in extracurricular activities Analysis of variance of the mathematics scores of the three groups yielded F value as 10.29 which is significant at .01 level (table 2). This implied that there is significant overall difference in the means of these groups. Hence F test was found significant therefore Duncan's post hoc test was applied for further investigations.

When Duncan's post hoc test was applied for further investigation, the mean scores, standard deviations and significant pairs are given in table 2. The mean scores in mathematics achievement of the above three defined groups (never, sometimes & always) are 43.15, 46.36 and 46.02 respectively. From the scores it is quite clear that as the involvement in extracurricular activities increases the achievement in mathematics also increases accordingly, when Duncan's post hoc test was applied to compare each mean with every other mean achievement scores, significant difference were obtained between two means out of three means with significant pairs (N_1 Vs N_2, & N_1 Vs N_3).

These analyses do not confirm the prediction hypothesized in this study for the present sample. A relationship between mathematics achievement scores of student and extracurricular activities has been demonstrated by the findings. Hence the eighth hypothesis stating that "there is no significant difference among the categories of extra-curricular activities and mathematics achievement of students" was rejected.

Table 3 Comparison of mathematics achievement scores among the three categories of location of schools (L_1=Urban, L_2= Rural, L_3= Semi-urban) of secondary school students -Duncan's Mean test

Urban L_1 (N=935)		Rural L_2 (N=568)		Semi- Urban L_3 (N=441)		Significant pairs (*)	F- value
Mean	SD	Mean	SD	Mean	SD		
48.29	11.99	40.28	16.85	44.11	16.16	L_1 Vs L_2 L_1 Vs L_3 L_2 Vs L_3	54.69**

** Significant at 0.01 level

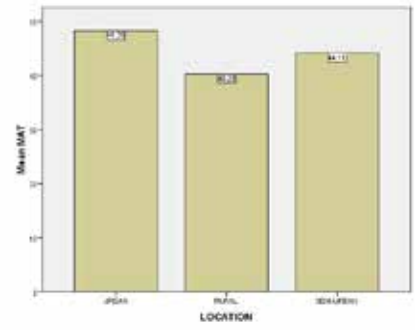


Fig. 3 Graphical presentation of mean mathematics achievement score on the basis of the location of schools

The analysis of variance was employed to find out the influence of location of schools of students on mathematics achievement. The total samples were categorized into three groups i.e. urban, rural and semi-urban on the basis of their locations. Analysis of variance of the mathematics scores of the three group yielded F value as 16.16 which is significant at .01 level (table 3). This implied that there is significant overall difference in the means of these groups. Hence F test was found significant therefore Duncan's post hoc test was applied for further investigations.

The statistical method used in testing the major hypothesis was the Duncan's post hoc test for the difference between the means of three groups. The significant pairs obtained by comparing each group mean mathematics achievement score with that of every other group shows that out of three groups all the three pairs of groups are found to be significant. Further the table 3 shows that students of group of semi-urban group have the highest mathematics achievement scores than the other two groups and then students of urban group have higher mathematics achievement scores than rural students group.

These analyses do not confirm the prediction hypothesized in this study for the present sample. A relationship between mathematics achievement scores of students and location of schools has been demonstrated by the findings. Hence the twelfth hypothesis stating that, "there is no significant difference among the categories of location of school and mathematics achievement of secondary school students" was rejected. The fig 3 shows the mean scores of mathematics achievement of students of three groups of location of schools.

Table 4 Comparison of mathematics achievement score on the basis of their school resources of secondary school students

School Resources	N	Mean	SD	df	t- value	Sig.
Good	20	48.80	9.95	34	2.39*	0.05 level
Poor	16	39.60	13.08			

* Significant at 0.05 level

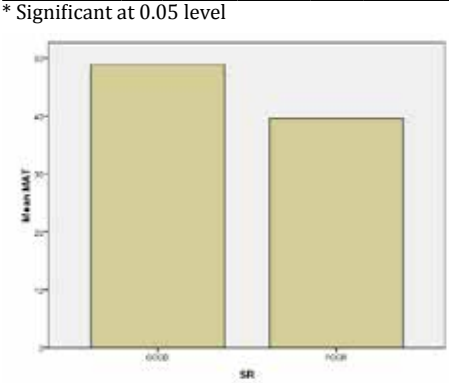


Fig. 4 Graphical presentation of mean mathematics achievement score on the basis of their school resources

The institutional resources in schools were categorized as good and poor resources. It is clear that good resources schools have good building, play ground, furniture's and other resources as compare to the poor resource schools.

At first the mean mathematics achievement scores are computed according to school wise then this mean mathematics achievement scores are estimated as the scores of that particular school and further analysis for t-value was done. The mean mathematics achievement scores 48.80 and 39.60 and standard deviations (SD= 9.95 and 13.08) of students of good and poor resource schools respectively. The statistically calculated t-value is 2.39 which is significant at 0.05 level with 34 df. Table 4 shows that the mean score of students of good resource schools were found significantly higher than the mean score of students of poor resource school students. A relationship between mathematics achievement scores of students and school resources has been demonstrated by the findings. Hence, the hypothesis stating that, "there is no significant difference between school resources and mathematics achievement of secondary school students" was rejected. Graphical presentation of mean mathematics achievement scores on the basis of their school resources were given in fig 4.

Discussion

The purpose of the present research was to determine the effects of personal and institutional factors on academic achievement in mathematics. These two variables were chosen for analysis because they are manipulable variables that have been identified as important influences on achievement in previous research. Data from a large contemporary sample of high schools students were analyzed. F-test followed by Duncan's mean test and t-test were used to determine the effects of these variables on academic achievement, while controlling for other relevant background influences.

There was significant difference in mathematics achievement scores between boys and girls in the present study. The finding of this study is supported by Asante, K Oppong (2010), Forgasz, Helen (2010) found that generally female students attained higher grades in all other school subjects besides mathematics, science and IT than their male counterparts. Gender differences and the findings on gender differences in mathematics achievement are not newly emerged fact. long research history in this area has demonstrated that male advantage in mathematics achievement is a universal phenomenon (Beaton et al, 1996; Mullis et al., 2000). Researchers have shown that boys tend to score higher than girls on problems that include spatial representation, measurement, proportions as well as complex problems; whereas girls tend to score higher on computations, simple problems and graph reading (Beaton et al. 1999) According to some research findings, the gender gap in mathematics achievement increases during middle school and becomes more disturbing at the upper secondary level (Fennema et al. 1998; Fennema, 1985). Friedman (1989) noted that until age 10 either no differences between genders or favoring girls are observed. He observed that 12th grade boys out performed girls, finally, other studies (Fox, Brody & Tobin, 1980) emphasized high mathematics achievement being dominated by males. Deder (1992) has also reported the existence of gender differences in science subject in general as well as in mathematics but Branholt, Goodraw & conney (1999), Ewers & Wood 1992; Skaalvik, 1990; hilton & Berglund (1974). Awartani and Gray (1989) reported no significant differences between male and female students in mathematics achievement. Ma (1995) studied a sample of high school seniors, based on algebra and geometry achievement. He found no gender differences in algebra but males significantly outperformed females in geometry. Gender differences in achievement, especially mathematics, have not been consistent and continue to be a much debated topic (leder, 1992).

Knowledge of how students spend their non school hours can help predict their performance in school. the results presented support the idea that participating in sports activities brings some benefits for students. The students who participate in sport activities present significantly better academic achievement in mathematics. Along these lines Cooper and Valentine (1999) concluded that, generally more time in extracurricular activities and other structured groups and less time in jobs and television viewing were associated with higher test scores and class grades. Lipscomb (2007) reported that athletic participation is associated with a 2 percent increase in mathematics and science test scores. Using a national data base, Lisella & Serwatka (1996) found that, in almost 50 percent of the cases, male student participation in extracurricular activities was associated with lower achievement levels. For female students, the results were mixed. in 23 of the 90 different analysis run, females who participated in extracurricular activities were found to have higher achievement levels than nonparticipating females. Eide and Ronan (2001) point out that participation can be both consumption and an investment. extracurricular involvement provides short run investment returns on outcomes that are positively correlated with labor market success. Given their popularity, society ought to have a better understanding of the benefits these activities afford. Positive associations between after school pursuits and achievement have been observed. students involved in extracurricular activities such as sports also tend to have good attitudes, positive self concept and higher achievement than do students not involved in these activities (Holland & Andre 1987). Gerber's (1996) results indicated the school - related extracurricular activities (eg, sports, band honor society) and outside - school activities (eg. hobby groups, scouting, and 4-H) were related positively to mathematics achievement, Marsh (1992) had similar findings with small but statistically significant positive correlations between activities (eg. sports, drama clubs, etc.) and achievement.

When data was analyzed to see the significant difference in mathematics achievement scores on the basis of location of the schools, it is found that students of urban areas schools achieved significantly more achievement score in mathematics than the students of rural and semi-urban schools. It is clear that urban schools have good facilities as compare to rural and semi-urban schools. This result is supported by Ojha (1979) reported that achievement of rural boys was found to be better than urban students.

When data was analyzed to see the significant difference in mathematics achievement scores on the basis of resources of the schools, it is found that students of good resources schools achieved significantly more achievement score in mathematics than the students of poor resources schools. It is clear that good resources schools have good building, play ground facilities and other such facilities as compare to poor resource schools. Overall, schools that had more resources, had higher average parent education and were larger (on the basis of full time teachers) on average had higher mean advanced mathematics achievement (Schreiber, 2002). In a review of 377 studies, Hanushek (1989) observed no consistent pattern between the amount of money spent (eg. teacher: student ratio or per pupil expenditure) and achievement, Numerous studies in Hanushek's review had either significantly positive or negative results or non significant positive or negative results. He concluded that no strong or consistent relationship exists between school resources and student performance and that more resources would not yield performance gains for the students. Greenwald, Hedges and Laine (1996) performed a meta-analytic review of the studies from Hanushek's review and concluded that resources do have an influence on student achievement. Neither study focused on the impact of resources on student variables that could affect performance. On the other hand school facilities like building, separate classrooms, students reading places positively influence learner achievement (Arriagada 1983, Muammwenda, 1987, Urwick & Junaido, 1991, Varghese (1994), Jangira (1994), Govinda & Varghese (1993). Chubb and Moe stated that money is not what makes some schools more effective than others. Better schools do not require lots of expensive equipment or huge new buildings or vast libraries. The performance problems of schools have little or nothing to do with inadequate funding and they cannot be corrected by digging deep into the public purse. The results suggest that the conditions of schools which are not

properly equipped with the necessary basic physical facilities and educational facilities may be considered for improvement on priority basis.

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