

# Effect of Gender on Interest in Mathematics of Students

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**Abstract:** *Fundamental analysis studies the importance of mathematics in day to day life, history of mathematics in India, problems of mathematics education in school education and present day status of mathematics in Indian education system. This study is primary based, collecting various information from school of CBSE in UP This paper is based on Data analysis which is confined to measures of central tendency (mean), measures of dispersion (standard deviation), t-test, ANOVA, Chi-square analysis, Correlation-coefficient and Regression analysis.*

**Keywords:** CBSE, T-Test, ANOVA, Education, Data analysis

## 1. Introduction

According to some educationists, mathematics is the science of number and space, even as others have defined it as the science of measurement, quantity and magnitude. Mathematics, in the real feel, is a science of space and quantity that helps us in solving the problems of life using numeration and calculations. It is an actual science and involves high cognitive abilities and powers.

## 2. Importance of Mathematics in Day to Day Life

The book Vedang Jyotish (1000 BC) mentioned the importance of 'Ganit' (mathematics) as: "just as the feathers of a peacock and the jewel-stone of a snake are placed at the highest point of the body (at the forehead), similarly, the position of 'Ganit' is the best amongst all branches of the Vedas and the Shastras". Use of fundamental tactics of this subject is vital in every day existence. A common man can lead his life with out learning how to examine and write, but it is very difficult. For him/her to pull on with out getting to know how to count and calculate. Knowledge of these fundamental processes and the skill to use them are the preliminary requirements of human beings these days. Counting, notation, addition, subtraction, multiplication, division, weighing, measuring, selling, buying and many extra are simple and fundamental processes of mathematics which have got an immense realistic value in life. The knowledge and skill in those processes may be supplied in an effective and systematic manner only by teaching mathematics in school. It has become the basis of the world's entire business and commercial system. It is also helpful in the study of various sciences. Barry [1] has rightly said, "Mathematics is the gate and key of the sciences".

According to Lewis R. Aiken [2], "Mathematics is a way to settle in the mind a habit of reasoning" [3]. Most works in mathematics demands original thinking. In mathematics, before starting with the solution of a problem, the student has to grasp the whole meaning [4]. Similarly, in daily life, while undertaking a task, one must have a firm grip on the situation. This habit of thinking will get transferred to the problems of daily life also. Ability to apply knowledge to

new situations is inculcated in students through study of mathematics.

Besides, it has been truly said that "mathematics is the mirror of civilization". Current civilization owes its advancement to the progress of numerous occupations together with agriculture, engineering, medication, industry, navigation and so forth. These occupations build up culture and they're its backbone. It's miles widely known that in the development of these occupations, mathematics has been contributing extensively. Therefore, it can be said that mathematics takes a vital element in shaping of culture.

Study of mathematics helps in developing right moral attitudes also, as there is no place for prejudiced feelings, biased outlook, doubts etc. within the learning of this problem. The qualities like honesty, justice, punctuality; self-confidence and so on, indirectly gets inculcated thru the teaching and studying of mathematics. These qualities help within the development of morality and sound character. A few people wrongly consider mathematics as un-artistic and non-aesthetic. However, for a true student of mathematics it is all beauty, symmetry, balance, harmony, art and music. Music is nothing but mathematically organized sound. Baskaran, has rightly stated that tune is a hidden exercise in arithmetic of a thoughts subconscious of dealing with numbers.

One should further note that it's far a universal difficulty and it helps in creating global understanding. All people should agree that knowledge of mathematics is helpful in achieving vocational efficiency in many spheres.

## 3. History of Mathematics in India

It is well said that the records of mathematics is the history of civilization. The mathematical background of the Indian sub-continent has lengthily been recognized as greater ordinarily rich. Mathematics has played a significant role in the development of Indian subculture. Ancient India has contributed an excellent deal to the world's mathematical heritage. In India, mathematics has its roots in Vedic literature which is nearly 4000 years vintage.

After ancient Greeks, the primary people whose researches wielded a huge influence at the development of mathematics belonged to the Aryan race living in India. Indian civilization, more appropriately known as Hindu civilization, was unfold over several nations like Bangladesh, Pakistan, Bhutan, Burma, Sri Lanka and so on. many of these countries had been once part of the greater India. India has a long history of teaching and learning of mathematics dating back to Vedic age (1500 B.C. to 500 B.C.). The credit of inventing a practically useful notation for writing and communicating with numbers goes to some thinkers of Hindu school. It is an amazing fact found from history that long before these notations were used, probably even before the time of the Mahabharata, Sanskrit literature had already been using numbers. They used unique single word-names for powers of 10 up to the seventeenth [5].

The following table list all the names.-

**Table 1.1:** List of word-names used for powers of 10

Eka	1	Prayuta	$10^6$	Mahapadma	$10^{12}$
Dasa	10	Koti	$10^7$	Sankha	$10^{13}$
Sata	$10^2$	Arbuda	$10^8$	Jaladhi	$10^{14}$
Sahasra	$10^3$	Abja	$10^9$	Antya	$10^{15}$
Ayuta	$10^4$	Kharva	$10^{10}$	Madhya	$10^{16}$
Laksha	$10^5$	Nikharba	$10^{11}$	Paraadha	$10^{17}$

These words were freely used both in literary and scientific writings ever since the Mahabharata times [6]. Our present notation system in the form of numerals 1, 2, 3, 4, ... etc. was originated by Hindus. As it was transmitted to the west through Arabs, hence it got the name Hindu-Arabic number system. Arabs also made some modifications of these numerals. Early Hindus had different symbols for 10, 20, 30 etc. but had no symbols for zero. At a later stage, the Hindu mind evolved the symbol for '0'. Zero was derived from the concept of nothingness or void. This concept exists in Hindu philosophy. '0' is not only a numeral but also a concept which is fundamental. In the absence of the concept zero, there could have only been the positive numbers in computation. But the invention of '0' in mathematics opened a new concept of negative numbers [7].

During 13<sup>th</sup> century the Hindu-Arabic numerals became popular in the west and virtually spread all over the world. The binary digits of '0' and '1' are so vital for present day digital world. It is well known that geometry was pursued in India in the context of construction of 'vedis' for the 'yajnas' of the vedic period. The Sulva sutras contain elaborate descriptions of constructions of 'Vedis' and also enunciated various geometric principles. These sutras were formulated by some scholars of Vedic period. Some great formulators were Baudhayan, Apastamba, Katyayan, Manav, Matrayan, Varah and Bandhul. Baudhayan discovered his theorem independently, prior to Pythagoras, in the context of fire altars. Baudhayan sulva sutra is similar as Pythagoras's theorem. Both the Apastamba and Katyayan Sulva Sutras gave the approximation to  $\sqrt{2}$  up to nine places which is 1.414215686, where as the correct value of  $\sqrt{2}$  is 1.414213562. In this context, it can be said that Sulva sutras are appendices to Vedas and are construction manuals for geometric shapes such as squares, circles, rectangles etc. Ancient Hindus were first to suggest

about a heliocentric solar system. Speed of light was calculated as 1, 85, 016 miles/sec. They had even calculated the distance between earth and moon to be 108 diameters of moon. Again the distance between the earth and sun was calculated to be 108 diameters of the sun. Surprisingly, these figures are very close to the modern day values. All these were stated several thousand years before the famous scientist Galileo postulated in the west that sun was the center of the planetary system and the earth is round rather than flat. The modern estimate of the age of the earth is 4.5 billion years. But the ancient Hindus calculated it to be 4.3 billion years.

In ancient India, conventional mathematics termed 'Ganitam' was known before the development of algebra. The techniques of algebraic computation were developed in India in earlier times. While Indian 'Beez Ganit' reached Arab, they called it Algebra. After evolution through several stages, algebra has now come to play a key role in modern mathematics both as an independent area as well as an indispensable tool in other fields [8].

The great Indians like Aryabhata, Brahmagupta, Bhaskara contributed a lot to mathematics. Aryabhata wrote Aryabhata Sidhanta, Aryabhatiya etc. His writings consist of mathematical theory and astronomical theory which were viewed to be perfect in modern mathematics. The Greeks and the Arabs developed some of his works to suit their present demands. He was the man, who created the formula

$$(a+b)^2 = a^2 + b^2 + 2ab .$$

His 'Aryabhatiya' is a summary of Hindu mathematics up to his time, including astronomy, spherical trigonometry, plane trigonometry, arithmetic and algebra. He introduced trigonometry in order to make his astronomical calculations based on the Greek epicycle theory. It consists of a collection of astronomical tables. It is Aryabhata who learnt the use of letters to represent the unknown.

Brahmagupta tried to give the rules for arithmetic involving zero and negative numbers in the 7<sup>th</sup> century. His rules were- "The sum of zero and a negative number is negative, the sum of a positive number and zero is positive, the sum of zero and zero is zero". He also said that, any number when multiplied by zero is zero.

The most celebrated work 'Lilavati' of Bhaskaracharya includes notation, the operations with integers and fractions, the 'Rule of Three', the most common commercial rules, interest, series, permutations, mensuration and a little algebra. He also wrote 'Bija Ganita', a work on algebra. Another work of importance written by him is the 'Sidhanta Siromani', wherein he systematized mathematics known at that was written when he was 36 years old. He also made some contributions to the subjects of differential calculus and trigonometry [9].

At the beginning of the 20th century, mathematical activity alongside modern lines sprang up in India. in the year 1907, 'Indian Mathematical Society' was founded and in 1909 the 'journal of the Indian Mathematical Society' was first published from Madras. Srinivasa Ramanujan (1887-1920)

is perhaps the most well-known of present day Indian mathematicians. He has become a Fellow of the Royal Society and a Fellow of Trinity College, Cambridge. During his short lifetime of 32 years, Ramanujan independently compiled nearly 3900 results, mostly identities and equations. Nearly all his claims have now been proven correct. He stated results that were each original and highly unconventional, such as the Ramanujan prime and the Ramanujan theta function, and these have inspired a vast quantity of further studies. The 'Ramanujan Journal', an international publication, was launched to put up work in all regions of mathematics inspired by his work.

#### 4. Modern Indian Education System:

British laid the foundation of modern education in India. Macaulay's policy of 1835, Sir Charles Wood's Despatch of 1854 and the Hunter Commission of 1882 were the historical landmarks. In 1882, Lord Ripon organized the Hunter Commission under William Wilson Hunter. The Hunter Commission brought out the fact of negligence to the primary and secondary education in the country. The commission recommended that the responsibility for the Primary Education must be given to the Local Boards and Municipal Boards. The important recommendations were as follows:

- a) The government should take special care to extend the primary education.
- b) There should be literary and vocational training in secondary education.
- c) The government should take special care to extend female education in the country [10].

The recommendations were partially implemented and there was a slow growth in the number of the secondary schools in the country. The educational system that emerged gradually was classified into primary, high school / secondary school and College / University education [11].

Education in India falls under the control of each the important and the nation governments. Now a days, in India, formal schooling is subdivided into extraordinary stages consisting of simple or number one level, secondary level, senior secondary stage, under graduate stage and post graduate degree. Indian government has recommended compulsory primary education up to the age of 14. primary degree is again subdivided into two levels, namely pre-primary stage which is from 6 to 11 years and upper-primary stage which is from 11 to 14 years. authorities of India as well as U.P has laid greater emphasis on essential schooling. Sarva Siksha Abhiyan mission of the government has given opportunity and right to all the youngsters up to the age of 14, a free and obligatory schooling. Indian colleges are controlled by specific government. some are through the valuable or state government and some other by private bodies. schools which are below the central Board of Secondary education (CBSE) are under study.

#### 5. Present day status of mathematics in Indian education

In post independent India, great emphasis has been placed on mathematics teaching and learning. In 1937, when Gandhiji propounded the idea of 'basic education', a committee under the chairmanship of Dr. Zakir Husain was appointed to submit a report on this idea. It recommended: "Knowledge of mathematics is an essential part of any curriculum. Every child is expected to work out the ordinary calculations required in the course of his craft work or his personal and community concerns and activities" [12]

The secondary education commission appointed in 1952 also emphasized the need for mathematics as a compulsory subject in the schools [13].

Keeping in view its importance, the 'Education Commission' (1964-66) recommended it as a compulsory subject for students at school level [14]. The 'National Policy of Education' (1986) has also considered the importance of mathematics in general education and suggested that, "Mathematics should be visualized as a vehicle to train a child to think, reason, analyze and to articulate logically. Apart from being a specific subject, it should be treated as concomitant to any subject involving analysis and reasoning". The National curriculum Framework for school Education (NCFSE), 2000, also forwarded same type of suggestions.

In present Indian education system, mathematics is a compulsory subject up to secondary level. At this stage, students begin to perceive the structure of mathematics.

At the higher secondary stage, the students' interest and aptitude gets identified and they are guided towards career choices. In present Indian education system, mathematics is an optional subject at this stage.

#### Present status of mathematics education in India:

In India, 'mathematics education' is still in its infancy. although mathematics occupies a place of importance, studies works in the area of 'mathematics education' have been scanty. The most important area worried with school education is probably the mathematics education, and its importance is vital for the improvement of science and technology in India is observed even today that in an average college, instructions still conform to a mechanical routine. therefore, learning of mathematics remains dull and un-inspiring as before. As a result, students are losing hobby in mathematics. learning mathematics becomes a tiresome work for them. This disinterest leads them to fear for mathematics which is one of the causes of under-achievement in the subject. According to Nutan (1979), factors responsible for failure in mathematics are poor mathematical background, negative attitude toward mathematics and low motivation [5].

#### Problems of mathematics education in school education

The main goal of mathematics education in schools is to incorporate mathematics to children's thinking process.

School mathematics should take place in an environment where children learn to enjoy by dealing with mathematics, learn important mathematical concepts, pose and solve meaningful problems, use abstractions to perceive relationships and structure, understand the basic structure of mathematics [16].

But contrary to these, mathematics education in our schools is beset with problems. Regarding mathematics, a majority of students have a sense of fear and failure. In this 21<sup>st</sup> century also, for most of us, boys are considered to be better at mathematics than girls. So, gender discrimination existing in the society in the context of teaching and learning mathematics is also a problem. Another vital problem in the teaching of mathematics is the lack of support from the teachers. There is dearth of good mathematics teachers in the elementary level. Though, there is a number of mathematics teachers in this level, all of them do not have required understanding of mathematics or have positive attitudes towards mathematics [17].

Failure in mathematics could be due to social prejudices as well. Prevalent social attitudes which see girls as incapable of learning and doing mathematics, association of computational abilities with the upper caste students etc., may deepen failure in mathematics among girls and lower caste students by lessening their self belief [18].

Mathematics, by and large, is taught in a stereotyped and mechanical ways in schools. According to NCERT (2000), "experience has shown that the majority of students normally fail in mathematics at the end of class X".

Achievement in mathematics has been studied in relation to a number of variables, both cognitive and affective. Studies in the past decade have confirmed that intelligence and socio-economic background are major contributors to mathematics achievement [19]. A mid-term national survey of learning and achievement of class V students (2008) stated that-

- 1) National average in mathematics was 48.46% indicating an increase of 1.95% from the Baseline Achievement measured in 2001-2002.
- 2) In the context of achievement, rural students scored significantly better than their urban counterparts. Urban girls scored significantly better than urban boys.
- 3) Performance of children is seen to be poorest in mathematics [20].

Dr. R. Choudhury investigated on problems of learning mathematics at secondary stage in greater U.P and concluded that interest in mathematics and gender of pupils are significantly co-related with their achievement in mathematics [21]. Researchers like Patel (1984) investigated on the factors responsible for poor achievement and found that attitude towards mathematics significantly related to the mathematics achievement. Singh (1986) found attitudes of the students towards mathematics to be related to their mathematics achievement. One of the factors predominant among failures was attitude towards mathematics as studied by Jain (1979).

## 6. Significance of the study of the topic (Motivation for our research topic)

In order to promote scientific study of education, the activities like school surveys have great importance [22]. Research in every field and more so in the field of education is the demand of the day. Without systematic research, and its application, there would have been very little progress. Research is often defined as scientific thinking. In this regard the report of the University Education Commission of 1948 has the opinion that-"human civilization has derived great benefits from the efforts of specialists who have penetrated deeply into the secrets of nature and the motives and process of human behavior- individual and social. "To a constantly increasing extent, modern life is the outcome of research" [23]. In India, the importance of educational research has been recognized rather late. Most of the research, in the field of education was conducted after independence. Educational progress and national development go hand in hand. The Indian Education Commission (1964-66) [24], rightly observed: "If the pace of national development is to be accelerated, there is need for a well-defined, bold and imaginative educational policy and for determined and vigorous action to utilize, improve and expand education".

The present century has seen great advancement in scientific and technical knowledge as a result of exploration of knowledge. The rest of the world is marching ahead in every field of human activity. In order to keep pace with modernization, the Indian Education Commission (1964-66) suggested that education should awaken curiosity, develop interests, attitude, and build up essential skills to think and judge for one self [25].

Academic achievement is the accomplishment or acquired proficiency in the performance of an individual in a given skill or body of knowledge. There are several factors that influence the academic achievement of an individual, such as his/her personality, intellectual ability, environment etc.

Recent NCERT research has indicated that the maximum number of failures at secondary level is in mathematics and social sciences.

In the field of education, it has become a burning problem and the numbers of low achiever students in mathematics in the school level are constantly increasing [26]. In spite of the pedagogic progress and efforts of teachers of mathematics, results in general are unsatisfactory. It is a fact that, despite its utility and importance, mathematics is perceived by most pupils as difficult, boring, not very practical, abstract etc. For most students, the subject is not a source of satisfaction, but rather one of frustration, discouragement and anxiety [27].

This may be due to the lack of 'interest' of the students in the subject. A trend has been growing in the recent past that the students are losing interest in mathematics. Enrolment in mathematics in higher education has declined in our state. Unless interest in studying mathematics is developed from school stage, one cannot expect it at a later stage. From psychological view point, interest is an internal faculty which leads a particular person in its environment toward a thing, person and activity, or diverts him from them [28].

Interest is the key factor in achieving success in any task we perform. Whatever one learns, interest plays a dominant role in making him learn that thing. When a student attributes high value to a particular subject area, then it is said that the student has interest in that area (Setidisho, A.W.) [29]. According to Gardener and Tamir (1989, a); the term 'interest' refers to engage in some types of activities rather than others

An interest may be regarded as a highly specific type of attitude. When we are interested in a particular phenomenon or activity, we are favorably inclined to it and give time to it. The term 'interest' is used also to indicate a permanent mental disposition [30]. According to Stuart, V, by taking interest is meant the bearing of a condition or subject. If a person takes interest in a subject, he would centralize himself in it despite being tired [31]. Therefore if one wants to learn something he/she should try to develop 'interest' in that thing. It is equally true for mathematics. So, it is true that for attaining high achievement and proper learning in mathematics, one should be highly interested in the subject.

It is required to develop interest of students in mathematics, to develop different intellectual traits like power of thinking and reasoning, analysis, synthesis, discovery etc. in the students and there by lead the society towards a positive and constructive direction.

Different studies done so far clearly bring out the importance of 'interest' on students' achievement. Davis, K. and Pamela, E. confirmed positive correlation in 'interest in mathematics' and 'mathematics achievement'[32]. Several authors have proposed that interests influence academic achievement and learning in school [33]. Attitude of high school students towards learning of mathematics and their achievement in mathematics are highly correlated [34].

Owing to the importance of 'interest' of the students in learning of mathematics, there is a great necessity to study about interest. There may be different factors such as age of the pupil, psychological development, environment where they live and learn, socio-economic status of the parents etc. which influences interest of a student in the mathematics. Some of the factors pointed out by Getzel (1956) were physical capabilities, various socio-cultural factors, family influences etc. So, there is a great need to study different factors responsible for making the students interested or disinterested in mathematics and suggest remedies for those. The above stated facts motivated us to select our topic of investigation as "Factors Effecting Interest In Mathematics Among Upper Primary School Students - A Study On The Basis Of The Students Of U.P".

In the present study an attempt has been made to find out the factors responsible for making the subject uninteresting and dreadful for most of the students. In this regard, we investigated whether the gender of students, socio-economic status of parents and different factors related to the institutions are responsible or not. So, the broad objectives of this study is to assess the influence of above factors on 'interest in mathematics' for the upper primary students of UP from CBSE schools.

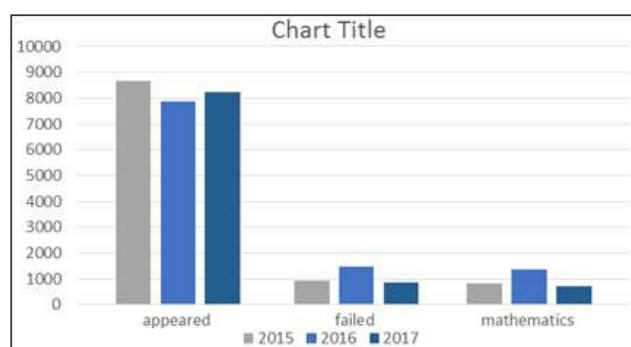
The population of the study is taken from the upper primary level (age group of 14-16 ), because after passing class X, students input into the secondary level in which tune a scholar will go. consequently, it has a super effect on students' future life. hence, before entering this level, a student's 'mathematics interest' should be analyzed so that drawbacks can be removed for their betterment. The study may be very much important from the perspective of a teacher also. teachers of their teaching methods are primarily concerned with motivating his/her pupils and stimulating them to hard work. The reasons for the lack of interest in pupils may be manifold and instructors of mathematics must know these so that they can execute their teaching in a right manner. the main objective of mathematics education research is to be of help in improvement of classroom learning and teaching which can be completed through improving the interest of students towards mathematics.

All the schools of U.P metropolis have been taken up for the survey. the faculties of U.P comprises one-of-a-kind varieties of colleges, specifically, government and govt. government colleges under significant Board of Secondary schooling (CBSE) and personal faculties below CBSE. however, for our take a look at, the govt. CBSE faculties had been no longer taken under consideration. those schools consist of college students from different socio-financial backgrounds. all the private CBSE colleges are of English medium. In U.P it has been observed that mathematics is one of the subjects in which a large number of students fail in high school. Similarly, observations show that in case of secondary level final examination run by CBSE also, there is large number of failures in mathematics. This is also the case for the schools of U.P. These can be explained with the help of following data.

**Table 1.2:** Table showing number of failed students in CBSE schools of UP:

Year	No. of Students Appeared	No. of students failed	No. of students failed in Mathematics	% of Students failed in Mathematics
2015	8657	914	838	91.24
2016	7858	1459	1348	93.39
2017	8234	854	726	85

Sources: Questionnaire based, selected from selected CBSE schools



**Figure 1.1:** Bar diagram showing the relationship between the total number of failed students and failed students in mathematics of selected banks of CBSE schools of U.P

From the above table it is observed that more than 77% of total unsuccessful students of U.P at class X examination during the last three years failed in mathematics.

In case of Pvt. CBSE schools of U.P, it is observed that 50% or above students of total unsuccessful students at Secondary examination failed in mathematics. This result is observed from the analysis of data from the last three years. Hence, it is rightly concluded that the majority of the students fail in the final examination of Secondary level due to the failure in mathematics in case of both SEBA and CBSE schools of U.P.

Therefore, to raise the achievement level of students in Secondary examination, measures should be taken to enhance the achievement of students in mathematics. It is well known that achievement in mathematics is dependent on the 'interest' of the students in the subject. Hence, a study on interest of the students in mathematics is most needed.

### 7. Limitations of the Study

- 1) The study was confined to the pupils of class X only.
- 2) The schools incorporated in the sample were only from-
  - a) Govt. and Govt. Provincialized schools under CBSE
  - b) Affiliated Private schools under CBSE.
- 3) No schools other than English and Hindi medium were included in the sample.
- 4) No schools existing in the rural areas were undertaken.
- 5) No 'special schools' like 'Blind School', 'deaf and dumb school' etc. were included.
- 6) Data analysis was confined to measures of central tendency (mean), measures of dispersion (standard deviation), t-test, ANOVA, Chi-square analysis, Correlation-coefficient and Regression analysis.

### 8. Conclusion

This look at suggests that the mathematical interest is declining because of many reasons in CBSE school. According to some educationists, mathematics is the technology of quantity and space, while others have defined it because the science of measurement, amount and magnitude. mathematics, in the real sense, is a science of space and quantity that helps us in solving the problems of existence the usage of numeration and calculations it's miles and specific science and involves high cognitive abilities and powers.

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