

Mathematical Aptitude Analysis of Prospective Teachers at the Indian Institute of Teacher Education

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ABSTRACT

In this study, the researcher wants to find the mathematical aptitude of future teachers. The sample taken for the study is the teacher trainees of different colleges under the Indian Institute of Teacher Education, and the technique used is a random sampling technique. An investigation that covers the entire population is challenging to carry out. The population's representative subjects must, therefore, be chosen. An examined and observed sample is a subset of a larger population. DIET Gandhinagar, DIET Ahmedabad, Centre for Education, M. N. Shukla College, A.G. teacher's college. The sample is drawn from the 168 prospective teachers (teacher trainees) enrolled; 84 are from the District Institute of Education and Training, and the remaining 84 are from other colleges. The data is collected through a questionnaire as the research tool. Collected data were analyzed by t-test. The findings denoted that there are some differences between mathematical aptitude concerning gender and based on colleges.

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1. INTRODUCTION

Education is the key to success in everyone's life and to many future opportunities. Education enlightens a person's mind and thinking. It helps people feel better, provides success, and improves their fulfillment for them and also for their community. Moreover, it shapes a person's personality, thoughts, and interactions with others and prepares them for life's challenges. Education gives people a unique position in their community and wherever they reside. Everyone is thought to be entitled to education from cradle to tomb. There are numerous advantages to obtaining an education, including having a successful career, an excellent social position, and promoting equality, health benefits, economic progress, and self-confidence. Education provides the chance to have a promising career in everyone's life and gives plenty of opportunities to work at any workplace. It will be

simpler to find better career chances. Generally, those with more education have a greater probability than those without.

Additionally, education broadens our ideas, supports our convictions, and improves our morality and interpersonal behavior. It gives us knowledge on a wide range of topics in general. Additionally, education gives us an excellent level of social esteem.

In today's culture, educated individuals are regarded as essential knowledge providers. In today's culture, education aids in developing morality, ethics, and manners. A competent teacher is the only one who can comprehend pupils' reactions to mathematics and pique their interest in the subject, according to India's National School Policy 2020, which calls for extensive school reform. Education demonstrates assurance. It always results in several advantages and life accomplishments. It allows us to finish particular tasks, deal with problems in life, and have a positive outlook. How to pique people's interest in math

Education teaches people to see challenges as opportunities to overcome fear and try new things. It is the most essential factor contributing to successful people and prosperous countries' achievements. As a result, education is seen as a true success factor in any future success [1]. The main aim of education is to develop a harmonious personality of the learner. It is to make pupils fit to live in the ever-changing world. In modern societies, the youths are prepared for their three future roles through educational processes. It shapes and molds an individual; nothing is more robust to mold human life than thought [2].

There is no universally accepted definition of Mathematics. Aristotle defined Mathematics as "the science of quantity" until the 18th century. Mathematicians and philosophers began to suggest several new definitions in the 19th century, as mathematical studies became more rigorous and began to handle abstract issues such as group theory and projective geometry, which have no apparent relationship to quantity and measurement [1], [3]–[6]. The dream of every developing country is to see itself developed technologically, leading to industrial development. This need for technological development will be realized through sound education in mathematics. This is because the knowledge of mathematics influences the understanding of all science subjects. Mathematics is widely referred to as the language of science and technology and, thus, the mother of science and technology.

“Most people regard mathematics as a difficult and dull subject.” Why does the image of mathematics seem distorted? There can be a hundred and one reasons for this, like inappropriate textbooks, inadequate teachers, rote learning instead of comprehending, parents' negative attitudes towards the subject, etc. This formed a pessimistic attitude in most people toward the subject. Thereby, fear diverges the majority of the people. Conversely, the few individuals who find mathematics interesting, easy, and enjoyable enkindle the fire of a positive attitude toward it. Those who think learning mathematics is a source of joy do not feel any stress or tension [7].

Mathematics tutors a child to think and think logically. It has also been considered the science of logical thinking and systematic reasoning. Logical intelligence consists of various competencies, such as analyzing problems logically, carrying out mathematical

operations, and investigating issues scientifically. It entails detecting patterns, reasoning deductively, and thinking logically. This intellect is frequently linked to scientific and mathematical reasoning [8], [9].

A condition or set of characteristics regarded as symptomatic of an individual's ability to acquire with 161 training some (usually specified) knowledge, skill or set of responses such as the ability to speak a language, to produce music, etc. [10] "Aptitude as a condition symptomatic of a person's general fitness of which one aspect is his readiness to acquire proficiency, his general ability and another is his readiness to develop an interest in exercising the ability" [11]. Aptitude is the dynamic trend of the whole personality with a mental organization that makes one good at learning and performing specialized work [12]. Aptitude describes a person's innate or learned capacity to learn and apply a certain skill or body of knowledge. It results from a person's capacity to organize their thoughts, maintain overall fitness, be open to discovering new interests, and study and carry out specialized tasks. It is believed that aptitude is a dynamic tendency that permeates the entire psyche and is not restricted to any area or sector. In general, aptitude is essential when determining a person's likelihood of success in a certain sector or endeavor.

"Given the right conditions, someone with aptitude can learn new things or become proficient in their existing talents" [13]. When given the right environment, aptitude is a natural talent or collection of traits that show a person's potential to learn and become proficient in a particular skill. A key indicator of success in mathematics and other related fields, mathematical aptitude is a particular natural skill that indicates a person's competency and proficiency in handling abstract mathematical ideas. Mathematical aptitude tests have been standardized to assess this talent and its usefulness in predicting success. As a result, a person's aptitude for mathematics is critical in predicting their chances of success in mathematics and related professions.

An attempt to determine the differential item functioning on six types of the scholarship aptitude test in Mathematics in the motive to recognize relative plus and minus for male and female students related with three general areas they are (i) the areas that are being tested, (ii) the set-up in which the test items are presented, (iii) the subject content where the test items are rooted. The sample of the present study was collected from 1 81,228 male and 1 98,668 female students in high school. In every group of associations, the differential item functioning method equals male and female students relevant to the overall mathematics score on the test and then identifies test items on which groups with the same total score perform differently. The results of the present study are recognizable styles of gender differences in how male and female students arrive at their total scores. These findings affect the differences, which have implications for policymakers, policymakers, and teachers of mathematics [14].

The study provides the construct and criterion validity of the differential aptitude test for assessing the secondary school minority students compared to majority group students in The Netherlands. The investigator collected the required data from three secondary schools. A sample of 429 students was taken up for the study, which comprised 215 males, which are 50.1%, and 214 females, 49.9%. The racial group members were divided equally by gender. The tools used by the investigator to collect data were the

Dutch differential aptitude test by Evers & Lucassen, 1992, partly translated and partly adapted from the American DAT, Forms S&T [15].

Along with these eight American subtests, a vocabulary subtest was also added. The Dutch version of the differential aptitude test does not have two parallel tests; Form T items were used primarily for the 110 construction of the Dutch test. The method of data analysis used was hierarchical regression analysis. The results of the data analysis revealed well-built relations were found between differences in the loadings of the subtests and subtest scores and between differences in estimated cognitive complexity and educational achievement. From this, it is clear that *g* becomes the essential factor accounting for the differences in criterion scores and subtests [16].

The study was to discover the influence of reasoning ability on the mathematical ability of secondary school students in Shimoga District, Karnataka. The study assessed the differences in mathematical ability based on gender and the differences in the mathematical ability of students based on their level of reasoning ability. The present study sample comprised 100 students from eight standards, consisting of 50 boys and 50 girls. The tools used for the study to measure the mathematical ability and reasoning ability of students were: (i) a mathematical ability inventory constructed and standardized by the investigator; (ii) verbal reasoning constructed by George K. Bennett, Herold G. Seasbore, and Alexander G. Women were used by the investigator. The data were analyzed with the help of Statistical Package for the Social Sciences to find the mean, standard deviation, *t*-test, one-way ANOVA, and Pearson's coefficient of correlation. The present study's findings revealed (i) a positive and significant relationship between mathematical ability and reasoning ability and (ii) a difference in the mathematical ability of students based on their level of reasoning ability, while students with low reasoning ability have a low level of mathematical ability. The study suggests that teachers have to work hard to recognize reasoning ability and try to implement teaching and learning techniques so that students can develop their reasoning ability [17].

Test the differential aptitude of the youth. The purpose of the present study is to (i) study the differential aptitude of college students in eight areas, (ii) study the socioeconomic status and personal features of college students, and (iii) determine the difference in the differential aptitude test in all eight areas. (iv) To determine the correlation between socioeconomic status and personal features and the differential aptitude of college students. The sample size of the present study, 113, decided by the investigator, comprises 120 students from all the disciplines selected from Shri Shivaji College, Akola. The sampling technique employed by the investigator is a simple random sampling technique. The eight differential aptitude tests were given to various department students in two rounds. Only a few personal features established a strong correlation, while other features failed to reveal a correlation in aptitude. At this moment, it is concluded that a relationship exists between personal characteristics and students' aptitude. Department-wise relationships are significant, with 0.54 in verbal reasoning, 0.40 in numerical ability, and 0.46 in speed and accuracy. Parental education revealed an excellent relationship with their children's language and sentence ability. As far as gender is concerned, a significant but negative correlation is found in some regions of aptitude [18].

Intelligence is needed to be measured along with aptitude tests for career guidance. The present study was determined to find the relationship between aptitude and intelligence quotient for better career guidance. The sample for the present study involves 40 students from different undergraduate courses studying in Keshav Mahavidyalaya, University of Delhi. The investigator employed a simple random sampling technique for the present study. After detailing the study's objective to the participants, SPM was assessed first. The differential aptitude test was given to the students at an interval of fifteen minutes. The study's findings revealed that other than Perceptual Speed accuracy, Mechanical Reasoning, and Spelling, a significant relationship was not found between the other subtests of the differential aptitude test and the intelligence quotient. The study also reveals that the intelligence quotient significantly correlated to the subtest of the differential aptitude test. The study concludes with the assumption that aptitude tests and intelligence can be given for career guidance in the educational set-up [19].

To construct and standardize numerical aptitude tests for the secondary school students of the Saurashtra district's ninth, tenth, and eleventh standards. The investigator employed a normative survey method for the present study. The sample comprises 100 students of both genders in the ninth, tenth, and eleventh grades. The investigator adopted a stratified random sampling technique by giving due weight to gender and the school's locale. The results of the present study revealed that the presentation of boys was highly significant compared to girls, and no significant difference was observed in the cases of city and urban students [22].

According to Harris, Abigail M., and Carlton Sydell T. [20], there are discernible gender variations in the methods used by male and female students to calculate their final mathematics scholarship exam results. Jan Te Nijenhuis, Arne Evers, and Jakko P. Mur [21] demonstrated that *g* becomes the significant factor accounting for the differences in criterion scores and subtests, and they also found that there are strong correlations between estimated cognitive complexity and educational achievement as well as between differences in subtest *g* loadings and scores. According to Shivakumar T. S. and Mary Suvarna [22], there is a substantial and positive correlation between mathematical aptitude and reasoning aptitude, and pupils with weak reasoning aptitude also have weak mathematical aptitude. According to Jyoti Mankar and Dhanshree Chavan [23], departmental ties are highly crucial, and a relationship exists between personal attributes and student ability. In order to provide better career counseling, Gopal Chandra Mahakud [24] discovered a positive and substantial association between aptitude and intelligence quotient [20]–[24].

In this study, the researcher must examine the attitude towards mathematics among the B.ED. Candidates who would eventually become teachers. Research of B.Ed. Students in colleges affiliated with the Indian Institute of Teacher Education were done. How much interest in mathematics do individuals who will become teachers in the future have? The best instructors for the future will be those who can make math engaging for students. In India, the National Education Policy 2020 is now in effect. When it comes to the National Education Policy 2020, which emphasizes teaching mathematics and numeracy to all students, this becomes quite crucial. Such teachers can develop the student's capacity for

thinking and vision. The study was conducted to find the difference based on gender, medium of college, i.e., DIET and Government, and the overall mathematical aptitude of the college's trainees. Any subject's value is determined by how much it aids a person in achieving educational goals. Self-actualization has been made possible through the study of mathematics. The current high-tech world requires fundamental mathematical understanding to maintain its compatibility with time and the well-being of humanity. As a result, mathematics is not only essential as a topic in and of itself, but it also plays a crucial role in creating a well-rounded personality with a logical viewpoint that would enable someone to operate at the highest level of inquiry.

The purpose of this study was also strengthened by the lack of comprehensive data on the topic of mathematical aptitude available in the literature review [25]. The investigator attempts to research and study the Mathematical Aptitude of undergraduate-level Students.

2. METHOD

The researcher tries to carry out the study to examine the mathematical aptitude of undergraduate students. The inquiry in this study is restricted to the B.Ed. Colleges associated with the Indian Institute of Teacher Education (IITE), giving it a narrow focus. Additionally, only the districts of Ahmedabad and Gandhinagar were used for the research. Furthermore, only undergraduate students were included in the sample in this study. The research aims to fully comprehend the educational environment and experiences of this particular set of students and institutions, which is accomplished by identifying these delimitations. However, it is essential to recognize that the results could not entirely reflect all educational settings or student groups. However, they will provide important information about the regions that are being studied and taken into account.

A Population is any group of individuals with one or more characteristics in common that interest the researcher [26]. In the present study, the population is IITE-affiliated B.Ed. Colleges teacher trainees. Researchers have employed survey research. In this study, the researcher employed a questionnaire. There are 40 total multiple-choice questions in the survey. A formal, standardized questionnaire that the researcher created in order to evaluate and quantify hypotheses. The same was distinguished by prescribed phrasing and question sequence to guarantee that each responder receives the same stimulus. There were just four possibilities available. The questions were kept to a broad level to assess the varied levels of knowledge within a fixed population. Each section on the questionnaire's fundamental thinking and numerical abilities had 20 questions.

The investigator came into contact with the relevant colleges' headteachers and principals. In order to obtain permission to gather data, the researcher provided a summary of the study. A questionnaire was given to the college's trainees. On the response form, each trainee gave their opinion on which of the four alternatives they felt applied to each statement and made their selection. The investigator got their response as soon as the students were through with their replies.

An outstanding sample produces exceptional findings, demonstrating the value of the sample. The choice of the sample that was utilized to gather the research's data is

arguably the most significant component in determining the generalizability of the study. Time, money, and effort will be wasted if the study findings cannot be broadly generalized outside the research sample [27]. In the present research, random sampling techniques have been used. It is challenging to conduct an inquiry that includes the entire population. So, it is necessary to choose from the population's representative subjects. A sample is a small population chosen for examination and observation. 1. DIET Gandhinagar 2. DIET Ahmadabad 3. Centre of Education 4. M. N. Shukla College 5. A.G. teacher's college and 168 future teachers (teacher's trainees) are selected as the sample, out of which 84 are from the District Institute of Education and Training and 84 from other colleges.

3. RESULTS AND DISCUSSION

3.1. Results

According to the objectives and hypothesis, the researcher calculates and interprets the t-value for the data analysis.

3.1.1 Analysis and interpretation of mean score of Male and Female trainees

Table 1. Calculation of the t-value of Male and Female trainees

Gander	Number	Mean	SD	SE	t-value	Significant level
Male	84	22.40	6.71	0.73	7.18	Significant at 0.01
Female	84	17.94	7.47	0.81		

In Table 1, the calculated t-value of 7.18 is higher than the table t-value of 2.68, which is significant at 0.01. So, the hypothesis, "There will be no significant difference between the mean score of the mathematical aptitude of Male and Female trainees." is rejected at 0.01 level. Therefore, we can say there is a significant difference in the mean score of Male and Female trainees. It means that Male and Female trainees do not have the same mathematical aptitude.

3.1.2 Analysis and interpretation of mean scores of Government college's and DIET college's trainees

Table 2. Calculation of the t-value of Government College's and DIET College's trainees

College	Number	Mean	SD	SE	t-value	Significant level
Government	84	16.96	7.09	0.77	0.001	Not Significant at 0.05

In Table 2, the calculated t-value of 0.001 is lower than the table t-value, which is not significant at the 0.05 level. So, the hypothesis, "There will be no significant difference between the mean score of mathematical aptitude of DIETs and Government college's trainees." is not rejected at 0.05 level. Therefore, we can say that there is no significant difference in the mean score of DIETs and Government college trainees. It means that DIETs and Government college trainees have the same mathematical aptitude.

3.2. Discussion

The researcher analyzed various papers that were based on research for this study. According to the research firm that was examined, studies have looked at a wide range of

subjects, including the importance of cross-sectional relationships, the interaction between aptitude and intelligence, gender differences in test study methods, the significance of the "g" factor in determining score differences, cognitive complexity, and academic achievement: correlation, connection, and more between logical and mathematical ability. These findings encourage the development of more effective career counseling techniques, which advance our knowledge of the variables impacting student accomplishment. In this study, the researcher has attempted to determine prospective instructors' aptitude for mathematics. Compared to other studies, the researcher in this study has focused more on aptitude.

This study aimed to evaluate potential B.Ed. Candidates' math skills. This study demonstrates that the mathematics skills of trainees, both boys and girls, may vary based on their B.Ed. Experience. The study found that male and female trainees' mean scores varied significantly. It implies that trainees of both sexes do not possess equal mathematical ability. The mean scores of government college trainees and DIETs do not significantly differ. It implies that trainees from government colleges and DIETs have comparable mathematical skills. Parents may support their children's mathematical skills by using the information this research gives on the degree of mathematical proficiency among future instructors.

4. CONCLUSION

The value of departmental ties, the interaction between aptitude and intelligence quotient, gender differences in exam study methods, the significance of the "g" factor in determining score differences, correlations between cognitive complexity and academic achievement, the interaction between mathematical and reasoning aptitudes, and other topics were all the focus of studies, according to an analysis of the literature. The researchers found a significant discrepancy between the mathematics skills of B.Ed. Candidates in this study.

The purpose of this study was to evaluate potential B.Ed. Trainees' math skills. This study shows that trainees, both boys and girls, may have variable mathematical aptitudes based on their B.Ed. Experiences. Regarding mathematical proficiency, the poll showed no difference between education at government institutions and DIETs. For parents to help their children improve their mathematical talents, this research gives information on the degree of mathematical ability among possible teachers.

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