

# Values and Effects of Mathematics among Secondary Level Students of Mayurbhanj District, Odisha: An Analytical Study

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**Abstract:** *The foremost purposes of the research work are to find the values and effects of mathematics among secondary level students of Mayurbhanj district, Odisha. This study was conducted on 150 students studying in secondary schools in Mayurbhanj district of Odisha, India. A self developed questionnaire was used to collect data from secondary school students to investigate the values of mathematics and its impact on teaching learning process and student's performance. The findings of the study revealed that secondary school students have an average level of mathematical concepts learning, an average spatial ability in learning of mathematics and high problem solving ability. The outcomes of the study showed that there is a significant and positive relationship among learning mathematical concepts, values of mathematics, problem solving skills and spatial ability among the students at secondary level. Further, the results of study indicates that the secondary school students understand mathematical concepts, values of mathematics and effects of mathematics in a co-operative and responsive way in the teaching-learning process. In addition to this, educational implications and recommendations were given on the basis of obtained findings of the research work.*

**Keywords:** Values, Effects, Mathematics, Secondary level students, Percentage analysis

## 1. Introduction

Mathematics is an obligatory subject for the development of critical thinking, logical reasoning, creativity, abstract thinking and intellectual growth of students. The knowledge of mathematics is inevitable for secondary school students; as it is very helpful for higher education also. Hence, mathematics occupies the central place in the secondary school curriculum. Mathematics enables a person competent one who is able to apply the knowledge of mathematics in the day-to-day life to solve problems effectively and efficiently in an organized and systematic way. Values are an intrinsic part of the educational process at all levels starting from the institutional to level of curriculum development, where it plays an critical role in establishment of personal and social identity for the student. Mathematics inculcates different values like practical, scientific, intellectual, cultural, social, moral, aesthetic, artistic, disciplinary, psychological, vocational, and international among the secondary school learners to articulate these values in his or her way of thinking, perception, participation. The values of mathematics are the integral and indispensable part of mathematics education as it disciplines the mind, systematizes ones thought and reasoning ability. The values of mathematics are not only responsible for development of problem solving skills, but also decision making ability among the learners in a precise manner. The values of mathematics and its effect on teaching learning process have a remarkable and tremendous impact on a secondary level student's life. In particular, the values of mathematics in the teaching learning process invariably affect the student's academic performance.

## 2. Review of Related Literature

Butler & Wren (1960) obtained that through the teaching of mathematics students attain higher intellectual and mathematical abilities like logical thinking, rational reasoning, attending to the essential aspects of the sum, orderly presentation, precision, accuracy, analytical and inductive skills and above all general problem solving abilities and spatial abilities. Fennema & Sherman (1978) found that the mathematics self-concept is correlated with academic achievement in mathematics and mathematics self-concept is higher in males than in females at high school level. One of the fundamental problems in mathematics classrooms is that teaching is aimed at acquisition of knowledge, giving minimum emphasis on the values in mathematics education (Bishop, 1988) <sup>[4]</sup>. Further, Maqsd & Khalique (1991) revealed that there is a significant positive relationship between self-concept and attitude towards mathematics for female groups, but no significant correlation between these variables for male groups. In addition to this, the findings show that self-concept measures for both males and females do not reveal any significant association with their mathematics achievement. A study on dimensions of effective teaching of mathematics showed that effective and non-effective teachers differ in all eleven variables i.e. problem solving, skill, review, reinforcement, assignment, organization of subject matter, warmth of teacher, planning, preparation, concept teaching and valuation (Dandapani, 1992). A study on attitudes of high school students towards homework and achievement in mathematics showed that girls, urban and private school students have a more positive attitude towards homework and students with this positive attitude have better academic achievements (Hariharan, 1992). According to Chin, Leu, & Lin (2001) <sup>[10]</sup>, the values portrayed by teachers in mathematics classrooms are linked to their pedagogical values, mathematics teaching, and teacher education. Seah & Bishop (2001) <sup>[5]</sup> described the values held by teachers as representing their 'cognisation' of affective variables such as

motivation, beliefs, attitudes and the subsequent internalization of these values into their respective affective-cognitive personal system. Saha (2007) <sup>[27]</sup> conducted a study on academic achievement in mathematics in relation to cognitive styles and attitude towards mathematics and its findings showed that the boys and girls differed significantly on all the three measures i.e. academic achievements, cognitive styles and attitudes towards mathematics. Xavier & Annaraja (2007) performed a study on effectiveness of multiple intelligence based teaching mathematics on achievement of IX standards students and the findings revealed that 10% of the control group students had high level of gain scores and 26.67% of the experimental group students had high level of gain scores. It is also found that there is no significant difference between control and experimental group students in their multiple intelligences. Deshmukh (2010) studied the correlation of mathematics learning and certain personality variables of the students and found that positive and highly significant correlation between mathematics learning and responsible and ascendant temperaments. The findings of the study showed that the low, but negative and highly significant correlation between mathematics learning and three temperamental dimensions viz., sociable, accepting and impulsive. A study on self-regulation, self efficacy and attitude towards mathematics of higher secondary students in relation to achievement and the result of the study reveals that there is achievement in mathematics of boys is significantly greater than girls and there is exists positive and significant correlation between achievement and self efficacy (Saileela, 2012).

### 3. Research Problem

Mathematics plays very significant role for the development of intelligence as well as critical thinking of secondary school students. Knowledge of mathematics has both conceptual and functional implications in the field of mathematics education for secondary school students. Mathematics makes our life style orderly and brevity. There are certain qualities nurtured by mathematics are power of reasoning, critical thinking, creativity, abstract thinking or spatial thinking, problem solving ability and effective communication skills. Values are the integral part of educational process from the grass root level i.e. primary education to auxiliary level i.e. higher education. Mathematics is a subject which helps to develop the values such as disciplinary, practical, cultural, social, scientific, intellectual, moral, aesthetic, artistic, psychological, vocational and international. The outcomes that are found from the study have potential to improve secondary school mathematics teaching and learning. The findings of the research work assists to help children to become more confident and optimistic in teaching learning process in mathematics and help them to have a positive sense of application of abstract concepts in mathematics. Hence, the researcher has undertaken to study this topic. It is expected that the findings of the study would be utilized by scholars, teachers, students, parents, teacher-educators, researchers and others teaching as well as non-teaching professionals in the near future.

### 4. Objectives of the Study

The objectives of the research work are; (1) To study the different values of mathematics among secondary level students, and (2) To study the effects that values bring on mathematics students at secondary level.

### 5. Research Questions

The research questions of the present study are; (1) what are the different values in mathematics among secondary level students?; (2) What are the effects that values bring on mathematics students at secondary level?

### 6. Delimitation of the Study

The population of the study delimited to secondary school students only. The study delimited to 150 students as sample. The present study has been confined to secondary school students studying in secondary schools of Mayurbhanj district in Odisha, India. The study is delimited to the students of the age group of 13-16 years only.

### 7. Methodology

According to the exigency of study the investigator adopted the descriptive survey method to investigate the values of mathematics and its effects among secondary school students. In the present study, the population constituted out of secondary school students of Mayurbhanj district, Odisha, India. For the collection of sample for this study simple random sampling technique was used. For the present study a total number of 150 secondary level students selected as sample by aforesaid sampling technique.

### 8. Tools and Techniques

Tools and techniques are indispensable constituent of research work as they play outstanding role in collection, analysis and interpretation of data. The investigator developed one questionnaire for the secondary school students for collection of data on values and effects of mathematics among secondary school students consisted of 25 'Yes' or 'No' type questions. The responses were classified into two types i.e., 'Yes' or 'No' and these were scored as '1' and '0' respectively. The total score varied from 0 to 25, showing the lowest to highest in values of mathematics and its effects among secondary school learners. The reliability of the tool was calculated by Karl Pearson's Product Moment Correlation method and the coefficient of reliability came out to be 0.68. Hence the tools are highly reliable. The tools are checked by the language and subject expert to find out the content validity of the tools. According to the expert, the tools are valid and appropriate to measure the values and effects in mathematics among secondary level students.

### 9. Analysis and Interpretation

Analysis and interpretation are the most crucial components of the research work as play significant role in outcomes of the study, educational implications and suggestions. It is revealed from table-1 that about 90% students like to learn

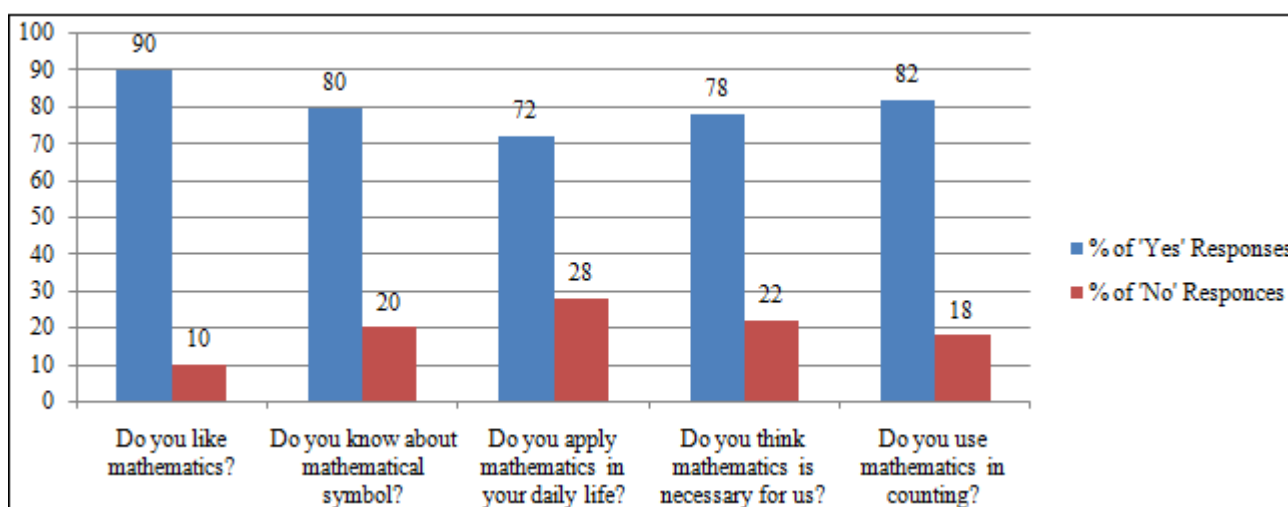
mathematics, whereas 10% students don't. Nearly, 80% students are known mathematical symbol and 20% are not known properly. Around 72% students used mathematics in their daily life situations, whereas the rests were not. Among them 78% students thought that mathematics is essential for

them and the remaining 22% of students didn't think so. The students of 82% used mathematics while counting anything, else the leftover students didn't use mathematics in counting.

**Table 1:** Percentage analysis of values and effects of mathematics among secondary level students

Sl. No.	Statements	No. of Samples	No. of 'Yes' Responses	% of 'Yes' Responses	No. of 'No' Responses	% of 'No' Responses
1	Do you like mathematics?	150	135	90%	15	10%
2	Do you know about mathematical symbol?	150	120	80%	30	20%
3	Do you apply mathematics in your daily life?	150	108	72%	42	28%
4	Do you think mathematics is necessary for us?	150	117	78%	33	22%
5	Do you use mathematics in counting?	150	123	82%	27	18%

The effects and values (practical) of mathematics among secondary level students as depicted in the above table is represented by the bar diagram.



**Figure 1:** Values and effects of mathematics among secondary level students

It is obtained from table-2 that about 64% students' responses indicates that mathematics was used in ancient period, whereas 36% students' responses were not in favors. Around 76% of students thought that mathematics helps to develop social values like empathy, co-operation, adjustment, sharing etc.; else 24% students don't think so. Nearly 68% of students responses show that mathematics is necessary to develop cultural values among them, elsewhere

remaining students' responses against it. Among them 70% students believed that mathematics assists to develop aesthetic values like beauty, design, arrangement, harmony, symmetry etc. the rest students didn't believe in it. The students of 74% cogitated that mathematics provides scope for development of artistic value; else the leftover students didn't ponder it.

**Table 2:** Percentage analysis of values and effects of mathematics among secondary level students

Sl. No	Statements	No. of Samples	No. of Yes' Responses	% of 'Yes' Responses	No. of 'No' Responses	% of 'No' Responses
1	Was mathematics used in ancient period?	150	96	64%	54	36%
2	Does mathematics help to develop social value?	150	114	76%	36	24%
3	Is mathematics necessary to develop cultural value?	150	102	68%	48	32%
4	Does mathematics assist to develop aesthetic value?	150	105	70%	45	30%
5	Does mathematics provide scope for development of artistic value?	150	111	74%	39	26%

The effects and values (social, cultural, aesthetic, artistic) of mathematics among secondary level students as delineated in the above table is portrayed by the bar diagram.

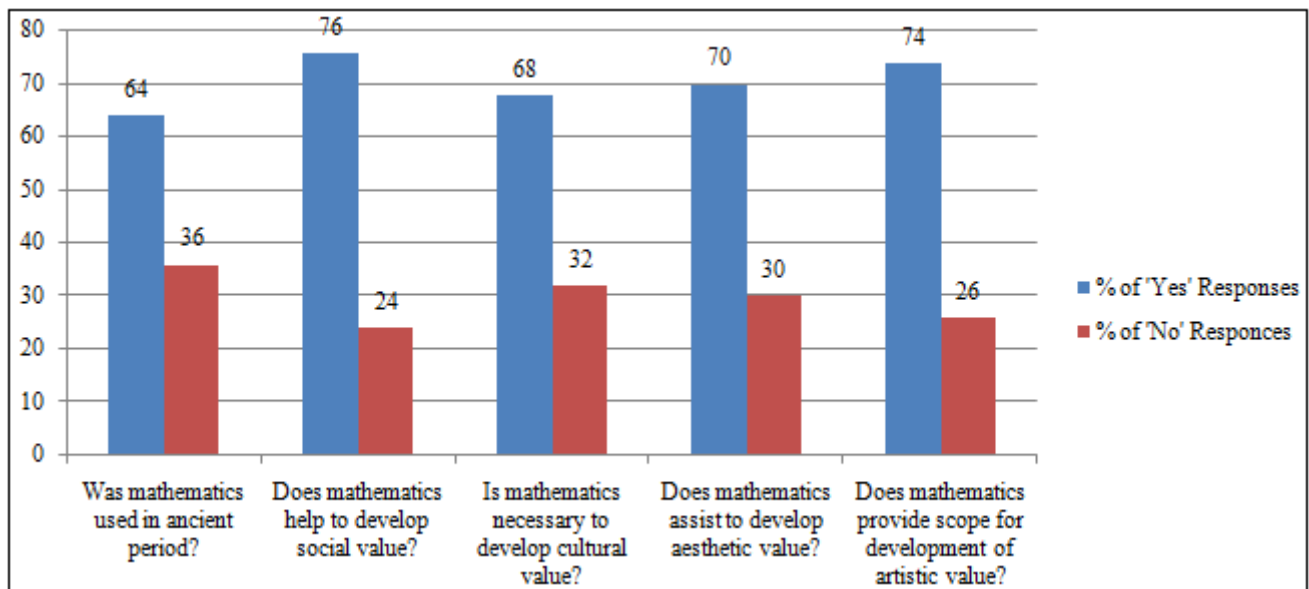


Figure 2: Values and effects of mathematics among secondary level students

It is inferred from the table-3 that about 84% students' responses specify that mathematics helps to develop moral values like truthfulness, honesty, punctuality, loyalty, cleanliness etc. whereas 16% students responses against it. Nearly, 66% students felt that mathematics is difficult subject, else other were not. Around 72% students used calculator in the mathematics classes for calculation, leftover

students did the calculation by their own. Among 78% students believed that mathematics is interesting for them, whereas the remaining students did not believe in it. The students of 76% pondered that mathematics helps to develop disciplinary value among them, else the rest 24% of students did not cogitate it.

Table 3: Percentage analysis of values and effects of mathematics among secondary level students

Sl. No	Statements	No. of Samples	No. of 'Yes' Responses	% of 'Yes' Responses	No. of 'No' Responses	% of 'No' Responses
1	Does mathematics help to develop moral value?	150	126	84%	24	16%
2	Do you feel mathematics is a tough subject?	150	99	66%	51	34%
3	Do you use calculator in mathematics classes?	150	108	72%	42	28%
4	Do you find mathematics is interesting in the classroom?	150	117	78%	33	22%
5	Does mathematics assist to develop disciplinary value?	150	114	76%	36	24%

The effects and values (moral, disciplinary) of mathematics among secondary level students as rendered in the above table is described by the bar diagram.

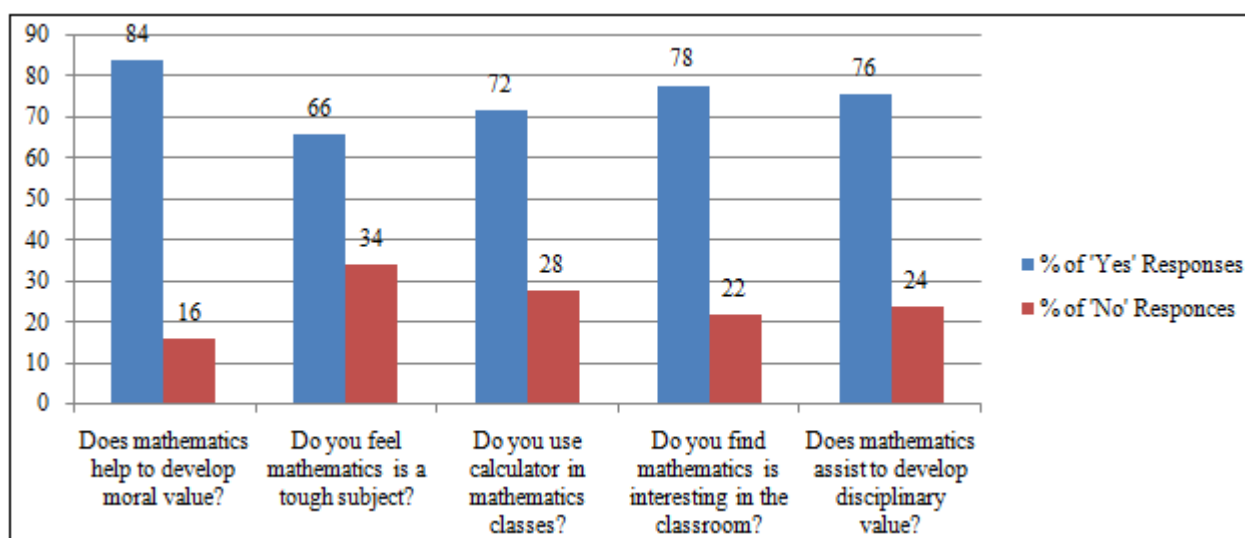


Figure 3: Values and effects of mathematics among secondary level students

It is observed from table-4 that about 70% students' responses suggests that they used TLMs in the mathematics

classes, whereas 30% students didn't use it. Nearby 62% of students had idea about different mathematical models, else

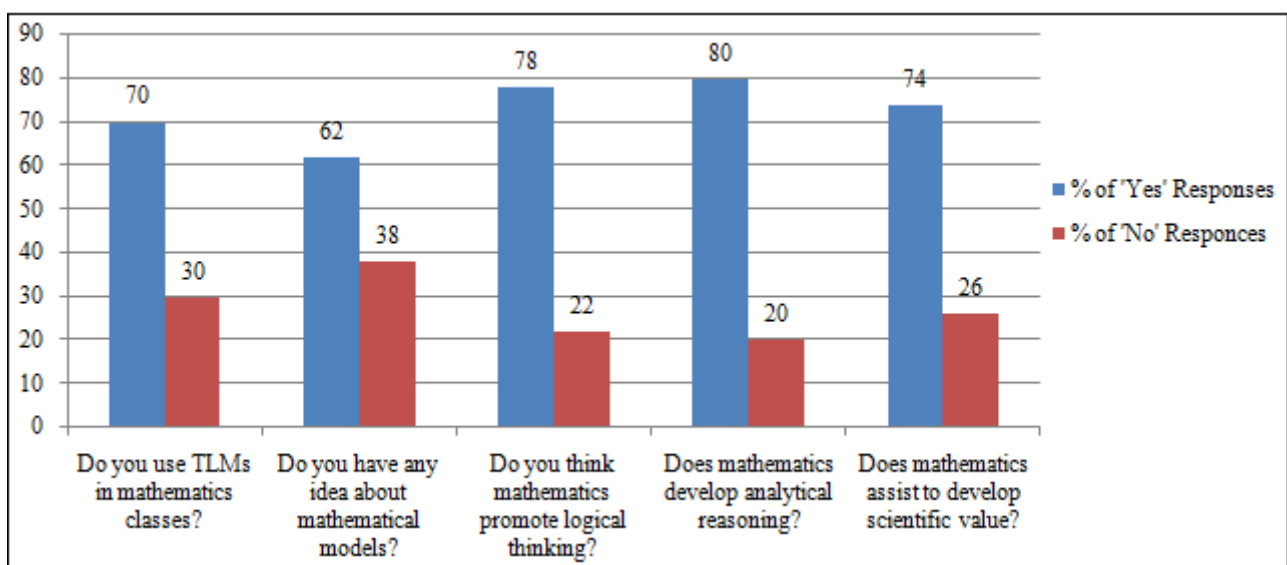
the remaining 38% of students had no idea about this. Around 78% students thought that mathematics promotes logical thinking; else the rest 22% of students didn't think so. Nearly, 80% of students responses indicate that mathematics helps in development of logical reasoning,

leftover students didn't believe in it. The students of 74% pondered that mathematics helps to develop scientific value among them; else the rest 26% of students did not conceive it.

**Table 4:** Percentage analysis of values and effects of mathematics among secondary level students

S. No	Statements	No. of Samples	No. of 'Yes' Responses	% of 'Yes' Responses	No. of 'No' Responses	% of 'No' Responses
1	Do you use TLMs in mathematics classes?	150	105	70%	55	30%
2	Do you have any idea about mathematical models?	150	93	62%	57	38%
3	Do you think mathematics promote logical thinking?	150	117	78%	33	22%
4	Does mathematics develop analytical reasoning?	150	120	80%	30	20%
5	Does mathematics assist to develop scientific values?	150	111	74%	39	26%

The effects and values (intellectual, scientific) of mathematics among secondary level students as portrayed in the above table is represented by the bar diagram.



**Figure 4:** Values and effects of mathematics among secondary level students)

It is noticed from table-5 that about 68% of students' responses indicate that mathematics helps to develop psychological values among the learners, whereas the remaining 32% of students' responses are against it. Nearby 82% of students realized that mathematics promote critical thinking ability, else the rest 18% didn't think so. Around 72% of students believed that mathematics improves

communicational skills among them, the leftover 28% of students did not believe in it. Nearly 86% of students' responses suggest that mathematics develops vocational value, whereas the remaining 14% students' responses are opposite to it. The students of 80% conceived that mathematics helps to develop international value among them; else the rest 20% of students did not ponder it.

**Table 5:** Percentage analysis of values and effects of mathematics among secondary level students

S. No	Statements	No. of Samples	No. of 'Yes' Responses	% of 'Yes' Responses	No. of 'No' Responses	% of 'No' Responses
1	Does mathematics help to develop psychological value?	150	102	68%	48	32%
2	Does mathematics promote critical thinking ability?	150	123	82%	27	18%
3	Does mathematics improve communication skills?	150	108	72%	42	28%
4	Does mathematics develop vocational value?	150	129	86%	21	14%
5	Does mathematics assist to develop international value?	150	120	80%	30	20%

The effects and values (psychological, vocational, international) of mathematics among secondary level students as illustrated in the above table is displayed by the bar diagram.

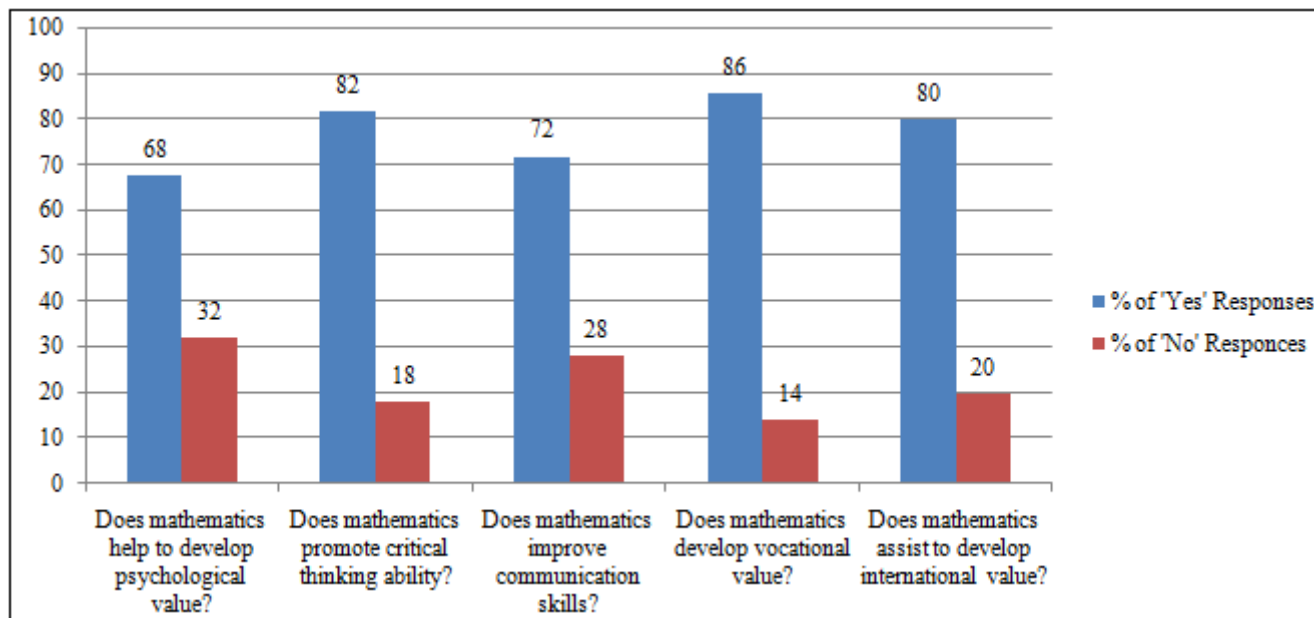


Figure 5: Values and effects of mathematics among secondary level students)

## 10. Findings and Educational Implications

Every research work provides some meaningful information and knowledge to the related field and this research work also has some systematic, organized and meaningful information.

- 1) The results of the research work revealed that secondary school students have an average level of mathematical concepts learning, an average spatial ability in learning of mathematics and high problem solving ability.
- 2) About 90% students like to learn mathematics, whereas 10% students don't. Nearly 80% students are known mathematical symbol and 20% are not known properly. Around 72% students used mathematics in their daily life situations, whereas the rests were not. Among them 78% of students thought that mathematics is essential for them and the remaining students didn't think so. The students of 82% used mathematics while counting anything, else the leftover students didn't use mathematics in counting.
- 3) About 64% students' responses indicate that mathematics was used in ancient period, whereas 36% students' responses were not in favors. Around 76% of students thought that mathematics helps to develop social values like empathy, co-operation, adjustment, sharing etc.; else 24% students don't think so. Nearly 68% of students responses show that mathematics is necessary to develop cultural values among them, elsewhere remaining students' responses against it. Among them 70% students believed that mathematics assists to develop aesthetic values like beauty, design, arrangement, harmony, symmetry etc. the rest students didn't believe in it. The students of 74% cogitated that mathematics provides scope for development of artistic value; else the leftover students didn't ponder it.
- 4) About 84% students' responses specify that mathematics helps to develop moral values like truthfulness, honesty, punctuality, cleanliness etc. whereas 16% students responses against it. Nearly 66% students felt that mathematics is difficult subject, else other were not. Around 72% students used calculator in the mathematics classes for calculation, leftover students did the calculation by their own. Among 78% students believed that mathematics is interesting for them, whereas the remaining students did not believe in it. The students of 76% pondered that mathematics helps to develop disciplinary value among them, else the rest 24% of students did not cogitate it.
- 5) About 70% students' responses suggest that they used TLMs in the mathematics classes, whereas 30% students didn't use it. Nearby 62% of students had idea about different mathematical models, else the remaining 38% of students had no idea about this. Around 78% students thought that mathematics promotes logical thinking; else the rest 22% of students didn't think so. Nearly 80% of students responses indicate that mathematics helps in development of logical reasoning, leftover students didn't believe in it. The students of 74% pondered that mathematics helps to develop scientific value among them; else the rest 26% of students did not conceive it.
- 6) About 68% of students' responses indicate that mathematics helps to develop psychological values among the learners, whereas the remaining 32% of students' responses are against it. Nearby 82% of students realized that mathematics promote critical thinking ability, else the rest 18% didn't think so. Around 72% of students believed that mathematics improves communicational skills among them, the leftover 28% of students did not believe in it. Nearly 86% of students' responses suggest that mathematics develops vocational value, whereas the remaining 14% students' responses are opposite to it. The students of 80% conceived that mathematics helps to develop international value among them; else the rest 20% of students did not ponder it.
- 7) The findings of the study showed that there is significant positive relationship among learning mathematical concepts, values of mathematics, problem solving skills and spatial ability among the students at secondary level.
- 8) The results of study indicates that the secondary school

students understand mathematical concepts, values of mathematics and effect of mathematics in a cooperative and responsive way in the teaching-learning process.

There are several educational implications of this study which are as follows:

- 1) This study will be helpful for the students to identify the needs and importance of learning mathematics at secondary level.
- 2) The results will be helpful for the teachers to know the ability of the students to apply mathematical knowledge in problem solving skills.
- 3) The findings of the study can be used to know different values of mathematics and their application in real life situation.
- 4) The obtained results can be helpful in improving the quality of mathematics teachers and hence quality of mathematics teaching.
- 5) The study will be helpful to find out pros and cons of secondary school students in mathematics learning.

## 11. Recommendations

This research work was conducted on the secondary school students only. Then, similar type of study may be conducted on students related to other subjects like English, Science, and Social Science etc at secondary level. Further, it is advised that the alike study can be conducted in other districts of Odisha as well as other states of India. It is suggested that the same type of research work may be conducted on primary, upper-primary and higher secondary school students also. It is also recommended that synonyms research work can be conducted using techniques like SD, t-test, ANOVA, ANCOVA etc. It is advised to conduct study on the impact of problem solving skills of secondary school students on their academic success in their life. This type of study can also be tried upon to find out the relationship between learning of mathematical concepts with other school subjects taught at secondary level.

## 12. Conclusion

Mathematics is placed as an obligatory subject in the secondary school's curriculum. Mathematics has been regarded as a vehicle of development for a nation. Learning mathematics is basically a constructive process that extends beyond learning facts, concepts, illustrations, procedures and their applications. As values of mathematics in secondary schools has an important role in the development of personality and social identity among the students, so it the prime role of teachers to inculcate different values like practical (utilitarian), scientific, intellectual, cultural, social, moral, aesthetic, artistic, disciplinary, psychological, vocational, and international among them. The values of mathematics significantly influence the academic achievement of the secondary school learners as it develops the scientific knowledge and intellectual ability of secondary level students. The findings of the research work revealed that there is a significant and positive relationship among the learning of mathematical concepts, values, problem solving skills and spatial ability of secondary school students. The secondary students understand the

concept, mathematical values and the effects of mathematics in a co-operative and responsive way. Therefore, more attention should be given on the development of different values of mathematics among the primary, upper-primary, secondary, higher secondary school students in the teaching learning process so that they can develop an efficient and truthful career in mathematics as well as other subjects in the upcoming near future.

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