School Students' Attitudes and Perceptions towards Mathematics

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Abstract- *For over thirty years, researchers have been investigating students' attitudes and beliefs towards Mathematics. In the present study, 134 responses were received from Mathematics students studying from Class 6 to Class 12. Among them 21 responses were rejected and 113 responses were used for the study. Mathematics Attitudes and Perceptions Survey (MAPS) was used to understand the perception of the students' right at school level and guide them their true ability to undertake higher studies and to understand the difficulties faced by school children in understanding Mathematics.*

Among the respondents under study 47 (41.6%) were male and 66 (58.4%) were female; 30 (26.6%) had received awards in Mathematics and remaining 83 (73.4%) did not get any such recognition. The educational status of father and mother was also important which was Doctorate/Post Graduation in 42 (37.2%) and 46 (40.7%), respectively. At least one graduate father and mother was 50 (44.2%) and 48 (42.5%), respectively. Statistically, more number of mathematics students were in 'Growth mindset' (61.1%); 'Real World' (77.9%); 'Confidence' (57.5%); 'Interest' (61.1%); and 'Problem solving' (55.8%); while in case of 'Sense making' (60.2%) and 'Answers' (56.6%) are significantly below the Mathematics group average. The results indicated that most of the Mathematics students in school had attitude for Mathematics, persistence on problem solving especially their use in daily life and high motivation and interest in Mathematics. In case of 'Interest' (40.7%) and 'Sense making' (39.8%) were above 0.80 indicating high motivational interest in Mathematics and learning mathematics for understanding.

The correlation study among the components indicated strong correlation between age of students and class. A significant and positive correlation between component 'Answers' with all others components except 'Real World' and 'Interest'. 'Sense Making' had significant and positive correlation with all other components. Similarly, 'Persistence in problem solving' too had significant and positive correlations with all the components except 'Real World'. There is strong correlation among 'Persistence', 'Sense making', 'Interest' and 'Answers'. The present study will help in identifying and guiding students to go for Mathematics based on their attitude and believes towards Mathematics.

***Key Words**: Answers; Attitudes towards Mathematics; Confidence; Correlation; Growth mindset; Interest; Mathematics education; Mean; Perceptions of Mathematics; Problem Solving; Real world; Sense making;*

Introduction

The importance of Mathematics can be understood by the definition given by Galileo. He defined Mathematics as *'a language in which God has written the world'*. There are many definitions of mathematics but no one definition of Mathematics is universally accepted. Its dictionary meaning states that, 'Mathematics is the science of numbers and space' or 'Mathematics is the science of measurement, quantity and magnitude'. It is exact, precise, systematic and a logical subject. Mathematics reveals hidden patterns that help us to understand the world around us. Mathematics is a branch of science, which deals with numbers and their operations. It involves calculation, computation, solving of problems etc. The different ideologies of these diverse social groups have affected and will continue to affect the aims of mathematics education (Cooper, 1985). It may also be defined as, 'Mathematics is the study of quantity, structure, space and change; it has historically developed, through the use of abstraction and logical reasoning, from counting, calculation, measurement, and the study of the shapes and motions of physical objects.

In ancient times, mathematical practices were divided into scientific mathematics and sub-scientific mathematics (Hyrum, 1994): the former being mathematical knowledge pursued for its own sake without any intentions of applications; and the latter being specialists' knowledge that was applied in jobs such as architects, surveyors and accountants. In present era, teachers of mathematics have to teach Mathematics through real concepts in personal life of students. Mathematics helps the man to give exact interpretation to his ideas and conclusions. It is the numerical and calculation part of man's life and knowledge. It plays a predominant role in our everyday life and it has become an indispensable factor for the progress of our present day world.

Mathematics is wonderful device to define the nature and relations between natural phenomena. As Moellwald (1997) showed that "the embedding of mathematics within the context of the learner is fundamental to the establishment of a meaningful association between personal beliefs and meaning making processes". Taiwan students had the highest average achievement in Mathematics among all participating countries in 2007 (Mullis *et al*, 2008). The students with higher levels of achievement in Mathematics do not present the same success when faced with real problems in life (Umay and Kaf, 2005). This matter may imply that the learning that took place may not be meaningful. Meaningful learning happens only when the students can relate concepts with their daily lives and the events affecting them (Parnell, 2001). In a study on 1,282 participants Liu and Lin (2010) using MSLQ were adapted into the Mathematics Motivated Strategies for Learning Questionnaire (MMSLQ), showed that the students have weak motivation and a less usage rate of learning strategies in learning mathematics. Besides, the result showed that the students went to cram school showed higher motivation for learning

mathematics, and the students went to cram school also used learning strategies better than the students didn't go to cram school.

The objective of the present study was to investigate students' attitudes and beliefs towards Mathematics and to understand the perception of the students' right at school level and guide them their true ability to undertake higher studies and to understand the difficulties faced by school children in understanding Mathematics.

Materials and Method

In the present study, the questionnaire was developed following Mathematics Attitudes and Perceptions Survey (MAPS) **(Code *et al,* 2016)**. It was shared online through 'https://docs.google.com' to the diverse students of different schools in different states of India. They were required to give their options online as and when convenient and it took 12 to 15 minutes to click on the right response. A total of 134 responses were received from the students of Mathematics studying from Class 6 to Class 12. On critically going through the responses 21 were rejected and 113 responses were used for the study. Mathematics Attitudes and Perceptions Survey (MAPS) was used to understand the perception of the students' right at school level and guide them their true ability to undertake higher studies and to understand the difficulties faced by school children in understanding mathematics. There are seven components of MAPS instrument, which are (1) confidence in, and attitudes towards mathematics (Confidence), (2) persistence in problem solving (Problem Solving), (3) a belief about whether mathematical ability is static or developed (Growth Mindset), (4) motivation and interest in studying Mathematics (Interest), (5) views on the applicability of Mathematics to everyday life (Real World), (6) learning mathematics for understanding (Sense Making), and (7) the nature of answers to mathematical problems (Answers).

The data was recorded for age, gender, class, type of school studying, qualification of father/mother, awards received in Mathematics by students & the seven components of MAPS and compiled and analysed for central tendencies, correlation coefficient (**Snedecor and Cochran, 1967).** The numbers of students were identified significantly below and above mean for each parameter.

Results and Discussion

The descriptive statistics was applied on the respondents. Among the 134 respondents the data was compiled for 113 respondents i.e. 21 respondents gave incomplete or partial responses hence not considered for analysis. Among the 113 respondents under study 47 (41.6%) were male and 66 (58.4%) were female. Thirty respondents (26.6%) had received awards in mathematics and remaining 83 (73.4%) did not get any such recognition. Both male and female respondents won award in mathematics i.e. 16 (55.2%) male and 13 (44.8%) female. Hence, number of awards won in mathematics does show the strong interest of respondents in mathematics.

The educational status of father and mother was also important which may affect the interest of the child in education/mathematics, the results showed that 46 (40.7%) were graduate and 42 (37.2%) parents had higher education like Doctorate/Post-Graduation. In addition, at least one graduate of father or mother was 50 (44.2%) and 48 (42.5%), respectively. In some cases, both the parents were doctorate (4 i.e. 3.5%); post-graduate (23 i.e. 20.4%); graduate (29 i.e. 25.7%); and intermediate or below (14 i.e. 12.4%). This indicated that 56 (49.6%) respondents had both the parents educated. In addition, 11 (9.7%) had both the parents educated up to intermediate or below.

Table1: Average score of the parameters for the Gender and Awards received

Parameters	**Gender**		**Awards**	
	Male	**Female**	**No**	**Yes**
Growth Mind set	**0.473 ±0.034**	0.424 ±0.022	**0.461 ±0.023**	0.400 ±0.035
Real World	0.553 ±0.037	**0.576 ±0.029**	0.563 ±0.025	**0.575 ±0.051**
Confidence	**0.447 ±0.041**	**0.443 ±0.037**	0.437 ±0.031	**0.467 ±0.055**
Interest	0.589 ±0.056	**0.636 ±0.046**	0.566 ±0.043	**0.756 ±0.055**
Problem Solving	**0.436 ±0.048**	**0.428 ±0.037**	0.389 ±0.034	**0.550 ±0.053**
Sense Making	**0.634 ±0.041**	0.612 ±0.033	0.593 ±0.029	**0.700 ±0.050**
Answer	**0.422 ±0.040**	0.366 ±0.034	0.386 ±0.028	**0.480 ±0.070**
Age (Years)	14.0 ±0.3	14.0 ±0.2	14.3 ±0.2	13.7 ±0.3
Class	9.5 ±0.3	9.0 ±0.2	9.4 ±0.2	8.8 ±0.3
Number (%)	47 (41.6)	66 (58.4)	83 (73.4)	30 (26.6)

Our results exhibited that male gender was more important for ‘Growth Mind Set’, ‘Sense Making’ and ‘Answer’, while female gender was more important for ‘Real World’ and ‘Interest’ (Table 1). Both the genders were important for ‘Confidence’ and ‘Problem Solving’. Our results exhibited that getting an award was more important for all the parameters except ‘Growth Mind Set’. Liu and Lin (2010) showed that male students had higher motivation for learning mathematics, and male students also used learning strategies better than female students (Liu and Lin, 2010). Hodaňová and Nocar (2016) found that popularity of Mathematics and solving practical task was fairly high in primary school (69%) which was reduced in secondary school (45%) and was drastically reduced in technical field (15%) thereby seen a regular reduction in the interest in mathematics as the pupil progresses in their education. Hence it was

suggested to educate pupils and students for technical practice so as to enable students to find jobs and be successful in the labour market. Salout *et al* (2013) studied 780 girl high school students are chosen via multi-steps cluster sampling method randomly, and found that students believed that the generalization of mathematics to the real life is surprisingly insufficiency and suggested to modify the textbooks and curriculums in terms of mathematics development and students' needs in real-life.

Table 2: Average score of the parameters for the Parent's Qualification

Parameters	Father's Qualification			Mother's Qualification		
	PG and above	Graduate	Less than Intermediate	PG and above	Graduate	Less than Intermediate
Growth Mind set	0.435 ±0.030	**0.480 ±0.030**	0.381±0.044	**0.467 ±0.028**	0.427 ±0.032	0.434 ±0.046
Real World	**0.601 ±0.037**	0.530 ±0.032	0.583±0.061	0.598 ±0.034	0.516 ±0.035	**0.618±0.059**
Confidence	0.446 ±0.049	**0.465 ±0.040**	0.393±0.053	**0.473 ±0.047**	0.432 ±0.041	0.408±0.051
Interest	0.571 ±0.059	0.600 ±0.056	**0.746±0.065**	0.594 ±0.058	0.618 ±0.054	**0.667±0.081**
Problem Solving	0.357 ±0.042	**0.505 ±0.047**	0.405±0.066	**0.473 ±0.043**	0.375 ±0.046	**0.474±0.0713**
Sense Making	0.610 ±0.040	**0.664 ±0.040**	0.543±0.056	**0.648 ±0.039**	0.629 ±0.041	0.537±0.055
Answer	**0.484 ±0.042**	0.367 ±0.038	0.254±0.052	**0.467 ±0.036**	0.375 ±0.043	0.237±0.048
Age (Years)	14.4 ±0.3	14.4 ±0.3	13.5±0.3	14.1 ±0.3	14.3 ±0.3	14.1±0.4
Class	9.6 ±0.3	9.3 ±0.3	8.3±0.3	9.2 ±0.3	9.3 ±0.3	9.0±0.4
Number %	42 (39.2)	50 (44.2)	21 (18.6)	46 (40.7)	48 (42.5)	19 (16.8)

The qualification of father and mother were important in creating interest in mathematics in child. Overall, it was observed that qualification of father graduation and above was more important for all the parameters except 'Interest'. On the other hand, the qualification of the was important for the parameters viz. 'Growth Mind Set', 'Confidence', Problem Solving', 'Sense Making' and 'Answer', while for other parameters the mother qualification was important. The graduation in mother qualification was not so important for various parameters of MAPS. The Post-Graduate and above qualification was important in both father and mother qualification for parameter i.e. 'Answer'. On the other hand, qualification of either father or mother was not important for 'MAPS' parameter 'Interest'.

If mathematical concepts taught *via* teachers formally then students will face many problems which cannot solve it. Statistically, more number of mathematics students significantly above mean were 61.1% in 'Growth Mind Set'; 77.9% in 'Real World'; 57.5% in 'Confidence'; 61.1% in 'Interest'; and 55.8% in 'Problem Solving'; while in case of 'Sense Making' (60.2%) and 'Answers' (56.6%) are significantly below the mathematics group average (Table 3). The results indicated that most of the mathematics students in school had attitude for mathematics, persistence on problem solving especially their use in daily life and high motivation and interest in mathematics. There are students with high motivational interest (above 0.80) and were very high in 'Interest' (40.7%) and 'Sense Making' (39.8%) indicating high motivational interest in mathematics and learning mathematics for understanding. Grouws (1996) argued that learners know that mathematics plays critical role in their life.

Table 3: Status of respondents in different parameters of MAPS

Parameters	**Mean ± SE**	**Range**		**< Mean (%)**	**Mean to 0.79 (%)**	**≥0.80 (%)**	**> Mean (%)**
		Min	**Max**				
Growth Mind set	0.445 ± 0.019	0.00	0.750	44 (38.9)	69(61.1)	0 (0.0)	69 (61.1)
Real World	0.566 ± 0.023	0.00	1.00	25 (22.1)	83 (73.5)	5 (4.4)	88 (77.9)
Confidence	0.445 ± 0.027	0.25	1.00	48 (42.5)	57 (50.4)	8 (7.1)	65 (57.5)
Interest	0.617 ± 0.036	0.00	1.00	44 (38.9)	23 (20.4)	46 (40.7)	69 (61.1)
Problem Solving	0.431 ± 0.029	0.00	1.00	50 (44.2)	55 (48.7)	8 (7.1)	63 55.8)
Sense Making	0.621 ± 0.025	0.00	1.00	68 (60.2)	0 (0.00)	45 (39.8)	45 (39.8)
Answer	0.389 ± 0.026	0.00	1.00	64 (56.6)	36 (31.9)	13 (11.5)	49 (43.4)
Age	14.2 ± 0.18	11	19	-	-	-	-
Class	9.2 ± 0.17	5	12	-	-	-	-

The correlation study among the components indicated strong association between age of students and class (Table 4). A significant and positive correlation between component 'Answers' with all others components except 'Real World' and 'Interest'. 'Sense Making' had significant and positive correlation with all other components. Similarly, 'Persistence' in problem solving' too had significant and positive correlations with all the components except 'Real World'. There is strong correlation among 'Persistence', 'Sense Making', 'Interest' and 'Answers'. The Mathematics teachers' ability to connect mathematics to real life problems in various subject areas is crucial to building students interest in Mathematics since it's predicts 63.1% of the variance in the student interest in mathematics (Arthur *et al* 2018).

Table 4: Correlation among parameters of age, class and parameters of MAPS

Parameters	Class	Growth Mind set	Real World	Confidence	Interest	Problem Solving	Sense Making	Answer
Age	0.954**	0.212*	-0.135	-0.092	-0.329**	-0.195*	-0.131	0.286**
Class		0.209*	-0.132	-0.062	-0.062**	-0.178	-0.092	0.299**
Growth Mind set			0.007	0.164	-0.122	0.194*	0.206*	0.241*
Real World				0.124	0.222*	0.150	0.223*	0.000
Confidence					0.437**	0.449**	0.364**	0.370**
Interest						0.433**	0.394**	-0.016
Problem Solving							0.395**	0.243*
Sense Making								0.233*

Note: * $P \leq 0.05$; ** $P \leq 0.01$

Conclusion

The present study will help in not only in identifying and guiding students to go for mathematics based on their attitude and believes towards mathematics. The perception of the students' right at school level and guide them their true ability to undertake higher studies and to understand the difficulties faced by school children in understanding mathematics. Mathematics is a main matter of the real-life that can cover all aspects of real world. Therefore, educational systems have to create new circumferences for mathematics education. The results of this study have indicated that the male and female students responded differently to different parameters. The numbers of students with award mathematics were much less than those not recognized by any award and the parameters were more important in students with awards. There is need to encourage more students with some sort of encouragement to understand the usefulness of mathematics in our daily life. In most of the respondents, the education of parents do had role in most of the parameters. The teaching of Mathematics is made interesting to students when teacher are able to connect mathematical concepts to real life problems and experiences as well as establishing connection between the various forms of Mathematical knowledge.

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