

Secondary School Students' Attitude towards Mathematics

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Abstract

The major objective of this article is to describe the perception of self-efficacy and attitude towards mathematics of students studying science and mathematics in grade 12 in Kathmandu valley. Cross-sectional descriptive design and quantitative method were used to collect and analyze data. Data were collected from 318 randomly selected students studying science in grade 12, from nine different schools of Kathmandu valley through self-administered questionnaire. The survey showed that majority of girls and boys were encouraged by their parents to get enrolled in the science stream. Most of them chose mathematics courses to enter into the fields of engineering and technical sciences. From the observation we found that perceived self-efficacy is good i.e. both girls and boys have positive and good attitude towards mathematics courses. There is no gender variation in attitude of students learning mathematics between girls and boys. Therefore, attitude towards mathematics are less likely to be influenced by gender of students, castes and educational status of parents. Many students can be attracted towards mathematics field of study by providing information and counseling about academic opportunity for mathematics in higher education.

Keywords: Mathematics, science, gender, attitude, self-efficacy.

Introduction

Mathematics is useful in daily life as compared to other subjects. Mathematics is indeed one of the most useful subjects and it would be difficult to live a normal life in very many parts of the world without it (Githua and Mwangi, 2003). Basic mathematics knowledge is essential for the study of subject matters in most discipline. It is the foundation of all sciences including economics and demography. Mathematics is a compulsory subject for all students up to grade 10 at the secondary school level. It was also compulsory subject for science students of grade 11 and 12, who want to go for engineering and technical field at Bachelor level. But now according to curriculum development center 2020 mathematics is not a compulsory subject for 11 and 12. Student should have positive attitude towards mathematics learning in order to do well performance in mathematics course. This paper analyzes the attitude and perceived self-efficacy of grade 12 male and female science students towards mathematics.

Attitude is a learned predilection of a person to react positively or negatively to any object, situation, concept or another person (Nicolaidu, 2003). Students usually develop positive or negative attitude towards mathematics in the process of learning mathematics at high school. Attitudes formed by students at high school level tend to remain for a long time and determine their intention to study mathematics in higher education (Yasar, 2016). Quality of teaching mathematics, social, psychological climate of the class and perceived self-efficacy help develop positive or negative attitude towards mathematics among student (Haladyna et al., 1983). Individual's attitude towards mathematics is determined by several factors ranging from intra-personal to school climate and family background of the students. Students' self-efficacy, self-concept and achievements in mathematics, extrinsic motivation and anxiety towards mathematics are responsible for formation of beliefs and attitudes towards mathematics (Kogce et al., 2009). Classroom management, mathematics teachers' personality, teaching styles and materials along with examples presented in classroom are some of inter personal factors that influence the students' attitude towards mathematics learning (Yilmaz, Altun & Olkun, 2010). Attitude is also affected by societal value, gender stereotype and home environment. Parental expectation, educational status and occupation of parent appear to be mediating factors for the formation of student's attitude towards mathematics (Tobias, 1993).

There are gender differences in attitude towards mathematics and females have more negative attitudes than that of males. Hyde et al., (1990) found that female students held more negative attitudes to mathematics than male students, and these differences increased gradually with age. The females lacked confidence, perceived mathematics as a male domain subjects and suffered from anxiety in studying mathematics. Mohd et al., (2011) and Köğçe et al., (2009) investigated that no significant difference between male and female students' attitude towards mathematics. Most students showed positive attitude towards mathematics, but they lacked intrinsic motivation to engage in mathematics learning (Lim, 2010). Overall, the negative attitude of female mathematics students over rules the positive attitude due to gender differences, wrong perception and lack of self-confidence. Therefore, this study aims at describing self-efficacy and attitudes of grade 12 science students towards mathematics.

Methodology

This study was conducted in selected nine schools of Kathmandu valley by employing cross-sectional descriptive survey design. Quantitative methods and procedures were used to collect and analyze data. A total of 318 secondary school (grade 12) students studying science were randomly selected and included in the survey. Questionnaires consisting questions related with self-efficacy and attitude measurement with 5 point likert scale and 3 point likert scale was developed. For reliability, test and re-test were done whereas for validity the questions were approved by the experts. Purpose, possible benefits and risks of the study were clearly explained to the students and informed consents were obtained from them before administering survey questionnaire. Data collected through those self-administered questionnaire were coded and entered in computer using SPSS (version 23). The data were analyzed using simple descriptive statistics: percentages, means and frequencies as well as chi-square and t test.

Results

After the data analysis, the data revealed different results. From the total 318 sample students, 75 percent were boys and 25 percent were girls. Proportion of girl students is slightly higher in private schools (27%) than community schools (22%). Highest percentages of students were from Brahman/Chhettri, followed by advantaged Janajatis (23%), Disadvantaged Janajatis (7%), Madhesi (9%) and, Dalits and others (3.1%). Share of Brahman/Chhettri students is significantly higher in both private (62%) and community schools (52%). Share of disadvantaged Janajati students is 6 percent in private and 10 percent in community schools. About 3 percent science students from Dalits and others were in both private and community schools. Findings suggest that students from Brahman/Chhettri caste students were highest in number than from other caste/ethnic backgrounds, and participation of girls in science stream of grade 12 is very low as compared to boys, indicating social and gender inequality in science education of high school. The overall result of background characteristic of the students is show in Table 1 below.

Table 1: Background characteristics of students

Background variables		Types of school		Total
		Private n = 175	Community n = 143	n = 318
Gender	Male	72.6%	78.3%	75.2%
	Female	27.4%	21.7%	24.8%
Caste/Ethnic Groups	Brahman/Chhettri	61.7%	52.4%	57.5%
	Advantaged Janajati	16.6%	30.1%	22.6%
	Disadvantaged Janajati	5.7%	9.1%	7.2%
	Madhesi	12.6%	5.6%	9.4%
	Dalit and others	3.4%	2.8%	3.1%
Father's education	Higher Education	45.7%	41.3%	43.7%
	High school and below	54.3%	58.7%	56.3%
Mother's Education	Higher Education	22.9%	22.4%	22.6%
	High school and below	77.1%	77.6%	77.4%
Highest level of education of immediate family	High school	22.9%	38.5%	29.9%
	Bachelor Degree	33.1%	32.9%	33.0%
	Master Degree (social sciences)	11.4%	9.8%	10.7%
	Master Degree (Science/Math)	15.4%	9.1%	12.6%
	PhD	8.0%	4.2%	6.3%

Data shows that majority of the students were encouraged by their parents to get enrolled in science stream and choose mathematics in grade 12. Only 13 percent chose science and mathematics course in their own decision. About 10 percent were influenced by their friends for the study of science and mathematics in grade 12. Proportion of students encouraged by parents is slightly higher among girls than boys, but it was not statistically significant at 0.05 p value. The Table 2 below summarizes the different factors which influence the scenario of enrollment and selection of Math/Science in Grade 12.

Table 2: Factors influencing in enrolling and choosing math/science in Grade 12

	Gender		Total	
	Male n = 239	Female n = 79	%	n = 318
<i>Who encouraged you to study science in Grade 11 and 12?*</i>				
Parents	56.1%	63.3%	57.9%	184
Relatives	10.9%	10.1%	10.7%	34
School science teachers	8.8%	5.1%	7.9%	25
Friends	10.5%	10.1%	10.4%	33
Own decision	13.8%	11.4%	13.2%	42
<i>What is primary factor that influence you to enroll in science stream of Grade 11 and 12? **</i>				
I am good at science and math	21.8%	12.7%	19.5%	62
I am very much interested in science and math	66.9%	72.2%	68.2%	217
My father or mother works in science, technology and engineering field	0.8%	6.3%	2.2%	7
Others	10.5%	8.9%	10.1%	32
<i>Why have you chosen mathematics courses in grade 11/12? **</i>				
I want to make career in the field of mathematics	11.3%	27.8%	15.4%	49
I want to become a mathematician	4.2%	5.1%	4.4%	14
Mathematics helps me understand science and engineering fields of study	73.2%	54.4%	68.6%	218
Others	11.3%	12.7%	11.6%	37

** Significant at 0.05 p value and * not significant

Perceived Self-efficacy

Self-efficacy refers to an individual's belief in his or her capacity or ability to perform specific performance in the given context and environment. This attempt was made to assess self-efficacy of girls and boys in grade 12 mathematics. Seventy-three percent of girls and 67 percent boys were confident in doing excellent performance in mathematics subject. About 66 percent both girls and boys were confident in learning mathematical concepts and skills easily. Proportion of students with confidence in getting A grade in mathematics is slightly higher among girls (79%) than boys (76%). The Table 3 below shows the self efficacy of boys and girls in mathematics.

Table 3: Self-efficacy of boys and girls in mathematics

Statements		Agree	Not sure	Disagree	Total
I am confident that I can do excellent performance in mathematic courses.	Boys	67.4%	28.5%	4.1%	100.0%
	Girls	73.4%	24.1%	2.5%	100.0%
I am confident that I can easily learn mathematical concepts and skills taught by teachers in classroom.	Boys	65.7%	32.2%	2.1%	100.0%
	Girls	67.1%	30.4%	2.5%	100.0%
I am confident that I can obtain A Grade in Mathematics.	Boys	75.7%	21.8%	2.5%	100.0%
	Girls	78.5%	21.5%	0.0%	100.0%
I am certain that I can understand the subject matters presented in the textbooks used in mathematic course.	Boys	65.7%	32.2%	2.1%	100.0%
	Girls	67.1%	30.4%	2.5%	100.0%
I expect to do well in my mathematics subject.	Boys	89.1%	10.5%	0.4%	100.0%
	Girls	93.7%	6.3%	0.0%	100.0%

Attitude towards Mathematics

It was assumed that there might be difference in attitude towards mathematics between boys and girls. Majority of students agreed that they enjoyed learning mathematics and argued that mathematics is useful in daily life. There is no difference in attitude toward learning mathematics. The attitude toward learning mathematics by gender is shown in Table 4.

Table 4: Attitude towards learning mathematics by gender

Group	N	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Male	239	4.322176	0.0455835	0.704704	4.232377 4.411974
Female	79	4.405063	0.0732227	0.650818	4.259288 4.550839
Combined	318	4.342767	0.0387848	0.691632	4.266459 4.419075
Difference		-0.08289	0.0897795		-0.2595287 0.0937535
Degrees of freedom = 316		t = -0.9	Pr(T < t) = 0.18		

Students were asked to response to the statement "I am happier in mathematics class than in any other classes". Fifty seven percent agreed to this statement. Mean score of attitude to this statement is significantly higher among girl students than among boys which illustrated shown in Table 5 below.

Table 5: Feeling happier in learning mathematics than other subjects

Group	N	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Male	239	3.585774	0.0630317	0.974446	3.461603 3.709945
Female	79	3.886076	0.0918407	0.816298	3.703235 4.068917
Combined	318	3.660377	0.0530147	0.945387	3.556072 3.764682
Difference		-0.3003	0.1217177		-0.53978 -0.06082
Degrees of freedom = 316			t = -2.5	Pr(T < t) = 0.01	

Maximum score of attitudes is 60. Mean of attitude score is 44.7 for girl and 45.1 for boys. There is no significant difference between boys and girls in mean score of attitude. This indicates that both girls and boys have very good and positive attitude towards mathematics which is elaborated by Table 6 below.

Table 6: Difference in mean of attitude scores by gender

Gender	N	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Male	239	44.65272	0.382546	5.914011	43.89911 45.40633
Female	79	45.11392	0.613329	5.451387	43.89288 46.33497
Combined	318	44.7673	0.325109	5.797525	44.12765 45.40694
Difference in mean		-0.4612	0.753134		-1.943 1.020586
Degrees of freedom = 316				t = -0.6124 P < 0.27	

Mean attitude score of students is slight higher among those whose mothers had high school and below education as compared to those students of educated parents; this is shown in Table 7 below. This difference is not statistically significant. Finding suggests that attitude of students towards mathematics is not influenced by educational status of mothers.

Table 7: Attitude score of students by mother's education

Category	N	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Higher Education	72	43.90278	0.7671257	6.509278	42.37317 45.43238
High school and below	246	45.02033	0.3545644	5.561125	44.32194 45.71871
Combined	318	44.7673	0.325109	5.797525	44.12765 45.40694
Difference in mean		-1.11755	0.7755077		-2.64336 0.408264
Degrees of freedom = 316			t = -1.44	Pr(T < t) = 0.07	

There is no significant difference in mean score of attitude between students with educated fathers and with high school and below education. This indicates that educational status of father does not affect attitude of students towards mathematics. Table 8 below shows attitude score of students by fathers' education.

Table 8: Attitude score of students by father education

Group	N	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Higher Education	139	44.70504	0.509574	6.007789	43.69745 45.71262
High school and below	179	44.81564	0.4219555	5.64538	43.98296 45.64832
Combined	318	44.7673	0.325109	5.797525	44.12765 45.40694
Difference in mean		-0.11061	0.6564306		-1.40213 1.18092
Degrees of freedom =	316		t = -0.17		Pr(T < t) = 0.43

There is slight difference in mean score of attitude between students from Brahman/Chhetri and those from Janajati and other groups. But this is not significant at 0.05 p value. Based on finding it can be said that attitude of high school science students is less likely to be influenced by caste and ethnic background which is shown in Table 9 below.

Table 9: Attitude score of students by caste and ethnic groups

Group	N	Mean	Std. Err.	Std. Dev.	[95% Conf. Interval]
Brahman/Chhetri	181	45.24862	0.4102662	5.519567	44.43907 46.05817
Janjatis and others	137	44.13139	0.521831	6.107875	43.09943 45.16334
Combined	318	44.7673	0.325109	5.797525	44.12765 45.40694
Difference		1.117232	0.6545607		-0.17062 2.40508
Degrees of freedom =	316		t = -1.7		Pr(T < t) = 0.95

Discussion

Findings indicate that majority of both girls and boys were encouraged by their parents to get enrolled in science stream of grade 11 and 12. Students coming to the science stream by their own decision are seen slightly higher among boys (14%) than girls (11%). Though majority of both girls and boys had interest to study mathematics, so they could decide to choose science and mathematics at grade 11 and 12. It suggests that high school students lack capacity to make decision by themselves for choosing field of study and choosing path of academic career in mathematics. Therefore, parent should make right decision and proper guidance about getting enrolled in grade 11 and 12 considering their interest and capacity to learn mathematics.

Majority of students said that they chose mathematics courses including physical science because they wanted to enter into the fields of engineering and technical sciences. They also know that mathematical knowledge and understanding is essential for the technical and engineering studies. There is gender variation in this view. Proportion of the students supporting this view is significantly higher among boys (73%) than girls (54%). About 4 percent of both boys and girls like to be mathematician in the future. Most of students were not informed that there is separate mathematics study in higher education and there is opportunity for making academic career in mathematics field. In this context Wood et al., (2012) explains that student conceptions of mathematics as a subject is that it has utility in future life and professional career. A considerable proportion of the student can make academic and professional career in mathematics because their perceived self-efficacy is positive. Majority of both girls and boy have confidence to perform well and obtain A grade in mathematics courses.

Findings present that both girls and boys have positive and good attitude towards mathematics courses. There is no significant difference between girls and boys attitude towards mathematics. This finding is supported by some studies which established no significant difference between attitude towards mathematics of male and female students (Mohd et al., 2011; Köğçe et al., 2009; Nicolaidou & Philippou, 2003). Student attitude towards mathematics are similar across caste category and parent educational category. Attitude score of students were not associated with educational status of parents. Home environment and family support to the education of boys and girls may be difference in educated and uneducated family. Köğçe et al., (2009) & Tobias, (1993) found that school attitude towards mathematics are influenced by occupation and educational status of parent. Similar findings can be reported in Nepalese context if similar studies were conducted among high school students who were studying compulsory mathematics.

Conclusion

In conclusion, parental encouragement and guidance influence the students' enrollment and choices of science and mathematics subjects in grade 12. Most of the girls and boys are less likely to choose mathematics as major subject at Bachelor level because they are not well informed about opportunities for making career in higher education. However, both boys and girls have good perceived self-efficacy in mathematics and positive attitude towards mathematics. Perceived self-efficacy and attitude towards mathematics are less likely to be influenced by gender of students, castes, occupation and educational status of parents. Most students who are studying science and mathematics at grade 12 have positive attitude towards mathematics. Many students can be attracted towards mathematics field of study in higher education if students are informed and counseled about future career in the mathematics field.

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