Participation and Achievement in Mathematics: A Gender Perspective in Secondary School of Nepal

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Abstract

This study sought to examine gender perspectives in participating in mathematics classes, interacting with teachers and peers, and the learning environment within schools for female students. The objectives of this study were to find the gender difference in the mathematics achievement of students and to identify the effect of gender in classroom participation of mathematics students at secondary school. A cross-sectional survey with 294 students from Ilam district was surveyed. Univariate and bivariate analysis were used to find the significant difference on achievement and chi-square test was used to find the association of participation of female students in different variables. There is significant difference between theachievement of boys and girls in mathematics at grade X (t = 2.508). The average achievement of boys was higher than that of girls. The effect of gender in different categorical variables viz; ethnicity, parental education, family income, attendance of students, interaction with teachers and peers had been done by bivariate analysis and the association was statistically significant. Educated family, better economic status of family, regular attendance in classroom, more interaction with teacher were the factors which is significantly associated with the participation of female students.

Keywords: performance, cross sectional survey, students' participation, secondary education, gender difference

Introduction

Education is a life-changing acquisition for an individual. Through instruction, it develops a complete understanding of the subject matter. Acquiring an education is a challenging process; gender and ethnicity are common issues in education. The proportion of girls who participate in mathematics education at a higher level is not as high as that of boys in school (Samuelsson & Samuelsson, 2016). In the education sector, there is a debate on reducing the gender gap. The gap is more challenging in developing countries like Nepal (Joshi, Digari, & James, 2022). However, research suggests that the increasing participation of women in the teaching workforce has been one of the major factors for reducing the gender gap (Tommaso et al., 2014). Promoting girls' education, national and international multilateral agencies and donor communities are incorporating their plans and policies.The investment in girls' education contributes to achieving several socio-economic development goals (Chaudhari, 2014). Advantages of returns to female education are higher than that of male education as female education improves children's health and reduces the number of unwanted births and causes women to want smaller families (Amwonya, Kigosa, & Kizza, 2022).

Participation of girl students in classroom activities iscomparatively lower than that of boys in Mathematicsat secondary schools (Giri, 2016). Classroom dynamics, teaching methods, and interactions with peers shapes girl's involvement in mathematics (DC & Rokaya, 2023). It is further recommended to improve girls' participation by addressing gender perceptions, improving communication between parents and teachers, as well as enhancing the appeal of math classes.

Across the globe, mathematics is associated with adult males, which contributes to underrepresentation of women in science, engineering, and mathematics. As early as possible, boys and girls perceive gender differences in math skills, which influences their identification of their skills and interests (Cvencek, Meltzoff, & Greenwald,

2011). In order to adapt to school tasks and responsibilities, students' perceptions of their academic abilities are crucial. Since mathematics is a creation of the human mind, it is intimately linked to the development of civilization and originated from practical experiences that addressed human needs (Giri, 2016). Despite its importance, he argues that mathematics is a necessity for the advancement of civilization, providing insight into the power of the human mind and challenging intellectual curiosity. As a result of fear of failure in examinations, a considerable number of female students at the secondary level avoid mathematics as a major subject (Chaudhari, 2014). A reluctance to change poses a significant challenge for educators and stakeholders, reinforcing the equity theory advocating equal educational opportunities for both genders.

The research on the effects of gender, class level and ethnicity on attitude and learning environment in college algebra course results that male students, White students, and freshman students consistently reported more positive perceptions in these four categories than did their counterparts (Das & Wilkinson, 2011). The result shows that students' final grades were consistently a little higher than Non-White students and female students' scores were higher than those of male students.

The interest in mathematics also effects the participation in mathematics in higher level. The study on Interest in mathematics in the ethnic group of Nepal (Poudel, 2020) mansion various factors influencing the interest in mathematics which include lack of fundamentals, parental attention and guidance, distraction, financial constraint and mathematical learning disability (Acharya, 2017). The most dominating factors for losing interest in mathematics were lack of fundamental knowledge on mathematics and parental attention and guidance (Jay, Rose, & Simmons, 2018). In fact, students in Nepal generally have lower interest in learning mathematics (Acharya, 2017). Thus, how to enhance students’ mathematics interest is major problem, especially for those

ethnic group students. Therefore, the teacher should change the way of teaching for gaining interest in mathematics for all the students in Nepalese schools and colleges.

In Mathematics, girls were identified to have found algebraic formulae and geometry more difficult and hence obtained low scores than boys (Koirala & Acharya, 2004). The Tarai girls were low scorers in Mathematics among the students. But the study found the girls scoring equal to that of boys in Computer education. In some cases, they were even better. Brahman and Kshetri girls surpassed others and it was particularly true of the girls of the Kailali district.

In some international instance the analysis showed that both beliefs and attitudes of girls are negatively influenced by some cultural and traditional norms (Nasir, Hand, & Taylor, 2008). Additional barriers include lack of support from parents, teachers and peers as well as the masculine face that is given to Mathematics and Science (Boahene, 2006). The investigation also revealed the need to motivate girls from an early age. This can be done by empowering and preparing them socially, physically and mentally in these fields. Motivating female students can also be achieved with the help and support from parents, teachers and the entire education sector.

Educational equality for all students in mathematics teaching and learning from different community andgender are burning issues in context of Nepal. The students' family belong different cultural, social and economic status. These characteristics influenced the achievement of students in mathematics. Pangeni (2014) claimed that the family characteristics explained the largest amount of variance in mathematics achievement, followed by student characteristics, school characteristics and parental involvement. Variables parental education, number of books at home, absenteeism, parental support for homework, school type and location, teacher training, the number of school days in the academic year and school physical facilities were significantly

related to students' mathematics achievement. These factors are directly related to the gender. The gender differences start from the society especially from home. Girls are more engage in the household work than that of boys. They have less chance to study at home.

Mathematics is one of the important subjects of study under the Nepalese education system. It has been introduced from the elementary level to the post-graduate level. Mathematics is comparatively a difficult subject; most of the students avoidparticipating in mathematics classes. It is a technical subject to study; students should give more time in this subject. The participation in classroom activities, doing homework, interaction with peers and teachers and in extra activities of girl students in secondary schools is the main focus of this study which is yet to be study. Also, the achievement of girl students in mathematics in comparison to boy students is to be study.

Asa teacher of mathematics with one and half decade experience of teaching mathematics to both the school and university level students, I have taught the students with various learning ability, intelligence, and the students representing from different cultural groups in the same class. In my experience girl students feel hesitate to share their experiences to the other students. Participation of girls in classroom activities in mathematics is a crucial issue that not yet been determined on the basis of the research. How does gender affect students' participation in mathematics classrooms at the secondarylevel? It is the key question of this research article. Secondary school students often exhibit differences in mathematics achievement, which can be influenced by various socio-cultural factors, stereotypes, and educational practices. These disparities not only affect students' academic performance but also their confidence and interest in pursuing further studies in mathematics and related fields. In Nepal, there is a need for a deeper understanding of how gender impacts students' participation and

performance in mathematics classrooms, especially at the secondary school level. Despite various educational reforms aimed at promoting gender equality, gaps in mathematics achievement between male and female students continue to be observed, raising concerns about the effectiveness of these initiatives. This study aims to investigate the gender differences in mathematics achievement among secondary school students in Nepal and to explore the impact of gender on students' participation in mathematics classrooms.

Methods

The data used in this paper were drawn from a cross- sectional quantitative survey method to investigate the students' participation and achievement in terms of gender. The survey was conducted with students of class ten who were taking their regular classes in the academic year of 2024/25. A structured likert scale questionnaire was used in the survey, and respondents were selected using a two-stage random sampling technique. Twelve schools (6 from public and 6 from private) out of 68 schools from Ilam district were selected randomly for the first stage. The list of all private and public schools was obtained from the office of Education Development and Coordination Office, Ilam. Secondly, among these cluster a total of 294 students (155 from public and 139 from private schools) were selected randomly from total of 1275 students. The sample calculator formula $n = N/(1+Ne^2)$ was used to calculate the sample size. The number of samples from each school was in the range of 20 to 40. The sampled schools were co-educational; all the male and female students were present on the day of feeling the questionnaire. The researcher himself distributed the questionnaire form to the students and collected it after three hours on the same day. Also, the researcher spent two weeks in different sampled schools. The independent variable of this research was sex, ethnicity, economic status of family, parental education, attendance of students, and interaction with teachers and peers, whereas the

variable 'the achievement of students' as the dependent variable. The univariate and bivariate analysis were used to analyze data. Initially, univariate ordescriptive analysis described the socio-demographic characteristic of the respondents. Bivariate analysis described the statistically significant of achievement in terms of gender. It also described the association of participation of female students in different independent variables. Statistical software SPSS version 20 was used for the data analysis.

Results

Background characteristics of respondents

More than half of the participants (53%) were boys. The majority of the respondents (41%) Janjati followed by Brahmin (24%). Nearly two percent of the parents of respondents were illiterate, while less than one third (30%) of the parents had SLC passed and around 6% had master degree. Nearly one third (31%) of the respondents belonged to the job holder family followed by agriculture (26%). Likewise, more than half (51%) had more than ninety percent attendance and only 16% had below eighty percent attendance in the class. Nearly three fifth (57%) always submitted their assignment. More than half (53%) interacted with their teacher about subject matter and more than two third (69%) interacted to their peers.

Table 1

Background characteristics of respondents

Sex of the students	N	%
Male	116	52.7
Female	104	47.3
Ethnicity		
Brahmin	53	24.1

Chhetri	51	23.2
Janajati	91	41.4
Dalit	18	8.2
Madheshi	7	3.2
Parental Education		
Illiterate	4	1.8
Primary Education	46	20.9
SLC Pass	66	30.0
Plus Two/ Intermediate	57	25.9
Bachelor	34	15.5
Master	13	5.9
Income status of Family		
Agriculture	58	26.4
Job	68	30.9
Business	34	15.5
Foreign employee	37	16.8
Labour	23	10.5
Attendance in classroom		
90% and above	112	50.9
(80-90) %	72	32.7
Below 80%	36	16.4
Submission of assignment in time		
Always	126	57.3
Sometimes	61	27.7
Never	33	15
Interaction with teachers in classroom		

Always	115	52.3
Sometimes	43	19.5
Never	62	28.2
Interaction with peers in classroom		
Always	147	66.8
Sometimes	18	8.2
Never	55	25

Bivariate analysis

A bivariate analysis was conducted to determine the statistical significance of gender in mathematics scores in the final internal examination of the school.The achievement of boys and girls was statistically significant (t = 2.508) between mean score of boys and girls.Bivariate analysis was used to find statistical associations between gender and categorical variables.Overall, closely 50% girls were participated in mathematics classroom among them higher participation of girls was madheshi (57%) than other ethnicity (Brahmin 51%, Janajati 49%, Chetree 43%, and Dalit 33%)and the association was statistically significant ($p<0.5$).Likewise,the participation from the educated family (77%) whose parents were masters, was higher than other family. Also, illiterate parents send their daughters in higher (72%) than others and the association was statistically significant ($p<0.5$). Similarly, the participation of girls from business holder and foreign employees around 60% was higher than others (agriculture, job holders, and labour around 50%) and the association was statistically significant ($p<0.1$). The attendance between 80 to 90 percent were higher participants 58% than above 90 and below 80 percent attendance and the association was statistically significant ($p<0.1$). Likewise, the participants of girl students who submitted their assignment occasionally (58%) was higher than never submitted and always submitted (51%) was list among them and the association was statistically

significant (p<0.1). Similarly, the girl students were never interacted with teacher (58%) was higher than sometimes interaction and always interaction (51%) and the association were statistically significant (p<0.1). similarly, always interaction with their peer (58%) was higher than other categories sometimes and never interaction (48%) and the association was statistically significant (p<0.1).

Table 2

Participation of gender by different sociodemographic characters

	Empact of gender		Total		χ^2- value and p value
	Male	Female	%	N	
Ethnicity**					χ^2- value = 3.604
Brahmin	43.3	56.7	100	67	p value = 0.111
Chhetri	53.6	46.4	100	69	
Janajati	44.1	55.9	100	118	
Dalit	48.3	51.7	100	29	
Madheshi	27.3	72.7	100	11	
Parental education**					χ^2- value = 5.738
Illiterate	28.6	71.4	100	7	p value = 0.140
Literate	50	50	100	64	
SLC	42.3	57.7	100	97	
PlusTwo/ Intermediate	48.6	51.4	100	74	
Bachelor	53.8	46.2	100	39	
Master	23.1	76.9	100	13	
Income status of family*					χ^2- value = 2.325
Agriculture	48.8	51.2	100	80	p value = 0.089

Job	49.4	50.6	100	81	
Business	39.6	60.4	100	48	
Foreign employee	40.4	59.6	100	57	
Labour	50	50	100	28	
Attendance*					χ^2- value = 1.905
90% and above	49	51	100	131	p value = 0.080
(80-90) %	42.1	57.9	100	107	
Below 80%	42.9	57.1	100	56	
Submission of assignment in time*					χ^2- value = 1.274 p value = 0.066
Always	49	51	100	151	
Sometimes	41.8	58.2	100	91	
Never	44.2	55.8	100	52	
Interaction with teacher*					χ^2- value = 0.918
Always	48.6	51.4	100	142	p value = 0.056
Sometimes	45.2	54.8	100	62	
Never	42.2	57.8	100	90	
Interaction with peers*					χ^2- value = 1.068
Always	42.2	57.8	100	197	p value = 0.060
Sometimes	45.5	54.5	100	33	
Never	51.6	48.4	100	64	
					t = 2.508

Note. Chi-square test significant at **=p<0.5 and * = p< 0.1

Discussion

My study revealed that there is significant difference between the achievement of boys and girls. In final examination of class ten the mean score of boys was greater than that of girls. The mean achievement scores of boys and girls was not statistically significant (t = 2.508). The factors affecting the low achievement for girl students may household work, not available more time to study, not more interaction with teachers, school environment, teachers' less encouragement, and lower attendance. The treatment in classroom was not biased but these extraneous variables cause the lower performance of girls.

Bivariate analysis showed that significantly high participation of ethnic *madheshi* girls than other ethnic communities. This result contradicted to the study result the Tarai girls were low scorers in Mathematics among the students(Koirala & Acharya, 2004). Girls from the educated family who had master degree (77%) were participated higher than other family. They got guidance and encouragement from the educated family. Similarly, female students from job holder and foreign employee family had higher participation. They provided additional materials for mathematics; also, they got extra classes for mathematics. Girls from labour family did not get such opportunity so; they had lower participation and achievement. Female students had lower attendance than boys. They had around 80% attendance. Attendance also affects the achievement in mathematics because it has sequential content. Likewise, female students did not interact with teachers. Because of shyness and fear most of the girls afraid to ask questions. They liked to interact with their peers but, they were discussed out of courses. In their mathematics class also, they used to discuss extra things so, it may decrease their performance in mathematics.

Conclusion

The study showed the achievement of female students in mathematics at secondary level was low in comparison to male students. With discussing to the mathematics teachers, the factors family encouragement, freeness to study at home, teachers support, additional supportive materials, and classroom environment may favour to boys to perform better in mathematics lead to lower performance of girls. An analysis of bivariate variables revealed that family education status, income status, students' attendance, and interaction with teachers and peers were key factors affecting female participation. Educated family, better economic status of family, regular attendance in classroom, more interaction with teacher were factors significantly associated with the participation of female students. The findings indicate that there is still a need for equal treatment inside and outside the classroom for both boy and girl students.

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