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A Study on Low Performing Students Perception towards Mathematics: A Case of Secondary Level Community School Students of Nepal

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Abstract

The students' perception of mathematics is equally important for the parents as well as the teachers to deal with them effectively. Therefore, this study is concerned with the secondary level low-performing students' perception of mathematics and its effects on their achievements. The study is based on the mixed-method survey research design consisting of 312 grade IX and X students, 119 male and 193 female students from the 10 community schools of Province No. 1, Nepal. A Likert-type survey questionnaire, 'Perception Towards Mathematics Inventory (PTMI) was developed and administered by the researchers to the participants. Thus, the collected quantitative data were analyzed by using descriptive statistics. The qualitative data collected through semi-structured interviews were summarized and analyzed categorically in high-performing and low-performing groups. The findings revealed that the perception of the low-performing students towards mathematics was found negative or they did not prefer to learn mathematics. Similarly, the student's perception of mathematics was found to have a greater effect on their achievement. The group of higher achiever students was found more positive and confident towards mathematics and the lower achievers were found negative and anxious. However, most of the students were found aware of the value of mathematics.

Keywords: community school, higher achiever, lower achiever, low performing student, perception

Introduction

Mathematics is one of the fundamental subjects in the school-level curriculum. It has a significant contribution to each person in his/her everyday life. Mathematics especially deals with the properties and relationships of numbers, symbols, and their applications. Aristotle(n.d)defined 'mathematics as the science of quantity. But mathematics is not just about numbers; it is also about finding solutions to every problem even if the problem seems impossible to solve. It is a subject and is also

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connected with other different subjects. Mathematics is a noteworthy subject by means of its wide applicability in people's daily life; so far, it is repeatedly measured as a complex subject in schools (Kaur, 2017). Numerous students consider mathematics as an uninteresting and disengaging subject and they hated mathematics and try to keep away from it because of mathematics anxiety (Colgan, 2014). It is an essential tool for the scientific-technological and economic advancement of any nation(Umameh, 2011).

Mathematics is an important subject not only from the point of view of getting an academic qualification at school or college but also a subject that prepares students for the future regardless of what work they choose to follow as part of their career (Priestley et al., 1982). Even when a person doesn’t know mathematics, he unconsciously uses it such as simply while looking at the watch or even counting his change after he purchases something. According to Umameh (2011), mathematics is intimately connected to everyone's daily life activities and life-long planning. Mefor(2014) truly remarks that mathematics relates to everything in the universe, from the smallest to the largest. Therefore, without mathematics education, human life cannot function properly and effectively.

The basic knowledge of mathematics is essential to maintain the daily tasks of a person such as cooking, playing, shopping, distributing, etc. Similarly, it can be utilized as a tool for different subject areas. It helps to develop the child to think critically and logically so that the children use their brains to work together for solving each problem. According to Cabatay, Henry, Captali, and Loren (2011), mathematics is learned for more than just one reason namely; to gain mastery over the basic mathematical skills to cope with the demand of life, for the symbolic means of communication to many other disciplines and so on. Similarly, it is the language of the sciences, and many disciplines that depend on this subject as a symbolic means of communication. Thus, mathematics education can help to develop problem-solving skills as well as the quick decision-making power of the students.

Student Perception towards Mathematics

Perception is the primary form of cognitive awareness about the person, place, thing, and event through the sensory organs around the person. All conceptual knowledge is based on or derived from this primary form of awareness. Perception is the quality of being aware, the ability to see, hear, or become aware of something through the senses, the way in which something is regarded (Efron, 1969). It is the process of identification, organization, and interpretation of sensory information in order to represent and understand the environment. In this study, the term 'perception

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towards mathematics is conceptualized as a mental representation or view of mathematics, apparently constructed as a result of social experiences, mediated through interactions at school, or the influence of parents, teachers, peers, or mass media. Students' perceptions have behavioural consequences on the learning approaches they adopt, which in turn influence their learning outcomes (Ferreira & Santoso, 2008). Positive perceptions have been associated with deep learning approaches (Jackling 2005), whereas negative perceptions are associated with the surface learning approach (Prosser & Trigwell, 1999). The deep approach has resulted in higher academic performance and the surface approach resulted in lower performance (Biggs, 1996). Negative perceptions are likely to cause negative feelings towards learning that decline in motivation and cognitive processing thus declining in the learner's performance (Isen, 2004).

It is widely claimed that negative perceptions and myths of mathematics are widespread among students, especially in the developed countries (Ernest, 1995; Gadanidis, 2012). Sam (1999) claimed that many students are scared of mathematics and feel powerless in the presence of mathematical ideas. They regard mathematics as difficult, cold, abstract, and in many cultures, largely masculine (Ernest, 1995). The relationship between perception toward mathematics and achievement in mathematics had traditionally been a major concern in mathematics education research (Ma & Kishor, 1997). According to McLeod (1989), students' perception of mathematics teaching and learning plays an important role in mathematics education. The learning outcomes of students are strongly related to their perceptions of mathematics (Leder et al., 2002; Thompson, 1992).

In fact, the poor performance of students globally in mathematics is mostly linked to perception than any other variable (Royster et al., 1999). It is not just a concern for particular countries but has become a global concern over the years (Hagan, et al., 2020). However, most of the students in Nepal are still found failing in mathematics at the school level of education. The ERO report (2019) shows that a large number of students is at the underperforming level in school-level education especially in mathematics, and the achievement of the students is also decreasing for some years. The ERO report (2017), shows that the average score in grade VIII mathematics in the year 2017 was 49.2 while the score in 2013 was 50.8. The report suggests that the reasons behind such underperformance as well as a downfall in mathematics achievement demand a further investigation to get the root of the fact. Thus it can be argued that the students' perceptions may be one of the causes of the low achievement and there have not been any studies focusing on the students'

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perceptions towards mathematics at the primary and secondary school levels. In such a context, it is necessary to explore the condition of the low-performing students-perception towards mathematics in the Nepalese context. Therefore, the study was conducted to find out specifically the low-performing students' perception towards mathematics and examine the effects of student’s perception on their mathematics achievement.

Methods and Materials

Research Design

This study is based on a mixed-method survey research design (Creswell, 2014).This study is aimed at providing more comprehensive results of the research problem than either approach alone (Creswell, 2014). This design consists of both tools questionnaire and semi-structured interview to collect the data. The data collected from the questionnaires were analyzed by using descriptive statistics; while the data collected from interviews were analyzed by using thematic analysis. Thus the collected data from questionnaires and interviews were triangulated for the validity and trustworthiness of the results. This design was particularly used to explore the in-depth perceptions of the students towards mathematics and their effect on mathematics achievement.

Population and Sample

The target population for this study comprised low-performing students in mathematics from the community secondary school of Jhapa District, Province 1, Nepal. In this study, a multi-stage sampling technique was employed to select the sample. In the beginning, 10 secondary schools, five from the rural municipal area and the other five from the rural municipal area were selected randomly for the study. From each of the selected schools, 15-20 low-performing students in mathematics from each grade IX and grade X were listed for the study on the basis of their achievement score obtained in the preceding final examination of the concerned school. The low-performing students in mathematics were labelled by their obtained marks in mathematics in descending order and then the priority was given to the failed students in mathematics. Thus, altogether 312 low-performing students in mathematics were selected from each of the selected schools with the consent of the school administration and the students themselves as the sample for the study. Among them, 193 were girls and the remaining 119 were boys. In the same way, one student from each selected 10 schools was chosen for the semi-structured interview purposively. Five students were selected from the list of low-performing students and other

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remaining five students were selected high performing students in the preceding grade taken by the respective school.

Instrumentation

In this study, the questionnaire related to students' perception of mathematics was used to collect the quantitative data. Similarly, the semi-structured interview guideline was used to collect the qualitative data. In order to gather the information regarding students' perception towards mathematics, an instrument 'Perception towards Mathematics Inventory (PTMI) was developed. It was adapted from two already tested different questionnaires related to student perception towards mathematics. The PTMI was formed by using the five different categories of variables related to perception towards mathematics. The inventory consists of the category of motivation, self-confidence, value, interest, and anxiety. Three categories namely, motivation in mathematics, self-confidence in learning mathematics and value of mathematics were developed by selecting and modifying items chosen from the scale Attitude Towards Mathematics Inventory (ATMI), developed by Tapia and Marsh, (2000). Likewise, two of the categories, interest, and anxiety in mathematics were developed by selecting and modifying items developed by Uwineza et al. (2018). The PTMI included 5 categories of variables each containing 5 items, thus a total of 25 items all relating to students' perceptions towards mathematics. The inventory was a 5 point Likert-type response score ranging from strongly agree (5), agree (4), uncertain (3), disagree (2), and strongly disagree for positive statement, and response scores for the negative statement were just in reverse order.

The inventory was translated into Nepali to achieve more accurate and context-specific results. In the process of translation and modification of the draft of the inventory, university mathematics education researchers and experienced secondary level mathematics teachers were requested and some changes and modifications were made. The test of Cronbach Alpha was used to determine the reliability of the inventory. The maximum score of this inventory was 125 points. The reliability of the instrument was calculated by conducting the inventory among the students of Province No. 1 of Nepal and was found to be 0.84 in total. As stated by Taber (2018), α value or the reliability coefficient with a value of 0.70 can be considered as a sufficient measure of reliability or internal consistency of an instrument. This indicates that the inventory could be used without any doubt to investigate the student's perception of mathematics. Table 1 indicates the reliability of the perception categorically and in total.

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Table 1

Internal Consistency of the Perception Category

S.N.	Perception Category	No. of Items	α- Value
01	Self-Confidence	5	0.84
02	Motivation	5	0.83
03	Value	5	0.86
04	Interest	5	0.84
05	Anxiety	5	0.84
	Total	25	0.84

Data Collection Procedures

The data were collected from the selected students from the respective schools using the instrument PTMI and semi-structured interviews. In this process, the investigator himself has visited the sampled schools, and the students' perceptions towards mathematics were explored through the inventory and interview. While collecting the data, ethical consideration was maintained and verbal consent to the school authority, participants, and respondents was taken. In this course, the purpose of the survey and interview was also informed precisely.

Results and Discussion

Results of the Students Perception towards Mathematics

The inventory was administered to the students with the help of their class teachers in each selected school. Descriptive statistics were used to determine the frequency and mean scores of the data collected by using the inventory. The results of this study gathered from the quantitative method using the instrument PTMI were analyzed by comparing the mean scores with the help of the level of interpretation given in Table 2. It shows the interpretation level of the mean scores of the students' perception towards mathematics adapted from Andamon and Tan (2018). The perception level was used to interpret the result of the low-performing students' perception of mathematics.

Table 2

Students Perception Mean Scores Interpretation Level

Range of Mean Score	Level of Student Perception
1.00-1.49	Very Poor
1.50-2.49	Poor
2.50-3.49	Average
3.50-4.49	Good
4.50-500	Excellent

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The students’ perception towards mathematics was determined on the basis of the 25 self-evaluative statements concerning the different five categories of students' perception towards mathematics. Table 3 presents the result of the low-performing students' responses collected through the inventory.

Table3: *Students' Perceptions towards Mathematics*

S. N	Items	Mean	Std. Deviation
	Self-confident		
01	I am confident that I could learn advanced mathematics.	2.47	1.12
02	I would like to avoid using mathematics in college.	2.32	1.16
03	I am willing to take more than the required amount of mathematics.	2.46	1.56
04	I can do mathematics self-study alone.	2.13	1.32
05	I am confident that I can acquire the skills and concepts taught in mathematics.	2.56	1.34
	Motivation		
06	I have usually enjoyed studying mathematics in school.	2.18	1.14
07	I would prefer doing math assignments to other subjects.	2.15	1.42
08	I feel comfortable answering questions in math class.	2.14	1.67
09	Learning mathematics will help me develop creative/critical thinking.	3.16	1.17
10	I like to do better in mathematics tests than other students.	2.45	1.87
	Value		
11	Mathematics is a very worthwhile and necessary subject.	4.32	1.23
12	Mathematics is important in everyday life.	4.41	1.24
13	Mathematics is one of the most important subjects for people.	4.12	1.12
14	Mathematical knowledge can help study each subject.	4.23	1.16
15	I believe that mathematics helps develop the creativity of the learner.	4.14	1.24

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	Interest		
16	I enjoy explaining mathematics to others.	2.46	1.41
17	I think learning mathematics will help in daily life activities.	3.12	1.48
18	I like to solve mathematics more than other subjects.	2.48	1.34
19	I do not feel lazy while doing maths.	2.34	1.45
20	I do not leave my math class.	3.18	1.23
	Anxiety		
21	I do not think about the usefulness of math that I learn.	2.22	1.36
22	I am worried that I will not be able to understand maths concepts.	2.41	1.23
23	I feel stressed while listening to math teachers in class.	2.65	1.56
24	Mathematics learning will not facilitate me to get a good job.	2.24	1.43
25	I don’t get nervous when I face challenges while working on math activities.	2.01	1.24

As presented in Table 3, the mean scores of the students' perception on each statement as well as the different five categories of the low-performing students' towards mathematics have been compared to the mean score interpretation in Table 2. The mean scores of the low performing students on five different aspects of perception such as self-confident (2.38), motivation (2.41), value (4.24), interest (2.71), and anxiety (2.30) shows that all aspects of the students' perception except value lie below the good level of student perception (3.50-4.49). The mean score, the aspects of the perception-value (4.24) only lies on the good level of student perception (3.50-4.49). The average score of all aspects of perception (2.40) shows that the low-performing student's perception towards mathematics lies in the poor level of perception (1.50-2.49). The responses of the students on self-confidence, motivation, interest, and anxiety were found low perception or negative perception towards mathematics however; the response of the students towards the aspect value about mathematics is found high or positive perception towards mathematics. It means that the responses of the low-performing students in mathematics indicated that they did not like or prefer mathematics. However, the student's responses also signify that the low-performing students are also aware of the value of mathematics.

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Results of Students Perception towards Mathematics and their Effects on Achievement

Students' perception towards mathematics and its effects on achievement was gathered through the semi-structured interview from the selected respondents. In this course, questions related to students' self-confidence, motivation, interest, and anxiety towards mathematics were asked to every five low-performing students and the other five high-performing students. The interview was conducted for about 5-10 minutes with each respondent and a recording of each interview was made. Thus, the responses given by both groups-higher performer and low performer students were transcribed and categorized according to the performance group. The summary of the responses given by both groups is given in Table 4.

Table 4: *Students Responses towards Mathematics*

High Performing Students Responses	Low Performing Students Responses
HS_1: I like to participate in math activities and asked questions when I get confused.	LS_1: I like more the subject related to literature and also engage more time in another subject than math.
HS_2: I am confident that I can do maths well and I like it much.	LS_2: Math is important but it is very difficult for me to pass.
HS_3: I prefer to do practice maths over another subject.	LS_3: I don't enjoy learning math. It always makes me confused.
HS_4: I can pass maths, however; it is a very difficult subject.	LS_4: I cannot remember and use the formula of math.
HS_5: Maths is difficult although it can be understood and performed better.	LS_5: I spent 90% of my study time on maths, however; It is difficult for me to get high marks.

From the above key summary of the responses of the respondents, it can be observed that there is a clear distinction between the responses of the high-performing students and low-performing students. The perception of high performing students toward mathematics is found more positive and the low performing students found negative towards mathematics. Thus, it can be concluded that the students, who perceive mathematics as a difficult subject or negative, were found to a low achievers in mathematics. Likewise, the students who have a positive perception of mathematics are also found as higher achievers in mathematics.

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Hence, seeing the results from both qualitative and quantitative methods, low-performing students did not prefer mathematics, or the students who prefer mathematics were found from the group of higher achievers in mathematics. Thus, the students' perceptions towards mathematics have greater effects on their achievement. In this study, most of the low-performing students are found to have perceived mathematics as a difficult subject however, the majority of the students were found aware of the value of mathematics. The higher achiever students were found positive towards mathematics and found more confident and less anxious. This result supports the result of Wasike et al. (2013) that students' perception towards mathematics was positively related to the student's achievement in mathematics. However, this result is contradicted with the results of Matudi (2014); Hagan et al. (2020) that students' perception of mathematics has no influence or effect on their academic performance. The low-performing students were found to have a negative perception of mathematics. This indicates that they do not prefer mathematics in comparison to other subjects. The result also supports the findings of Hagan et al. (2020).

Conclusions

The study mainly focuses on the low-performing students' perception of mathematics at secondary level schools of Nepal. On top of this background, the study has also pinpointed the perception of higher achiever students towards mathematics through a qualitative approach. In this context, it can be concluded the negative perception towards mathematics is more responsible for the low achievement in mathematics rather than being the subject itself as the difficult one. It is because the higher achiever students were found enthusiastic to learn mathematics and they also accept mathematics as usual and interesting as the other subjects. But the low achiever students viewed mathematics as a difficult subject. Thus, some of the attributing factors like learners' previous learning experiences, misconceptions as a difficult subject, and fear of failure in mathematics may cause them to have a negative perception towards mathematics. Thus, it is necessary to implement the student-centered teaching approach to facilitate student ownership through their active involvement and flexible assessment techniques. Similarly, from the result of this study, mathematics learners can be categorized into two groups as passive and struggling students. The passive students who have already full of negative perception towards mathematics need to provide support, relaxed and encouraged environment to learn mathematics. Similarly, the struggling students who still learn mathematics also need support to engage with different teaching approaches, materials and learning activities.

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Therefore, the results of the study may be helpful for the teacher as well as the learners. It can help the learner to make more positive and confident towards learning mathematics through providing a more supportive, relaxed, and joyful classroom learning environment. Similarly, it also helps to make aware the teacher promotes support and encouragement to the learner.

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Conflicting of Interests

The author declares no conflicts of interest with respect to the research, authorship and/or publication of this article.

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