



Perceptions of Pre-service Teachers toward Teaching and Learning Mathematics in Bhutan

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Authors' contributions

This study was carried out in collaboration between both the authors. Author KD has participated in each stage of the study, design of the study, data collection, analysis and interpretation of the results, where author KW have participated in data collection and reviewing the paper. Both authors have read and approved the final manuscript.

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Abstract

This study was carried out to investigate the perceptions of teaching and learning Mathematics by the pre-service Mathematics teachers in Bhutan. The research has employed quantitative methods. A five-point Likert scale survey questionnaire was administered to collect the data. The participants included both male and female pre-service Mathematics teachers from 2 colleges of education in Bhutan aged 18-29 (N = 261). In order to examine the perceptions of Mathematics, the mean interpretation developed by Roble and Bacabac (2016) was used and found that perceptions of pre-service teachers teaching and learning Mathematics were high indicating they enjoy teaching and learning Mathematics. The analysis also showed that there was no significant difference between male and female pre-service teachers perceptions toward teaching and learning Mathematics in Bhutan. Further, the findings also indicated there was no significant difference in perceptions of teaching and learning Mathematics between pre-service teachers at College A and College B. The College of Education might consider devoting additional attention to improving teaching practices in order to experience the real classroom scenario.

Keywords: Mathematics; perceptions; pre-service teachers; colleges of education.

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ABBREVIATIONS

<i>APA</i>	: <i>Annual Performance Agreement</i>
<i>B.Ed.</i>	: <i>Bachelor of Education</i>
<i>BCSEA</i>	: <i>Bhutan Council for School Examinations and Assessment</i>
<i>MoE</i>	: <i>Ministry of Education</i>
<i>NCTM</i>	: <i>National Council of Teachers of Mathematics</i>
<i>NEA</i>	: <i>National Education Assessment</i>
<i>OCED</i>	: <i>Organization for Economic Co-operation and Development</i>
<i>PCE</i>	: <i>Paro College of Education</i>
<i>PISA</i>	: <i>D – PISA for Development</i>
<i>PISA</i>	: <i>Program for International Student Assessment</i>
<i>REC</i>	: <i>Royal Educational Council</i>
<i>RUB</i>	: <i>Royal University of Bhutan</i>
<i>SCE</i>	: <i>Samtse College of Education</i>
<i>SPSS</i>	: <i>Statistical Package for Social Sciences</i>

1 Introduction

The success in Mathematics is influenced by several factors and some of them are pre-service training, medium of instruction, school system, student's family background, student's attitudes and perception towards Mathematics. Kabeera [1] remarks that preception towards Mathematics is important in effective teaching and learning of the students.

Mathematics has become a leading subject in Ministry of education throughout the world. Golding [2] added that today the world considered Mathematics as an engine for the development of science subjects. For this reason, many of institutions in the world encourage the students to study Mathematics from basic to tertiary education. On that note therefore, Bhutan is not too far from this scenario. In recent times Ministry of education (MoE) collaboration with Royal Education Council (REC) has made Mathematics as compulsory subject to promote next level.

In addition, Bhutan joined the International Student Assessment for Development Program (PISA-D) in 2018 to measure the worldwide standard of Science, Literacy, and Mathematics education [3]. One factor that adds to the effective learning of the students is teachers in the field. However, to become a professional teacher, one needs to be well trained. Therefore, in order to have competent Mathematics teachers in the field, pre-service teachers need to have solid Mathematics knowledge in terms of content as well as pedagogy [4].

There are two colleges of education, namely Paro college of education (PCE) and Samtse college of education (SCE) trains the teachers in Bhutan. PCE provides undergraduate and postgraduate programs in a range of educational development areas [5]. Similarly, SCE currently offers Masters, postgraduate, bachelors in primary and secondary education [6].

Undergraduate (Bachelor in Education [B.Ed.]) programs prepare students for bachelor's degrees in a diverse range of subject areas. Teacher training programs in Bhutan do not differ with respect to experience and pedagogy at two educational institutions. However, because of the nature of the subject, the content can differ. Pre-service teachers study the theories of teaching and learning in the college, and then bring those theories into practice in the actual classroom interactions in the field. Therefore, pre-service teachers must strive to be well versed with various teaching pedagogies to align with the delivery of the concepts in the schools.

The selection of pre-service teachers is based on the criteria set by the Royal University of Bhutan [5]. According to Bhutan Council for School Examinations and Assessment [7], the Ministry of Education (MoE) has taken several initiatives in collaboration with the Royal Education Council (REC) to enhance the quality of Mathematics teaching and learning. Further, MoE and REC has taken different steps to connect the students' learning outcomes to real life application [8].

1.1 Problem statement

According to Bhutan's National Education Assessment (NEA), the mean score for class X Mathematics was 38.97 [8] and the lowest score was reported during the NEA survey conducted in 2013 with the mean score of 38.03 percent. Further, an analysis report of PISA-D study shows that the performance of Bhutanese students in Mathematics is slightly lower than that of the Organization for Economic Co-operation and Development (OECD) with an aggregate mean mark score of 38.84%. In addition, the annual pupil performance report indicates that the performance of Mathematics of Class X students failed to achieve the target, 60% of the national Annual Performance Agreement (APA) as evident from Table 1.

Table 1. Mean marks of class X (BCSEA)

Sl#	Year	Mean marks
1	2013	53.31
2	2014	55.79
3	2015	51.21
4	2017	54.75
5	2018	50.75
6	2019	57.82
7	2020	52.66

There may be various factors that lead to the low achievement of the Bhutanese students in Mathematics, among which, the adequate training for pre-service teachers is found to be one factor [5]. Similarly, [6] pointed out that one of the potential ways to improve the success of learners in Mathematics is to train the teachers with Mathematical content, skills and strategies. Further, it is stated that pre-service teachers must thoroughly understand the Mathematics they will teach and be able to use the knowledge gained in their teaching [7]. Therefore, the present study is intended to investigate the self-perceptions of pre-service teachers as they are preparing for the first time to teach mathematics and to explore how pre-service teachers' understand and perceive their readiness to undertake the teaching role.

2 Literature Review

2.1 Perceptions of Preservice Teachers on Teaching and Learning Mathematics

According to OECD [12], the report found there was a strong positive correlation between self-concept in mathematics and self-efficacy in Mathematics, which helps to find out the perceptions. In fact, results indicate the high levels of performance due to confidence will lead to high perceptions. In addition, the report in PISA Mathematics Teaching and Learning Strategies in PISA also has found out that the students with high levels of anxiety in learning Mathematics has led to a low performance.

Perception is a collection of the subconscious cognitive function layer of the brain's internal sensational cognitive processes that detect, relate, interpret, and search in the mind for internal cognitive information [13]. Further, [14] defined perception as the world's sensory experience around an individual and in response to these stimuli involves both the recognition of environmental stimuli and actions. In addition, [15] added perception has a huge effect on how people communicate or how they understand the communication of others. Hence, understanding the perception of the word would encourage the person to recognize the possible misunderstandings that can arise and help communicate more effectively. The perception was critical because it influences the information that enters working memory.

Mathematics is a topic that generates strong views and beliefs on the meaning of information, how it is learned, and how it should be taught. The primary source of assumptions about Mathematics for many pre-service teachers is based on how Mathematics is learned and taught from their own experience as students [16]. Therefore, to have a successful facilitation of teaching and learning the discipline, perceptions of Mathematics are very necessary. For instance, in one of the journals of education, [17] revealed that this principle either positively or negatively affects the teaching of Mathematics across the education system as well as the attitudes

of students towards learning Mathematics in school. Moreover, such views or assumptions about Mathematics have an effect on the sense of self-efficacy of pre-service teachers to become a competent teacher.

The college of Education is essential in pre-service teacher’s professional preparation and formation as qualified Mathematics educators [18]. Boyd et al. [19] reported that pre-service mathematics teachers require training in mathematical content, mathematics pedagogy, and adequate practicum experiences. In addition, [19] found the teacher training institute has lack of understanding how to prepare pre-service teachers in better way. For instance, Bjerke et al. [16] reported pre-service teachers teaches the students the way they were taught by the mentors during the trainee.

In addition, the background knowledge in the form of schemas affects perception and subsequent learning. This is consistent with the view of researchers [20], where the students’ perception on a subject depends on the teachers’ knowledge and teaching skills. In addition, the study conducted by Lucas and Fugit [21] found out that a positive attitude opens the door for children to do well in Mathematics. Therefore, the perceptions on Mathematics influence the performance of the students.

3 Methods

Since the study was intended to find out the level of Perceptions on teaching and learning Mathematics by the pre-service teachers in Bhutanese from 2 colleges of Education, the study was carried out using the quantitative method. In this method, a survey was used to gather data by asking relevant questions to the participants. In the survey, a questionnaires were developed and circulated to the participants where they have shared their thought. The survey questionnaire with three sections were administered. In the first section, the demographic information of participants was included. In the second section, the five-point Likert scale was used to collected the data about the perceptions of preservice teachers’ degree of agreement and disagreement.

3.1 Research site and participants

This research was conducted at Samtse College of Education and Paro College of Education. The research site was selected because no other colleges in Bhutan train pre-service teachers. The study involved a total of 261 pre-service teachers comprising 147 males and 114 females.

3.2 Data collection tools

The study adopted the 9th-item Mathematics Beliefs Questionnaire (MBQ) developed by (16). Mean values were interpreted as evident from the Table 2.

Table 2. Mean interpretation table

Mean score	Level
1.00 – 1.80	Very Low
1.81 – 2.60	Low
2.61 – 3.20	Medium
3.21 – 4.20	High
4.21 – 5.00	Very High

Mathematics Beliefs Questionnaire (MBQ) interpretation was adapted from the study done by [16]. Since the study had adopted a 5-point Likert-type scale where 1 refers to “strongly disagree” and 5 refers to “strongly agree”. Therefore, there are 5 classes with an interval of 0.8 to interpret the perceptions on teaching and learning Mathematics.

3.3 Validity and reliability of instrument

The validity of the questionnaire was assured because most of the items of the questionnaire were adapted and modified from previous research studies; Mathematics Beliefs Questionnaire (MBQ) conducted by [16].

Moreover, the reliability of the test was assured from the pilot study with 12 pre-service teachers with the Cronbach alpha value 0.92.

3.4 Data Analysis

The survey questionnaire completed by the participants was documented. The data were punched in the statistical package for social sciences (SPSS) and analyzed using appropriate descriptive and inferential statistics. From Descriptive Statistics, means and standard deviations were calculated to find the perceptions on teaching and learning Mathematics by pre-service teachers. In addition, from Inferential Statistics, independent sample t-test was used to compare the perceptions between genders and colleges.

4 Results

The mean score on the perception towards Mathematics was compared as per the interpretation in Table 2. The mean scores were above 3.21 – 4.20 which indicates a high level of perceptions towards teaching and learning Mathematics by Mathematics pre-service teachers as evident from a Table 3.

Table 3. Mean and standard deviation

	Mean	Standard Deviation
Perception of pre-service teachers toward Mathematics (PM)	3.49	0.50

4.1 Perceptions on mathematics

The data collected from the survey were analysed to determine pre-service teacher's perceptions toward teaching and learning Mathematics. Table 4 shows that the pre-service teachers from both the colleges rated all nine items related to their perceptions towards teaching and learning Mathematics (PM) at high level (M= 3.49, SD = 0.50), indicating the pre-service teachers see the Mathematic subject as easy and enjoy the learning in the college.

Table 4. Perceptions on Mathematics

PM	Disagree		Neutral		Agree		Mean	SD
	F	%	F	%	F	%		
Mathematics is primarily an abstract subject	55	21.1	35	13.4	171	65.5	3.52	1.17
Mathematics play vital role in day to day life	13	5.0	16	6.1	232	88.9	4.29	0.9
When confronted with a difficult math concept, I generally worked until I understood the concept	19	7.3	43	16.5	199	76.2	3.86	0.91
My knowledge of numbers and operations is sufficient to teach the subject	26	9.9	64	24.5	171	65.5	3.73	0.97
Mathematics is mainly about having a good memory	80	30.5	64	24.5	117	44.8	3.19	1.2
Getting the right answer is more important than understanding why the answer works	174	66.4	42	16.1	45	17.2	2.23	1.17
My only interest in math is getting a passing score.	164	62.6	35	13.4	62	23.8	2.36	1.19
I give my best effort in Mathematics assignments	4	1.5	21	8	236	90.4	4.16	0.66
I always come to class with finished homework	13	5.0	38	14.6	210	80.5	4	0.77
Average							3.49	0.5

Note: F – frequency (number of participants), % - percentage

From Table 4, 90.5% of participants agreed with the item 'that they give their best effort in completing Mathematics assignments'. However, 17.2% of participants agreed with the item 'getting the right answer is more important than understanding why the answer works'. In addition, 88.9% of participants agreed Mathematics plays vital role in day to day life. Further 80.5% of participants always come to class with finished homework. Furthermore, 76.2% of participants shared they learnt till they understand the concepts well.

However, few participants agreed Mathematics is mainly about having a good memory and interest of Math is to get passing score. Therefore, pre-service teachers viewed Mathematics is easy and enjoyable subject.

4.2 Over all perceptions towards mathematics based on genders

An independent sample t-test was conducted to compare the male and female pre-service teacher’s perception towards teaching and learning Mathematics based on derived themes. Table 5 shows the results and Table 6 shows the descriptive statistics. There was no significant difference in the perceptions towards teaching and learning Mathematics between genders, $t(259) = -.19, p > .05$.

Table 5. The mean and standard deviation

Gender		Mean	Std. Deviation
Perception of pre-service teachers toward Mathematics (PM)	Male	3.48	.53
	Female	3.49	.46

Table 6. Independent samples t-test

Independent Samples Test		Levene's Test for Equality of Variances		t	Df	Sig. (2-tailed)	95% Confidence Interval of the Difference	
		F	Sig.				Lower	Upper
Perceptions on Mathematics	Equal variances assumed	1.72	.19	-.19	259	.85	-.14	.11
	Equal variances not assumed			-.19	256.45	.85	-.13	.11

4.3 Overall perception towards mathematics based on colleges

An independent sample t-test was conducted to compare the differences in variance to find out the perceptions towards Mathematics based on colleges. Table 7 shows descriptive statistics and Table 8 shows an analysis of variance between the groups. There was a statistically significant difference between the groups: An independent samples t-test was conducted to compare pre-service teacher’s perceptions towards teaching and learning Mathematics from college A and college B. There was no significant difference in the perceptions towards learning Mathematics between the colleges, $t(259) = -.32, p > .05$.

Table 7. The Mean and Standard Deviation

College		N	Mean	Std. Deviation
Perceptions on Mathematics	College A	101	3.47	.44
	College B	160	3.49	.54

5 Discussion

5.1 Perceptions towards Mathematics by pre-service teachers

Perception can be also defined as the process of attaining awareness or understanding of sensory information in philosophy, psychology, and cognitive science [22]. The perceptions towards teaching and learning

Mathematics by Mathematics pre-service teachers were explored through a survey with 261 pre-service teachers from two Educational Colleges in Bhutan.

Table 8. Independent Samples t-test

Independent Samples Test		Levene's Test for Equality of Variances		T	df	Sig. (2-tailed)	95% Confidence Interval of the Difference	
		F	Sig.				Lower	Upper
Perceptions on Mathematics	Equal variances assumed	7.23	.008	-.32	259	.749	-.15	.11
	Equal variances not assumed			-.34	241.8	.738	-.14	.10

This study revealed that the perceptions towards teaching and learning Mathematics among pre-service teachers in Bhutan were high. This was because pre-service teachers were conceptually grounded, familiar with curriculum, featured with different pedagogy and values of teaching. Additionally, it is found that pre-service teachers work very hard till they understand the concept to yield better results in Mathematics. This finding is supported by the study conducted by [23] on 'Investigate belief of pre-service Mathematics teachers' as they begin their teacher training' which also reported the high perceptions towards Mathematics. This is attributed to the motivation by tutors, timely completion of numerous exercises, and being attentive at all times.

The other finding of the study revealed that there is no significant difference in the way Mathematics is perceived between male and females. This could be because all the pre-service teachers were trained using the same pedagogies, learning environment, facilities and opportunities. This finding is parallel to the findings of [24] where they reported that there is no significant difference between male and female participants. The pre-service teachers were given equal opportunities irrespective of the genders. On the contrary, [25] affirmed the gender differences in terms of perceptions of Mathematics in their study on 'Gender differences in Mathematics in terms of perceptions for preservice teachers'. The study found that the pre-service teachers construct a different filter that regulates thinking and actions in Mathematics-related situations. For instance, it is found that the male pre-service teachers participate in group work more than the female, females are less involved in classroom activities and females are found less attentive compared to male pre-service teachers.

From the independent sample t-test, there was no significant difference found between the two colleges. This could be probably due to the colleges sharing the same goal and vision, implementing the same curriculum framework, and incorporating the same teaching skills and strategies. The finding is supported by the finding from a study on "Pre-service teachers' perception of their Mathematics classroom in Ghanaian colleges of education" by [26] who reported that there is no significant difference between the colleges in terms of perceptions on Mathematics which is attributed to the similar reasons found in this study. On the other hand, a study on "factors affecting pre-service Mathematics perceptions in Colleges of education in southwest Nigeria" by [27] reported the presence of difference in terms of perceptions on Mathematics. It was because of the difference in the inputs from the tutors in the classroom, effectiveness in the use of instructional materials and availability of resources in respective colleges.

6 Limitations

First, it is important to emphasize that the results and the conclusions cannot be generalized because of the sample and sampling design limitations. The different perceptions by pre-service Mathematics teachers, which includes primary, Maths, and IT and secondary pre-service teachers and a broader range of disciplines (first year, second year, and final year).

Second, while an emphasis was made to help pre-service teachers feel comfortable reporting their true feelings, it is possible that some students did not feel free to respond candidly.

Third, the duration for the collection of data was short as it coincided with lots of government holidays.

7 Scope of Future Research

The need for additional studies that investigate pre-service teachers' perceptions and attitudes of contextualized mathematics and its impact on their mathematics content knowledge. Secondly, the need for knowledge on how to integrate technology in Mathematics curriculum, which is a natural next step in this area that could strongly impact both teacher and student outcomes. Thirdly, to examine the pre-service teacher's actual practices, this may lead to the betterment and advancement of the teaching of Mathematics.

8 Conclusion

This study revealed that the pre-service teachers have high perceptions towards teaching and learning Mathematics, meaning the pre-service teachers have positive perceptions towards the training they receive and learning that takes place at college. The Ministry of Education may benefit in initiating engaging; teaching and learning activities for the pre-service teachers. In addition, the Royal Education Council (REC) may get insight to collaborate with colleges of education to align the curriculum of real classroom teaching to the pre-service teachers in order to experience the real classroom scenario.

Consent and Ethical Approval

The researchers have well-taken care of the ethical issue in this study. Written approval to conduct the study in respective colleges was obtained from the concerned authority before data collection. Moreover, consent letters were duly signed by all the participants before attending the survey questionnaire.

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Competing Interests

Authors have declared that no competing interests exist.

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