Investigating Student Teachers' Contemporary Mathematics Practices of Engagement (Try This) as they Begin their Lessons

Phuntsho Dolma
Paro College of Education, Bhutan

Jurme Thinley
Paro College of Education, Bhutan

Abstract

This study explores the extent to which pre-service teachers are able to implement contemporary practices in teaching mathematics during their practicum. The main focus of the study is on the importance of prior engagement of students in learning mathematical concepts. The total population of 150 student teachers from both the Colleges of Education, Paro College of Education (PCE) and Samtse College of Education (SCE), was targeted for this study. However, only 60 participants could actually return the questionnaires. A mixed-method comprising of both quantitative and qualitive methodologies was used. Research tools such as survey questionnaires (quantitative) along with a few open-ended questions, followed by lesson plans and interviews (qualitative) were used to collect the data. The findings from this study tend to reveal that although the student teachers are in favour of the contemporary ideas/approach of teaching and learning of mathematics, they do not seem to have practiced it while they were in a teaching practicum. The findings cast doubt on whether preservice teachers are able to drive changes for improvement in the teaching and learning of mathematics in mathematics classrooms. The benefit of this study was expected to be very relevant not only for the authorities to consider the effectiveness of the contemporary practices of teaching and learning of mathematics education in those two colleges of education, but also in Bhutanese schools using the current mathematics curriculum.

Keywords: contemporary practices in teaching mathematics, student engagement, social constructivism

Introduction

This study investigates the knowledge pre-service students have about utilizing students' prior knowledge through a social constructivist's lens and whether those pre-service teachers actually apply that knowledge in their planning and in their teaching. The activation of student prior knowledge can be done in a simple beginning activity known as "Try This" where students actively think, write, talk and/or problem solve mathematical concepts that scaffold to new concepts being taught. The main purpose of this activity is to explore how much students already know about the topic to be taught during a particular allocated lesson. In this sense, the teacher is supposed to facilitate students' learning according to how much they already know and where they need to know more.

Given the importance of engaging students prior to the actual introduction of the lesson topic, this study intends to investigate whether teachers use this strategy. This strategy is related to the teaching and learning of mathematics under the umbrella of a social constructivist approach. Further, this practice seemed to be strongly aligned with the intention of the current Bhutanese mathematics curriculum where learners are expected to explore their prior knowledge to new information from the teacher. Owing to all these reasons, this study intends to investigate whether student teachers, from the only two colleges of education in the country, implement a contemporary practice in teaching and learning of mathematics.

The main purpose of this study explores whether student teachers have high-quality experiences that allow learners to explore the knowledge of the mathematical concepts prior to the teacher's informational input. Moreover, such exploration mechanisms are considered as one of the best core approaches in the 21st-century classroom teaching (Hattie & Yates, 2014). However, based on some of the findings in past studies (Dolma, 2016; 2017), the majority of the Bhutanese schoolteachers teaching the current Bhutanese mathematics curriculum seem to have failed to use the "Try This' preassessment approach. The consequences of this gap were also observed with some of the in-take student teachers in the college. Some of the student teachers attending between 2017 – 2020 did not seem to have any idea of themselves participating in a similarly related learning activity prior to the introduction of the allocated topic during their school days and were quoted "Madam, during my school days, we were provided both questions and solutions on the board and we just copy the answers from the board" (Interviewee A). This experience is seen as a huge concern in the world of teaching and learning of mathematics in the Bhutanese schools, despite maintaining ideas suggested in the current mathematics curriculum, which had been introduced in 2008.

The current mathematics curriculum has included a set of very promising intentions in terms of helping learners learn mathematics meaningfully. However, until now, there seems to be hardly any substantial improvement taking place as intended when asking pre-service teachers about their practices now in comparison to their past mathematics curriculum. There could be so many reasons to explore for this not happening and this study was intended to investigate one of them. In particular, this study

was intended to examine the impact of student teachers in understanding the importance of engaging learners in exploring the mathematical concepts prior to the teacher's information input. Therefore, this study was aimed to investigate whether student teachers are aware and could implement contemporary practices in teaching mathematics such as the use of 'Try This' activity at the beginning of a lesson during their teaching practicum.

To start small, we decided to investigate with the final student teachers of the year (2020) in both the colleges of education (Paro College of Education (PCE) and Samtse College of Education (SCE)) under Royal University of Bhutan (RUB). The main reason being that this batch of student teachers have not only been in the schools teaching the subject during their teaching practicum, but it is also very close to the time of their being in the schools as mathematics teachers. Side by side, this study also focused on investigating the beliefs and practices of student teachers about mathematics from the two only colleges of Education in Bhutan who are implementing the practical intentions advocated in the current existing mathematics curriculum.

Significance of the study

This study informs the overall programme of the colleges in terms of the effectiveness of teaching and learning of mathematics based on the social constructivist approach. The application of students' prior engagement with learning activities related to the taught concept is considered a positive tool for improving the teaching and learning of mathematics (Ministry of Education, 2013). The outcome of this study intends to determine the importance of teaching mathematics based on what students already know rather than spoon-feeding them blindly. Further, an intent is to have teachers value students' prior engagement, as part of teaching evaluations of the previously taught lessons and also their immediate learning experiences, to make the new knowledge they will learn comprehensible.

This study also intends to help create awareness among Bhutanese academics and the module tutors on how to plan and deliver the modules (mathematics). Consequently, teachers can contribute to the effective development of the mathematical teaching and learning programme at least in the two colleges of education in Bhutan. Finally, this study is significant as it is the first of its kind in the history of the Bhutanese education context.

Questions and Purpose of the Research

The purpose of this research is to determine if student teachers implement contemporary practices in mathematics such as the 'Try This' activity to prompt engagement of students with previously learned mathematical concepts. The questions that this research will address are as follows:

1. To what extent are students' concepts on nature of mathematics related to a social constructivist view or philosophy?
2. How are student teachers' concepts on teaching of mathematics related to a social constructivist view or philosophy?

3. How are student teachers' concepts on learning of mathematics related to a social constructivist view or philosophy?
4. How are student teachers' beliefs on the practice of the 'Try This' activity, at the beginning of a mathematics lesson, related to a social constructivist view?

Literature Review

This study intends to find out if the philosophy of social constructivism has a positive influence on effective teaching and learning of mathematics in this 21st Century. Allowing students to explore on their own by engaging both physically and mentally is considered to be effective in terms of the depth and meaningful learning of mathematics (Hattie & Yates, 2014). Social constructivism is expected to serve as a grounding base for thinking, and thinking is considered the basis for learning to take place. Teachers' informational input can fill in the gaps when it is missing in student work. This way, whatever students learn, it can 'sieve in like a medicine' rather than providing direct answers that have no meaning when learners do not know what they are looking for.

NCTM's influence

The philosophy of the National Council of Teachers of Mathematics (NCTM) is considered to be consistent with the constructivist view of learning mathematics, where learners are expected to construct their own knowledge based on their previous knowledge and experiences (Lefrancois, 1997). Further, contemporary mathematics education based on social constructivism is the standards and principles developed by the NCTM (2000; 1989). The NCTM standards, created by the world's largest mathematics education organization, has offered a vision for more effective teaching, learning, and assessment of mathematics (K – 12). As a result, an emergent body of research studies on mathematics education tends to support NCTM's position on school mathematics (Bosse, 2006; Fillingim, 2010).

Riordan and Noyce (2001) conducted a study on the impact of NCTM standards-based curriculum upon elementary and middle school student achievement in Massachusetts. These authors reported that standards-based mathematics programs produced a significantly better result than did more traditional programs. Along the same lines, the teachers in Alba's (2001) study, who had positive beliefs about NCTM standards, were found to express the highest confidence in their use of standards and this was reflected in their classroom instruction. The term standards-based often refers to reform-based curricula, which have philosophical alignment with the NCTM standards (Bay, Reys, & Reys, 1999).

Aligning with the philosophy of a social constructivist view of teaching and learning of mathematics, the idea of providing a learning activity prior to teacher's information input is strongly adopted as one of the NCTM (2000) principles, under the name of 'teaching'. Of all these six principles, this research tends to focus mainly on the type of 'teaching' to be practiced in the

classroom. According to NCTM (2000), 'teaching' is not providing readymade information to students but rather, teaching should be based on what students already know and then building upon that knowledge. Similarly, the current Bhutanese mathematics curriculum has also suggested a 'Try This' activity prior to the information input from the teacher, as the curriculum is strongly based on NCTM principles and process standards (2000). This curriculum is linked with the social constructivist views of teaching and learning of mathematics.

An instruction that is aligned with the philosophical underpinnings of the NCTM standards is more effective than previous traditional mathematical instruction (Alba, 2001; Fillingim, 2010; Perrin, 2008). For instance, Alba (2001) pointed out that several studies have been conducted with respect to NCTM standards, which found that classroom practices in the top-performing countries were aligned with the pedagogical practices advocated within the NCTM standards. With such findings in mind, pedagogical practices associated with the NCTM standards can have an impact on improving student performance in mathematics. Hence, as argued by Perrin (2008), making NCTM's vision of school mathematics a reality requires many classroom teachers to modify their current practices.

Engaging learners' prior knowledge

As discussed earlier, according to social constructivists, learning is found to be very effective and meaningful when students are engaged in doing something on their own rather than the teacher feeding them with ready-made information. According to the NCTM (2000), teaching is expected to begin from what students already know and then scaffold the information to what they need to learn and support them in their learning. This is further argued by Hattie and Yates (2014), who support that activating prior knowledge is important in students' understanding because it allows students to make connections to the new information. For this activation of previous knowledge, a teacher is expected to prepare a learning activity to be provided prior to the new information input on the allocated mathematical topic.

The system of prior knowledge engagement with learning activities also plays a critical role in terms of deep understanding and gaining conceptual mathematical knowledge. Aligning with this idea, Hattie & Yates, (2014) support that prior knowledge has long been considered to be the most important factor influencing learning and student achievement.

The amount and quality of prior knowledge are considered to be positively influenced by both knowledge acquisition and the capacity of students to apply higher-order cognitive problem-solving skills. Several researchers (e.g., Mathews, 2000 Panthi & Belbase, 2017) have considered the importance of letting learners explore on their own, based on their experience and knowledge, Providing opportunities for students to explore on their own is influential on the quality of the students' learning process (Alea, Alea, & Rahman, 2016). Therefore, such an approach is considered effective mainly in terms of learners' deep understanding of the concept in connection to their prior knowledge and immediate experience.

Similarly, as supported by Laffan (2004), student engagement is an important element in the teaching and learning process with the subject matter to be learned. This was also supported by the studies done by Sidney and Alibali (2018) where they asserted that engaging learners prior to the actual information input from the teacher is critical and core teaching activities aid learning. Activities can provide information to students that can enable them to identify what knowledge, skills, and competencies they can and need to demonstrate.

Moreover, as argued by Chen and Hoshower (2003), students' connection of the new knowledge to their prior knowledge ratings is reflected as a primary measure of teaching effectiveness. These authors considered this idea to be one of the most important mechanisms by which students could inform teachers about their existing knowledge and experiences in a mathematical concept to be introduced in the class. Similarly, Kelso (2010), proposed that when "educators have generally positive attitudes towards students' prior engagement with the concept to be taught, [those] educators have a belief that their students were capable of exploring their own learning independently" (p 85). Therefore, the existing knowledge and experiences provided by students, if used appropriately, can support and scaffold students' learning and lead to substantial learning gains in mathematics.

Enhancement in teaching mathematics

The consequences of the students' prior knowledge engagement are expected to have multiple impacts on both the learners and also the teachers. For instance, the outcome of the prior knowledge engagement from the students is expected to not only help in the improvement of a deep learning process but also enhance the teaching profession of the mathematics teachers. Students' prior knowledge engagement could help the mathematics teacher choose an appropriate approach, according to their students' expertise, to base their future mathematical lesson. A system of prior engagement with learning activities is considered an essential approach in the 21st-Century classroom teaching to bring changes in teaching-learning styles and the nature of assessment (Brennan & Williams, 2004). Thus, prior engagement is also about giving teachers the opportunity to teach in ways that encourage students to explore, reflect on it, learn from it, and then teachers hopefully make changes for the better quality of their teaching of mathematics to their students.

A teacher being able to design a learning activity which could serve as a prior engagement activity, can be considered an essential tool in preassessment for learning, which if used appropriately, can support and scaffold students' learning and lead to substantial learning gains (Hattie & Yates, 2014). Hence, such teaching tools can directly add motivation to work for those students who are learning mathematics.

Methodology

A mixed-method approach was used to collect the data for the execution of the study (knowing the importance of quantitative and qualitative analysis of the study). The research data were retrieved first through a survey questionnaire that included open-ended questions, which are followed by

interviews and lesson plans used during the student teaching practicum. The main purpose of adding open-ended questions was to triangulate the uniqueness of the responses given to the five-point Richter scale for short-type questions.

A simple random sampling approach was used for survey questionnaires, mainly from the final year student teachers who have completed their teaching practicum. The questions included in the survey were comprised of Richter scale-type short responses followed by an open-ended question, requiring narrative responses to triangulate with the way they respond to the earlier questions. The main reason for adding these open-ended questions was to cross-check the consistency and trustworthiness of the participants in answering the survey questionnaires. The reason for including lesson plans taught during their teaching practicum was mainly because of their position to practice knowledge gained as a school student and also student teachers in one of the two colleges of education.

Similarly, interviews were conducted to gain in depth insights into the understanding and experiences of student participants based on a social constructivist approach of teaching and learning of mathematics.

The data generated by survey questionnaires were analyzed and interpreted using statistical tools, mainly the descriptive statistics, supported by SPSS Software. Descriptive statistical (mainly percentage) for this study was intended and compared including gender and program types using SPSS software for the Richter scale-type response. Analysis was of qualitative open-ended questions included at the end of survey questionnaires and sample lesson plans collected using some form of content analysis such as color coding. Interviews with a group of students (approximately 8 with equal participation from male and female population) were selected from both the colleges of education. Interviews were guided by using semi-structured questions. The transcribed interviews were then analyzed using similar color coding.

Demographics

Of the 60 returned questionnaires, 38 respondents were female (63.3%) and 22 (36.7%) were male. The percentages represented the schools' population. There were 46 participants (78%) from the B.Ed primary Program and 13 from the B.Ed Secondary (maths) Program. The Paro College of Education had 57 of the participants (88.3%) while Samtse College of education only had 3 participants (11.7%). The reason for this being that compared to SCE, the total number of students are far more in PCE in terms of B.Ed primary level students.

Survey questionnaire

In this section, the discussion presented answers the main research questions designed and presented earlier 'To what extent do student teachers have opportunities to implement contemporary practices in teaching maths such as the use of 'Try This' activity?' This was the main question, which was further divided into the four sub-questions noted above.

Of the six items included under this section, the most prominent item, which is closer to the definition of the concept on constructivist views was '*mathematics is beautiful, creative, and useful*

human endeavour that is both a way of knowing and a way of thinking' (4th statement)(See Table 1). The highest percentage was found with 96.7% of the respondents who have supported either 'agreed' or 'strongly agreed', indicating their beliefs about mathematics as '*problem solving belief*'. More so, depicting that the majority of the participants are aware of the concept on nature of mathematics and its association with constructivist view of mathematics.

Table 1

Students' concept on nature of mathematics

Item	Rating	Frequency	Percent
Mathematics is beautiful, creative, and useful human endeavour that is both a way of knowing and a way of thinking'	Strongly disagree	0	0.0
	Disagree	0	0.0
	Not sure	2	3.3
	Agree	24	40.0
	Strongly agree	34	56.7
	Total	60	100

Table 2

Students' concept on teaching of mathematics

Item	Rating	Frequency	Percent
Children's development of mathematical ideas should provide the basis for sequencing topics for instructions	Strongly disagree	01	01.7
	Disagree	01	01.7
	Not sure	08	13.3
	Agree	39	65.0
	Strongly agree	11	18.3
	Total	60	100

How are student teachers' concepts on teaching of mathematics related to a social constructivist view or philosophy?

Of all the items under this section, the most prominent item in relation to the concept of teaching based on a constructivist view stated was '*children's development of mathematical ideas should provide the basis for sequencing topics for instructions'*. (See Table 2). The result indicates that about 83% of the respondents have supported the statement with either 'agreed' or 'strongly agreed' thus depicting their concept of teaching and their beliefs about mathematics in relation to the constructivist view of teaching and thus reacting positively towards this second research sub question.

How are student teachers' concepts on learning of mathematics related to a social constructivist view or philosophy?

The majority of the respondents have strongly supported the statement '*Mathematics learning is enhanced by activities, which build upon and respect students' prior knowledge and experiences'*. (See Table 3). About 88.4% of the participants responded either 'agree' or 'strongly agree' to the statement. This tends to indicate the views of the participants geared more towards the constructivist view in learning of mathematics and support positively the third research sub-question: '*How are student teachers' concepts on learning of mathematics related to a social constructivist view or philosophy?'*

Table 3

Student teachers' concept on learning of mathematics

Item	Scale	Frequency	Percent
Mathematics learning is enhanced by activities, which build upon and respect students' prior knowledge and experiences	Strongly disagree	01	1.7
	Disagree	00	0.0
	Not sure	06	10.0
	Agree	31	51.7
	Strongly agree	22	36.7
	Total	60	100

How are student teachers' beliefs on the practice of including the 'Try This' activity in the beginning of mathematics lesson?

About 88% of the respondents have either agreed or strongly agreed to the statement '*the idea of providing a learning activity at the beginning of every lesson is a very enriching idea for the*

students' (See Table 4). This result indicates participants' beliefs towards the concept of the 'Try This' activity and their support in engaging learners in the beginning of every mathematics lesson and answers positively to the last research sub question.

Table 4

Student teachers' beliefs on practice of including 'Try This' activity

Item	Richter Scale	Frequency	Percent
The idea of providing learning activity at the beginning of every lesson is a very enriching idea for the students'	Strongly disagree	0	0.0
	Disagree	2	3.0
	Not sure	5	8.3
	Agree	33	55.0
	Strongly agree	20	33.7
	Total	60	100.0

Designing of 'Try This' activity

The designing of the 'Try This' activity was included at the end of the survey questionnaire as an open-ended question for the participants to design one from the list of topics provided. This was done mainly to crosscheck whether their response to the survey questionnaire, particularly on the concept of 'Try This' activity matches with how they design the learning activity and if they are the same. However, of the 60 questionnaires returned, not all had attempted this, and from those who have attempted, the findings were not very clear on the idea of designing a 'Try This' activity. In this sense, not many could design an activity involving all the key features such as the provision of connection for the students to apply to their prior knowledge and experiences outside the classroom. Hence, this tends to indicate that although participants do have some idea about the concept of 'Try This' activity, most of them are not able to identify this activity from the normal lesson activity.

Lesson Plan

Around 40 lesson plans were collected using a simple random sampling technique from the final year students (2020). Lesson plans collected were all taught during the time of the participants' teaching practicum. Out of 40 lesson plans collected, there were hardly any indications of using the 'Try This' activity in the beginning of the lesson. At the most, only three out of 40 of the lesson plans indicated that too in the form of questions asked to re-capitulating previous lessons. Most of the participants had followed the traditional approach of introducing the lesson directly.

The majority of the respondents have strongly supported the statement '*Mathematics learning is enhanced by activities, which build upon and respect students' prior knowledge and experiences'*. About 88.4% of the participants have responded to either 'agree' or 'strongly agree' to the statement. This tends to indicate the views of the participants geared more towards the constructivist view in learning of mathematics and support positively to the third research sub-question: *How are student teachers' concepts on learning of mathematics related to a social constructivist view or philosophy?*

As indicated in many introductions of the lesson topics, most all were without having any warm-up exercise such as 'Try This' activity to set the tone of the lesson even though it is suggested in the existing Bhutanese mathematics curriculum and to find out the readiness of the students in learning the new lesson topic so that it can be focused on during the 'teaching' based on what students already know and need to know, an idea formulated as one of the six NCTM principles. As stated earlier, inclusion of the 'Try This' activity was based on NCTM Principles and Process Standards (NCTM, 2000), supported by the constructivist view of teaching and learning of mathematics.

Interview

As stated earlier, eight participants were interviewed from both the programs of final year student teachers (B.Ed Pry and B.Ed Secondary mathematics). The majority of the interviewees seemed to have some idea about the nature of mathematics and its teaching and learning approach associated with social constructivist views: teaching based on 'what students already know' and learning to be focused more on 'learning by doing'. For instance, when asked about the concept on nature of mathematics, one of the participants stated, "I don't take mathematics as just the subject, but consider it as the way to solve the problems that we face in our day-to-day life" (Interviewee E). Similarly, another participant as quoted was supporting the same idea "Mathematics is not only a subject, but it is one of the essential things in our life that we practice every day" (Interviewee G).

In the same line of thinking, regarding the concept on 'teaching' in mathematics classrooms, the majority of the interviewees seem to have supported the idea as a social constructivist view of teaching and learning of mathematics. For instance, one of the interviewees has expressed as quoted "teaching mathematics is not showing students how to solve the problems and perform calculation, but it is giving students a platform to think more and explore what is around them" (Interviewee A). Thereby the same participant has even committed herself stating, "I am also going to teach by making connection with the real-world activities and use their prior knowledge so that students understand". Similarly, one of the interviewees argued by stating, "I think it is not important to teach our students, but it is important to learn by themselves…it is important for us to provide them real hand-on experiences and let them explore by themselves, instead of lecturing for long time" (Interviewee C).

Likewise, in terms of 'learning' according to a constructivist view of teaching and learning of mathematics, the majority of the interviewees seemed to have positive opinions on this. For instance, they tend to claim that learning would be of high quality if students are given opportunity to do things on their own as quoted, "providing learning activity to make students understand more on the concepts

by letting students think on the ideas and letting them explore more on their own" (Interviewee A). The same idea was being supported by another interviewee, who had stated that "it is important for children to have an opportunity to work on and solve problems by themselves" (Interviewee B). The same interviewee has even claimed that this idea of learning tended to work in the real classroom situation as quoted "during my teaching practicum, I gave more opportunity to children to explore and gave more hands-on experiences and through giving real hand-on experience, I have observed that children are learning more than giving just lecture"

Having discussed findings regarding the concept on nature of mathematics and its teaching and learning based on constructivist views, the majority of the participants seemed to support the idea positively. However, in terms of the concept of the 'Try This' activity, the majority of them tend to lack a clear idea about the purpose of using it and consequently, not many seem to have practiced using it during their teaching practicum as quoted that "I used blocks and other to them but I did not use Try This activity" (Interviewee D) and also the same participant seemed not to have an exact idea of using this activity as she seemed to get mixed up with some other method as quoted "I have seen that, using this method, I can give and provide concepts before the real topic was introduced". Similarly, Interviewee B stated, "yes madam, ahh ….to collect the prior knowledge, but we hardly focused on that activity (Try This), Madam…I think that activity is important for the students to check their understanding on the particular content".

Also, there seemed to be some exceptional cases with a few interviewees who have a very clear idea on both the concept and its purposes as quoted, "I think this activity (Try This) will go in lesson introduction, before going to the topic, it is important to know the students' level and prior knowledge" (Interviewee A). Therefore, findings tend to generate mixed opinions on the concept but in terms of implementing the same idea in mathematics classrooms, hardly any tended to have practiced it.

The main reason could be that many of them were not aware of using it in the beginning of the lesson as suggested in the textbook as quoted by one of the interviewees that "I did not know that it is very important for us to give this 'Try This' activity at first while I was on teaching practice" (Interviewee A). Of the eight interviewees, two remaining ones had nothing much to say on this, which indicated a lack of the concept totally. Hence, it could be partly the fault of the college module tutors and also the senior mentors in the school for not educating them with the use of this activity (Try This).

Discussion

The main focus being on the triangulation of findings among those data collected. As described earlier, there seemed to be a strong connection triangulating findings on the concept about 'nature of mathematics', 'teaching' and 'learning' among findings from the survey questionnaire and interview. In both, participants had strongly supported those stated components based on a social constructivist view on 'nature of mathematics', 'teaching' and 'learning'. These findings indicate that the majority of the participants are aware of the theory related to those components about mathematics.

However, in terms of concept and implementation, particularly in the form of the 'Try This' activity, not many participants seemed to have a clear idea on this based on their lesson planning. This idea was strongly shown in the findings from those research tools such as the inclusion of 'Try This' activity in the beginning of lesson plans collected from those used during the teaching practicum. As discussed earlier, of 40 lesson plans collected, not many have included that activity in their plans, indicating the lack of awareness on that and its importance. Similarly, the same findings were observed from the open-ended question (questionnaire) on designing the 'Try This' activity on any of the mathematical concepts provided. There were hardly any activities, which could qualify to fit in with the concept of framing a 'Try This' activity.

This study revealed three major findings as listed below:

A gap between the theory and practice

As discussed earlier, the findings from the survey questionnaire and interview indicated that the majority of the participants could express their idea supporting the social constructivist idea on the nature of mathematics and its teaching and learning of mathematics. However, in terms of practice and implementing it, there seemed to be a gap in it as shown in the data collected from the designing of the learning activity (Try This) in the open-ended question and the taught lesson plans collected from the participants. In those data, there were hardly any indications of clear understanding of it shown in the form of design and its inclusion in the lesson plan. Such findings illustrated that the participants were neither aware of the concept nor its importance in terms of implementing it.

Not only this, the inability to design and implement the 'Try This' activity indicated that the participants were also not very clear of the concept 'teaching' and 'learning' in terms of practice. This was because the purpose of the 'Try This' activity is to find out what students already know and need to know in order to practice the concept of teaching as per the social constructivist view. Moreover, not including such activity in the lesson plan indicates that the concept of learning in the form of an activity so that students can boost their understanding through 'learning by doing' had been missed.

Lack implementation

As discussed earlier, although the majority of the participants seemed to have some idea about the concept of the 'Try This' activity as stated in the responses towards the survey questionnaire, not many of them have tried to include it in their lesson plans collected. Moreover, there were hardly any participants who could design an activity of that nature when given the opportunity as an open-ended question under the survey questionnaire. Therefore, the findings tend to indicate that the majority of the participants are not very clear about it let alone able to implement it in the classroom.

Participants' gap between beliefs and practices

There seemed to be a bit of a gap between participants' beliefs about mathematics and their practice seen in those data collected from questionnaires, designing of learning activities and lesson plans, and interviews. However, as argued by Keys (2005), from among the three types of beliefs about mathematics such as: Expressed beliefs, entrenched beliefs, and built-in beliefs, the majority of the

participants could fall under 'expressed beliefs' as they could positively express supporting constructivist ideas of teaching and learning of mathematics while responding to the survey questionnaire. However, when they were given opportunity to enact their beliefs in the form of designing a learning activity supporting a constructivist view, most of them were not able to manifest it clearly let alone include it in their lesson plans or implement it during their teaching practicum. Such findings indicate that there is a huge gap between the expressed and manifested beliefs as formulated by Keys (2007). Consequently, teachers are not in the position to answer the research question positively in terms of manifesting the practice of designing and implementing the concept of 'Try This' activity in teaching mathematics: *To what extent do student teachers have opportunities to implement contemporary practices in teaching maths such as the use of the 'Try This' activity?'*

Conclusion

This study concludes that although the majority of the participants tended to have some understanding of the concept of the 'Try This' activity to be provided prior to the information input from the teacher', they seemed to lack in terms of implementing it in the mathematics classroom. As discussed earlier, such findings were shown from the data collected. For instance, from the survey questionnaire and interviews, the majority of the participants could strongly express supporting the social constructivist view of teaching and learning of mathematics. These findings also include their expressed beliefs about the nature of mathematics and its views towards teaching and learning of mathematics. However, these findings tend to contradict the ones collected from the open-ended question in designing a 'Try This' activity and its inclusion in lesson plans implemented during the teaching practicum. With these findings, there was an indication of a gap between the expressed and manifested beliefs supporting constructivist views of teaching and learning of mathematics. It also indicated participants' concept of the 'Try This' activity and its lack of implementation. From this study, a strong message indicated a need to improve the teaching and learning of mathematics in the school to demonstrate the correct acts of implementation. Therefore, there is room for improvement in the system in terms of service from two colleges of education in collaboration with strong support from the Ministry of Education, Bhutan.

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