Pema's Reflective Practices: Narrowing the Gap Between Espoused and Enacted Beliefs

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This case study examined a Bhutanese teacher, Pema's reflective practices and their effects on her beliefs and classroom practices over a sequence of four lessons sandwiching a professional development. Three instances of reflection (before, during and after each lesson) were analysed to determine the shift in her beliefs and practices. The result revealed that reflective practices challenged her beliefs and routine practices, resulting in a shift from a traditional view to a more constructivist approach in teaching.

Bhutan is a landlocked nation situated between China and India. It covers an area of about 38,000 square kilometres with a population just below a million. As Bhutan graduated from one of the Least Developed Countries (LDC) in 2023, the Ministry of Education (MoE), Bhutan, has prioritised Science, Technology, Engineering and Mathematics (STEM) as fundamental for national development and has initiated several rounds of mathematics curriculum reforms since the 1960s. Nevertheless, mathematics remained the poorest performed subject for decades in national and international assessments. Bhutanese students scored significantly lower than the PISA reference countries such as China, Singapore, and Macau.

The new curriculum advocated the importance of conceptual learning and student-centred approaches. However, most of the Bhutanese teachers are accustomed to procedural teaching (MoE, 2014), resulting in few changes in teachers' planned practices (Dolma et al., 2017). To bridge this gap, the MoE in 2014 initiated a minimum of 80 hours mandatory Professional Development (PD) per year for teachers but the focus on attaining the required hours compromised the quality and subjugated the actual purpose (MoE, 2014). Top-down In-Service Education and Training (INSET) programs may be ineffective if they do not take teachers' beliefs and practices into account.

Reflective practice is at the heart of teacher learning and it is important for their professional growth (Loughran, 1996). This case study is part of a larger study into Bhutanese secondary mathematics teachers' reflective practices, their effect on teachers' beliefs and classroom practices, and the impact of professional learning. It aims to pursue two research questions in the context of Pema (Pseudonym) who was teaching a year 8 mathematics class:

- What are Pema's beliefs of mathematics and mathematics education?
- How does the use of reflection influence Pema's beliefs and classroom practices?

Literature Review

The beliefs held by teachers influence their classroom practices (Beswick, 2005, 2007). Philipp (2007) defines beliefs as a "psychologically held understandings, premises, or propositions about the world that are thought to be true (p. 259). The espoused beliefs are teachers' ideal beliefs about teaching and learning, but enacted beliefs are those beliefs that are exhibited in teachers' classroom practices (Berk & Cai, 2019; Ernest, 1989). Thus, teachers possessing similar mathematical knowledge and teaching experiences have varying classroom practices and learning outcomes depending on the beliefs they have and their ability to enact their ideal beliefs in practice.

Ernest (1989) subsumed beliefs of mathematics teachers as beliefs about the nature of mathematics, beliefs about mathematics teaching and beliefs about mathematics learning.

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These beliefs are based on two factors: traditional and constructivist. A traditional view is where mathematics is seen as a static discipline which is taught and learned through the transmission of mathematical knowledge from teachers to the learners. A constructivist approach views mathematics as a dynamic discipline and learning as an "active and purposeful process whereby individuals adapt their constructions in order to optimise their fit with experience" (Beswick, 2007, p. 97) . The beliefs of teachers about the nature of mathematics are directly related to their teaching of mathematics and selection of teaching strategies.

Beliefs about teaching refer 'to their notions of the principles of classroom teaching and the nature of effective teaching' (Xie & Cai, 2020, p. 749). Teachers who view mathematics as a static body of knowledge possess a belief that the learners are passive receivers of the knowledge and focus on the mastery of instrumental and basic skills by heavily relying on the textbooks or content. Conversely, teachers who view mathematics as a dynamic body of knowledge believe that students construct their own knowledge, focus on problem posing and solving, and explore different resources to supplement student learning. Beliefs about mathematics learning refer to their beliefs about the role that students should have in their own mathematics learning and the perceived attributes of good learners (Xie & Cai, 2020). Teachers who hold the problem-solving view of mathematics are more likely to accept the learners' methods and approaches to a mathematical problem, whereas those with the Platonist or instrumental views insist on a single correct method for solving each task.

The gap between the expressed and enacted beliefs is noticeable when teachers' beliefs are not congruent to the beliefs underpinning the educational reforms (Ernest, 1989). The change in beliefs can be expected if educational reforms are compatible with teacher beliefs but are hindered if they contradict the teacher beliefs. Reflective practices are crucial for teachers' learning to make sense of what they observe, to challenge their existing beliefs and to appreciate associated change in beliefs and practice (Philipp, 2007). The attempt to change the practices of teachers is unreasonable without changing beliefs (Beswick, 2005). Beliefs are not consciously articulated or brought to teachers' awareness unless they engage in reflective practices.

John Dewey defined reflective practices as an "[a]ctive, persistent, and careful consideration of any belief or supposed form of knowledge in the light of the grounds that support it, and the further conclusion to which it tends" (1910, p. 6). He distinguished between routine and reflective action and characterised reflection as comprising five phases: suggestions, problem, hypothesis, reasoning and testing (Loughran, 1996). This rational-technicist model has a drawback of overreliance on rationalism and adherence to technical rationality. These criticisms have remained as a foundation and helped to develop other models in the field of reflective practices.

Against the backdrop of technical rationality, Schön described two forms of reflection-reflection-on-action (after an action) and reflection-in-action (during action). His experiential-intuitive model underscores the process of reflection which spirals through stages of appreciation, action, and reappreciation (Zeichner & Liston, 2014). However, this has been criticised as not recognising the social process, and insufficient attention was given to social conditions that frame and influence that practice (Zeichner & Liston, 2014).

Accordingly, Loughran (1996) explored three instances of reflection: anticipatory (pre-teaching), contemporaneous (during teaching) and retrospective (post-teaching) reflection. He asserts that anticipatory reflection is a starting point for teachers to develop ways of thinking about their approaches to pedagogy. Contemporaneous reflection is the way to learn from and about their practices in action, and the retrospective reflection encompasses learning from experiences regardless of the perceived success of the episode. These three instances may help teachers compare their thinking about practice with their actual practice thus sustaining

professional growth. Teachers who engage in reflective practices consider problems in their own teaching and think about how those problems are related to their learners' understanding of mathematics (Posthuma, 2012).

Good reflective practices in mathematics education shape a meaningful and productive professional development, create opportunities to acquire new insights and skills in teaching, and are a source of professional growth (Posthuma, 2012). Conversely, reflective practice is not free of barriers. Teacher shortage, time constraints and heavy teaching periods hindered teachers' engagement in reflective practice in Bhutan (Dolma et al., 2017). A lack of subject-area specific supervisors, reflective disposition and hesitation in giving authentic feedback are some of the barriers in implementing reflective practices. However, it has the potential to assist teachers in re-evaluating their teaching practices, challenge beliefs, align theories and practices, and augment teacher professional learning.

Methods

This case study comprised two phases. In phase one, pre- and post-teaching interviews were conducted with Pema and one lesson was observed (video recorded) to establish her existing practices. In phase two, following a half-day Professional Development (PD) program, three lessons were observed. Pema was interviewed before and after each lesson to enable the observation of her enactment of reflective practices. Student work sample and her reflective journal for every lesson was also collected.

The PD program was conducted for the teachers at Pema's school. It was not based on a specific subject but included all teachers from all teaching areas. The PD focused on helping teachers understand and differentiate between routine action and reflective thinking. It was aimed not only to help teachers to understand what reflective practice in education is, but it provided an opportunity for the participants to challenge their existing beliefs. The importance of reflective practice and the prerequisite attitudes of reflection were presented. Action reflective cycle was introduced to help teachers to enact reflection in their classroom practices. The barriers and misconceptions of reflective practice were discussed. It was a platform for the teachers to learn, reflect on their beliefs and practice anticipatory, contemporaneous and retrospective reflections through group discussion and sharing their experiences based on one of their recent lessons. This was particularly relevant to Pema since she had completed the first phase of the study.

Pema's data was analysed for evidence of beliefs and practices using the three phases of reflection and compared the lessons before and those after the PD. The audio-recorded interviews and video-recorded lessons were transcribed into written form and colour coded to pieces of data that were interesting, unique, relevant and important for the study. Codes were defined in relation to the research questions and were aimed at identifying themes (Powell et al., 2003). For instance, Pema's expressed and enacted beliefs, selection of pedagogical approaches, use of mathematical reasoning and presentation, evaluation of students' learning, the influences of reflection on mathematical meaning-making process of learners and identifying the misconception through the lens of reflective practices were coded. These codes were used to construct the storyline by interpreting and making sense of it (Powell et al., 2003).

Findings

Pema was teaching Year 8 mathematics for the 2024 academic year in one of the rural schools in Bhutan. She was 27 years old and had three years of teaching experience. She completed her B.Ed. Secondary (Math/Physics) from one of the Colleges of Education in Bhutan. There were 26 students (boys=12, girls=14) in her class. The ages of the students ranged from 14 to 19 years. The age gap is due to late admission in pre-primary and low

achievers repeating year levels. The classroom was arranged in rows facing the chalkboard with two students sharing a table.

Pema's Existing Beliefs and Practices (Before PD)

Anticipatory Reflection

Pema's pre-teaching reflection involved her thinking about linking the real-life experiences of learners with the intended mathematical knowledge, which she considers as an important component of lesson planning.

> **Pema:** Whenever I plan a lesson, I always think about how to connect with the real-life situation. If you connect with the real-life situation, students will get clear concept of the topic. Therefore, I also make related questions for students to apply in their real-life situation.

In relation to problem solving, Pema commented that:

> **Pema:** Some students think mathematics is very difficult and some say mathematics is all about numbers. Word problem is very difficult for them. Unlike other subjects, they can't directly listen and understand mathematics. Mathematics is all about solving the problems.

To resolve this, Pema wanted to explain the concept and demonstrate how to solve the proportion problem, as she believed that first students should learn to be able to solve the given task. Her thinking about the approaches of pedagogy supported the traditional view where the teacher is expert, and the learners are passive receivers of knowledge in the learning process.

Pema attributed students' poor performance to lack of careful reading and comprehension of the questions. She highlighted the importance of connecting mathematical knowledge to the real-life experience of learners, but the pedagogical approach she described showed a transmission and teacher-centred approach.

Contemporaneous Reflection

When teaching, Pema emphasised rules and procedures instead of initiating problem-posing and solving. In consequence, the students gave the answers that Pema sought rather than asking for clarification on the topic. Pema demonstrated how to find missing terms in a proportion using two methods- scale factor and cross-multiplication.

> **Pema:** Let's say the ratio of boys to girls in a class is '6 is to 7'. If there are 42 girls, how many boys will be there? We are going to use the scale factor method… we must either multiply or divide, so right now we can see that one numerator from this ratio is missing (wrote $\frac{6}{7} = \frac{}{42}$), so we can use the other two denominators. What number times 7 will give you 42?
>
> **Students:** 7 times 6 [few students answered]
>
> **Pema:** 7 times what number will give 42?
>
> **Students:** 6 (chorus).
>
> **Pema:** Similarly, you multiply the numerator by the same number. How many boys are there in this class?
>
> **Students:** 36 [chorus answer]
>
> **Pema:** This number [pointing at 6] is called scale factor.

She defined proportion as two equal ratios but used no single ratios in finding the missing term of a proportion. She taught the cross-multiplication method by showing how to multiply the 'numerator of the first fraction with the denominator of the second fraction' and 'denominator of the first fraction with a numerator of the second fraction' and do cancellation of zeros. This method resonates with the traditional transmission of teaching mathematics as Pema emphasised procedures. A disparity between the espoused and enacted beliefs was observed. For instance, Pema expressed that "students are not reading and trying to understand the questions" but in the class she gave questions verbally and demonstrated how to solve the problem. Students had no opportunity to read the questions and comprehend them. The lesson

was closed by asking students to copy and complete the incomplete tasks at home. Pema could not assess students' learning.

Retrospective Reflection

In the post-teaching interview, Pema once again underscored the importance of linking mathematics to real life situation which indicated the existence of a gap between the expressed and enacted beliefs.

> **Pema:** To understand the concept, I gave them word problems to solve which is related to real life situation. I tried to connect my lesson with real life as it helps to make learning mathematics meaningful, interesting and motivates the learners.

However, the lesson was dominated by teacher talk and demonstration. Students' participation and interaction were minimal. Student's inability to compute basic multiplication and division problems prompted her retrospective reflection.

> **Pema:** Some students were not able to multiply and divide the numbers. I felt embarrassed to know that the students of Grade 8 were still not confident about multiplication and division which are the main components in mathematics.

Pema reported that her reflections involve thinking about what went well and what did not do well during the teaching episode. Pema shared that the presence of the observer in the class made her self-conscious and hindered the smooth flow of the lesson. She also acknowledged that there is no culture of reflection besides the MoE's mandatory observations of at least two lessons of every teacher by the principal per year.

Pema's Enactment of Reflective Practices (After PD)

Anticipatory Reflection

After attending the half-day PD program on reflective practice, Pema noted the difference between planning a lesson and reflecting on how the lesson might unfold, decisions on the selection of the pedagogical approaches, and reasons for the actions adopted (Loughran, 1996). The progression of Pema's anticipatory reflection was visible in every subsequent lesson as her reflection was influenced by learning experiences from previous lessons and PD.

> **Pema:** Before the PD, when we plan the lesson, we usually don't think of the students. But after attending the [PD] program, I learned that it is important for the teachers to reflect not only on us [teachers] but also based on the students' thinking and [learning].

Pema acknowledged that a mathematical problem can be approached with multiple solutions, and it is important for the students to know that they need not have to depend on what the teacher has taught or demonstrated in the class.

> **Pema:** If students get same answer using different solution, we can always accept because math is not only about the steps and procedures, and not only about the answers. There are different strategies or methods. It is important to share and learn from other students.

Pema recognised and appreciated participatory learning as she agrees that students learn when they do pair or group activities. She planned to let students show their solutions on the board and initiate discussion as a whole class to promote communication in mathematics and assess students' learning to ensure that every child learns and attains the lesson objectives.

Pema commented that the pre-lesson reflection helped her to reduce the risk of confusion when unexpected problems arise in the classroom.

> **Pema:** Planning lessons without reflection will confuse you while explaining the concept and ideas get mixed, but when we reflect while planning, then lesson activities can be conducted as per the plan.

Identifying misconceptions and difficulties through anticipatory reflection helped her to be more confident and supported her to handle the situation when contemporaneous reflection is prompted in the class.

Contemporaneous Reflection

Pema started letting students to do pair work in the second lesson and group work in the third lesson. Due to the minimum participation of students in the group work, Pema conducted an activity in pairs in the fourth lesson. The shift of pedagogical approaches from traditional chalk-and-talk to more of a participatory learning was observed. The reflective practices assisted Pema in asking probing and guiding questions to promote students' participation in the process of learning. As a process, she realised that language appeared very important for students to learn mathematics. She explained the question in English, but the students responded in Dzongkha (Bhutan's official language). She also noticed that students were struggling with basic multiplication and division facts. However, much of her instruction remained focus on instrumental understanding. For instance, Pema taught multiplication and division algorithm instead of using other methods like factorisation method to promote relational understanding.

In another instance, Pema was challenged by a student who solved the problem using a different formula. She called two students to show the class their solution using two different approaches and explain their reasoning and initiated a whole class discussion. It was learnt that the students who solved differently were repeaters who were taught by a different mathematics teacher in the previous year.

The contemporaneous reflection of Pema was enhanced and noticeable as she learned from the experiences of previous lessons. Gradually, Pema was giving more time for students to discuss and initiated whole class discussion. Students were allowed to share and justify their answers, which assisted learners to construct their own mathematics knowledge.

Retrospective Reflection

Pema's retrospective reflection was prompted by the success of her lessons and her satisfaction derived from engaging the students in the process of learning.

> **Pema:** I related the topic to a real-life situation. Everyone was curious and were listening very attentively. The activity was given in pair… some were explaining to their friends… I called one of the students to solve on board and explain. I felt that students enjoyed and learnt the lesson when explained by their friend and that also in Dzongkha (local) language.

The success of students working in pairs made Pema consider participatory learning. She recognised the importance of language and thinks that it is an important tool to communicate and create mathematical situations in solving a problem.

Pema delved into how her beliefs were challenged after few students solved a problem using a different approach from what she taught.

> **Pema:** We were taught by our teachers adapting stringent methods. I never thought of other methods. I prefer to teach the way I was taught before. But one of the girls solved using different method. Her previous teacher taught the method, and she finds more comfortable with it… I think sometimes the teacher can also learn from the students.

Pema believes that the teacher can be a co-learner and facilitate whole class discussion. She recounted how her students approached the task differently and enjoyed sharing it with their friends. She agreed that students are learning genuinely and confidently when they can reason and solve problems in their own ways. Hence, it indicated a shift of the teacher's beliefs about learning mathematics from a traditional to a constructivist view.

Pema viewed reflection as more than thinking and recognised it in practice as it is a source of learning and a means to appreciate students in constructing knowledge. Reflection helped

her find her students using ineffective strategies (e.g. using fingers) to retrieve multiplication facts and prompted her to think about how to teach basic multiplication facts for quick retrieval.

> **Pema:** Reflecting before, during and after teaching helped me to explore different methods, and let students work in groups and pairs which I usually don't do. Before this study, I was always thinking about what I know and never thought about how students learn and share the ideas.

Pema feels that all the teachers should do reflection and make it a school culture to make teaching and learning meaningful for all the students and teachers. She feels accomplished as she could use different methods of teaching and could promote student participation through reflective practices.

Discussion and Conclusion

Pema held more of a traditional view before the PD. Her beliefs were shifted towards a more constructivist approach after the PD as she started to recognise the need for looking at the student learning and challenged her routine practices through reflective practices. Pre-lesson, during and post-lesson reflection helped Pema recognise the gap between her beliefs and existing practices. The finding supports the notion that the enactment of beliefs is limited if espoused beliefs are represented in a disconnected verbal way and not integrated with the pedagogical knowledge (Ernest, 1989). Pema's teaching was associated with the traditional model of teaching besides her attempt to connect mathematical knowledge to the real-life experience of the learners and initiation of participatory learning. Pema became more aware of her own beliefs and practices through reflection. This led towards greater integration of Pema's beliefs and practices (Ernest, 1989), and indicated a shift of her beliefs about mathematics and mathematics education towards a problem-solving view as she adopted participatory and child-centred approaches in teaching. Learning about one's pedagogy through reflection can lead to a cycle of learning by doing and be a source of greater ideas and suggestions (Loughran, 1996).

The three instances of reflection, viz., anticipatory, contemporaneous and retrospective, guided Pema to understand how reflection influences the practices (Loughran, 1996). She reported that she never reflected before and during teaching until she took part in this study. Moreover, she admitted that her reflection after the teaching involved just thinking about what went well or what didn't go well. The findings support those of Loughran (1996) where he differentiated between planning a lesson and reflecting on how to teach, and thinking that a lesson was either good or bad and a teacher reflecting on that experience to learn. Reflective practices helped Pema shift her focus from teaching to student learning, leading her to notice learning difficulties (for example, multiplication and division problems) and recognise the importance of language in learning mathematics. The ability to notice problems can lead to new suggestions and testing of hypotheses strengthening the meaning making process in learning mathematics.

The findings about beliefs about teaching mathematics concurred with those of Dolma et al. (2017) where Bhutanese primary mathematics teachers perceived the role of the teacher to be an authoritative source of mathematical knowledge and students acquired knowledge by attentive listening. Pema believed that participatory learning is not appropriate as students should first learn from teachers to learn in pairs or groups. However, after participating in this study and implementing some reflective practices, Pema began to believe that teachers can equally learn from students and be co-learners as there are multiple approaches to solve mathematics problems. This supports the findings of Posthuma (2012) who claimed that reflection is a potential tool to shape a meaningful and productive professional development by creating opportunities to acquire new insights and skills in teaching. The shift of Pema's role from an explainer to a facilitator, emphasising the students constructing their own knowledge, aligns with the intention of Bhutan's new mathematics curriculum which supports participatory learning.

The gap between beliefs and practices is created when teachers' beliefs are not congruent with the beliefs underpinning the educational reforms (Ernest, 1989). Teachers' beliefs can be aligned to the beliefs supporting the curriculum reforms and PD programs by providing opportunities for teachers to develop knowledge that has a positive influence on their beliefs through reflection leading to the cycle of learning by doing. Inculcating a reflective culture in Bhutanese schools can be a teacher's source of sustaining professional development that may improve mathematics standards as teachers come to appreciate the underpinning principles of curriculum reforms. However, reflection and how it influences the thinking and practices of teachers depends on context like content knowledge, experience, time, actions, feelings and self-confidence (Loughran, 1996). It is acknowledged that findings of this study are based on Pema's context over a short period of time and have not yet determined the sustainability of any changes exhibited over time. Further studies over longer periods are needed to determine how reflective practices can influence the teachers' beliefs and bridge the gap between beliefs and practices to realise the underpinning beliefs of mathematics curriculum reforms in Bhutanese schools.

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