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Exploring Physics teachers' reflective practices and the challenges

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ABSTRACT: *Reflective practices have become an important part of the teaching and learning process. When teachers practice it, they are considering their own practice, examining curricular choices, incorporating students' feedback and making changes to improve students' learning. This study aimed at exploring reflective practices of Physics teachers in Bhutan. In addition, it also examined the challenges that affected Physics teachers' reflective practices. This qualitative study gathered data from seven Physics teachers teaching in two Higher and Middle Secondary Schools located in the eastern part of Bhutan. Data for this study were obtained from four sources; semi-structured face-to-face interviews, class observations with post-observation conferences and analysis of documents. The study revealed that Physics teachers incorporated different reflective practices such as self-reflection, different strategies and skills and feedback. Factors promoting reflective approaches included different classroom activities, questions, and responses by students while challenges in the process of reflection were lack of resources, large student number, bulky syllabus, and workload. This study recommends the need for an ICT-enabled environment in the schools to promote reflective practices. In addition, it recommends the Ministry of Education to review the workload of Physics teachers.*

KEYWORDS: **Reflective practices, reflection, teaching-learning process, feedback, qualitative method.**

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1. Introduction

To survive and prosper in today's rapidly changing world, various skills are required. Orakcı (2021) acknowledges that present society demands people to have certain skills such as problem-solving, creative thinking, critical thinking, learning to learn, and reflective thinking. Further, he emphasizes that reflective thinking abilities are considered as the highest degree of thinking. Reflective thinking, according to Dewey (1933), is a method of thinking that is efficient, persistent, and exact. Reflective thinking while teaching and after teaching aids teachers in identifying strengths and weaknesses as a teacher. Daker and Latchanna (2017) mention "reflection in teaching" as conscious recall and remembrance as a response to experience.

In the realm of education, Dewey's concepts about contemplation, action, and learning were timely. In the framework of constructivism's knowledge theory, reflective thinking can be found in the principles of inquiry-based, problem-based, and experiential learning (Dimova & Kamarska, 2015). The Science curriculum in Bhutan was revised from pre-primary to class twelve incorporating diverse teaching approaches such as placed-based Education, experiential learning, reflective practices of students, blended learning and differentiated instruction etc. Construction of knowledge is emphasized in recent changes in the Science curriculum in Bhutan (Department of Curriculum and Professional Development [DCPD], 2022).

Reflective practices are an important factor for successful learning for teachers and learners as a whole. Teachers analyze their lesson delivery, with a self-critical review to verify strengths and flaws (Habib, 2017; Islam, 2015). Thus, teachers tend to remain aware of the shortcomings and strengths that need to be continually reformed. Moreover, reflective practices can be effective both for prospective teachers and experienced

teachers since it analyzes teaching and provides constructive feedback. It evaluates the reliability of different teaching approaches in specific areas (Etkina, et al., 2010). New Normal Curriculum (NNC) instructional guides designed by the Department of Curriculum and Professional Development of Bhutan (DCPD) requires teachers to be cognizant of learners' individual learning difference, situation and adapt teaching strategies accordingly.

In Bhutan, several reforms in the education system are instituted. With the launch of the Bhutan Professional Standard for Teachers (BPST), teachers are expected to be lifelong learners, and reflection is perceived as a potential tool to achieve it (Ministry of Education [MoE], 2020). For instance, the Ministry of Education (MoE) initiated several activities, particularly the launch of the Sherig Endowment Fund (SEF) which encourages teachers to undertake action research. This indicates that teachers are expected to be reflective learners for professional growth. Hence reflective components of teaching are important for a successful teaching and learning process.

In schools across Bhutan, teachers include reflective practices such as, peer observation of the lesson, school leaders observing the lesson, and seeking feedback from students. Further, summative assessment like class test and term-end examination enables teachers to reflect on the lesson taught. As a result, both formative and summative assessments can be employed for reflections. Moreover, most of the time, teachers in the class ask questions and assign activity that fosters students' critical thinking skills (Latchanna and Daker, 2016). Further they recommended that asking questions makes students attentive and reflect on the content being taught. Similarly, Olaya Mesa (2018) suggested methods that encourage reflective practice such as journals, reports for the lesson, audio or video recording, and self-evaluation.

In Bhutan, courses offered by two colleges of education at Samtse and Paro exclusively focus on developing reflective practices. For instance, in courses such as Postgraduate Diploma in Education (PgDE) and Bachelors of Education (B.Ed), student teachers perform micro-teaching where they are required to write a reflection on their micro-teaching experience. Even in courses like Masters in Education (M.Ed), student teachers are required to practice extensive reflective writing. Additionally, to enhance the reflective abilities of in-service teachers in Bhutan, the Ministry of Education initiated various nationwide professional development such as Transformative Pedagogy and English for Effective Communication to develop teachers' reflective skills. Nevertheless, teachers' reflective practice is impeded in real-life situations due to bulky syllabus and heavy workload (Wangdi, 2016).

The findings from Bhutan's Experience in PISA for Development (PISA-D) stated that in Science subjects in-depth conceptual understanding of scientific courses and instructions should be emphasized by teachers (Bhutan Council for School Examinations and Assessment [BCSEA], 2019). Consequently, reflective practices are one of many effective teaching practices for Science teachers that can help to gain deep conceptual and epistemic knowledge of science curricula and instructions. Therefore, reflective practices by teachers can be a significant contributing factor in making students understand the lesson taught.

As a result of the above reasoning, Latchanna and Daker (2016) point out that in terms of the teaching subjects, variance in reflective teaching approaches in Bhutan could be studied in the future. Besides, a reliable study on reflective practices in Physics education in the Bhutanese context is literally non-existent. Therefore, this study explored reflective practices of Physics teachers in schools. It also examined issues that Physics teachers encounter in the process of reflective practices.

2. Research questions

Main Question: The main question is *"What are reflective practices of Physics teachers?"* To answer the main question, the following sub-questions were investigated:

Sub-questions:

How do Physics teachers in Higher Secondary

and Middle Secondary schools perceive reflective practices?

What are the factors that promote the reflective practices of teachers?

What are the issues Physics teachers encounter in the process of reflective practices?

3. Literature review

3.1. Reflection

Reflection, in general, includes critically assessing one's own ideas in order to improve one's behaviors. Nguyen et al. (2014) in a practical sense defined the term reflection as "*the process of engaging the self-inattentive, critical, exploratory and iterative interactions with one's thoughts and actions, and their underlying conceptual frame, intending to change them and with a view on the change itself*" (p.1182). To illustrate, Johns (2009) noted that reflection is a way of thinking deeply and systematically about self in a practice, a learning journey of our everyday experiences realizing one's vision of good practices and executing them.

Reflection consists of a process or activity that is susceptible to change for better (Kidd & Czerniawski, 2010; Yuen Lie Lim, 2011). Daker and Latchanna (2017) mentioned "*reflection in teaching*" is a response to an event that involves conscious recollection and remembering. They added that as a foundation for assessment, teachers evaluate their experiences. They further suggested that in the context of teaching and learning, reflection is a strategy that allows teachers to expand and learn from their prior contact in teaching. Finally, they summarized reflective teaching as a method that can adjust well with ever changing context of the classroom with experiences

Reflection can be employed not only at an individual level but also in a group to collect diverse views and opinions to come to a good conclusion. Krutka et al. (2014) suggested reflection done with a peer helps people as they clarify, establish, and improve teaching skills by garnering several perceptions. They further alluded that collaborative learning encourages different perspectives, ultimately when we communicate with others who see things differently and ask questions from different stands, resulting in challenging our assumptions. Reflection with the peer and group is the best source of obtaining different insights and perceptions to further improve the teaching process.

3.2. Developing an ability for reflection

There are certain attributes that help in enhancing the reflective practices possessed by an individual. For instance, Farrell (2008) summarized the three attributes of a reflective person identified by Dewey as open-mindedness which is listening to more than one side of the problem and considering alternative views; a responsibility which is giving regard to the consequences of the action; and finally, whole-heartedness refers to teachers critically evaluating their practices for purposeful change. Hence, to incorporate reflective practices in the teaching and learning process, these three attitudes are indispensable.

Ashraf and Rarieya (2008) opined that teachers' involvement in reflective practices can be influenced by numerous factors such as content knowledge and pedagogy, further teachers' personal attitude toward the reflective practices also plays a role. Moreover, they conceded that apart from teachers' content knowledge and pedagogy, teachers should have an interest in personal development and enhancing students' outcomes. Similarly evaluating the teaching experience by being cognizant of one's weaknesses, additionally trying to improve, further attributes like being patient, listening attentively, encouraging to think, incorporating student's feedback and avoiding similar mistakes are the attributes of reflective teachers (Sunra & Nur, 2020).

Teachers can implement various activities for fostering reflective practices in the class. A study by Tok and Dolapçolu (2013) concluded that teachers perform different activities as reflective teachers such as implementing learner-centered instructions like considering students' individual needs, evaluating students' levels by incorporating different activities, and acknowledging students' efforts and linking the content with students'

lives. Further, their study also suggested that teachers create a reflective class environment by considering students' opinions concerning decision making, valuing criticism by accepting students' and colleagues' feedback reviewing teaching practices constantly, and always devising alternative methods. Hence teachers can practice various strategies to implement and develop reflective practices in the class.

3.3. Strategies for reflective practices

For the successful teaching process, it is of paramount importance for teachers to reflect on their lesson using different reflective practices. Teachers in Bhutanese classrooms use reflective practices such as self-reflection, obtain feedback from students, and infrequent observations of the teachers' lessons by the principal and colleagues (Wangdi,2016). In the same vein Impedovo and Khatoon Malik (2016) suggested that a teacher might include a variety of ways to become a reflective practitioner. For instance, examine and challenge events that occur in the teaching-learning context, demonstrate that you are sensitive to moods and behaviors, maintain a regular or daily log of significant classroom events, share examples of students' learning, and lastly ask for feedback from colleagues and the families of the students.

Similarly, Olaya Mesa (2018) suggested strategies such as journals, lesson reports, audio or video recording, and the self-monitoring method in promoting reflective teaching. Fatemipour (2009) studied "The Effectiveness of Reflective Teaching Tools in English Language Teaching" of 10 lecturers and 250 students of the Islamic Azad University of Roudehen branch. The study found that the teacher journal proved to be the most productive reflective instrument, followed by peer observation and finally input from students. Consequently, teachers have the options to employ numerous reflective practices to promote effective teaching.

Due to the importance of reflection, two education colleges in Bhutan also encourage student teachers to engage in reflection, since reflective practices have a significant impact on their teaching careers. Korucu Kis and Kartal (2019) investigated involving 60 third-year English as a Foreign Language (EFL) student instructors in reflective activities like self-monitoring, peer observation, and journal writing and came to conclusion that those reflective practices boosted self-awareness, criticality, and reflective mindsets. Further study by Seden et al. (2016) noted that strategies such as Reading, Asking, and, Participation (RAP), modeling and questioning enhanced the reflective writing skills for the pre-service teachers.

3.4. Challenges in employing reflective practices

A teacher might encounter numerous challenges while incorporating reflective practices. A study by Tajik and Ranjbar (2017) reported challenges that can be categorized into three levels: institutional problems, self-directional problems, and problems with reflective teaching principles. Institutional problems included a lack of resources and opportunity for instructors to improve, a lack of autonomy for teachers, and diverse and overcrowded courses. Further teachers' lack of enthusiasm, their severe workload, and their disqualification owing to weak language abilities or expertise in areas other than teaching are also contributing factors which are categorized as self-directional. Finally, issues with reflective teaching principles are concerned with the challenging essence of reflective practice.

According to Kano et al. (2017), teachers' knowledge of the definition and usage of reflection as a teaching approach is lower than expected. They went on to say that this could be due to a variety of obstacles associated to reflective practices, including a lack of freedom of speech, a lack of understanding of the benefits of reflective teaching, and a lack of prior experience. Hence, they noted that one of the most significant obstacles to reflective practice is a lack of time for reflection. Teachers confront a variety of problems while implementing reflective activities in general. According to Gheith and Aljaberi (2018), instructors rarely ask their colleagues to evaluate their teaching techniques or also do not enable students to freely voice their ideas on their teaching methods.

All of the participating teachers in the study titled *"Teachers' Reflective Practice and Challenges in an Indonesian EFL Secondary School Classroom"* said that workload and a lack of time to reflect were two major factors that made it difficult for them to reflect (Sunra & Nur, 2020). Further, according to Bawaneh et al. (2020), the minimal use of reflective teaching practice among science teachers may be attributed to serious socio-economic problems that have a detrimental impact on the teaching profession. Additionally, they also noted an important factor that is shortage of time owing to the academic and administrative demands placed on teachers that may be seen as an external element. Further they reported that the above-mentioned factors might impede any sort of educational critical thinking and reflection.

4. Methodology

4.1. Research design

In this particular study, a qualitative approach is ideally suited as the research design. In addition, the qualitative method has a long history of its use in education and the social sciences (Denzin & Lincoln, 2005). Williams (2007) noted that special characteristics of qualitative research are social events that are investigated considering participants' views. He added that poststructuralist framework is employed in qualitative research.

Since this research explored reflective practices used by Physics teachers which involved describing lived experiences of the phenomenon and collecting experiences from different individuals, phenomenology as a research design is felt apt for the study. Creswell and Creswell (2018) described phenomenological research as a philosophy and psychology approach in which the researcher describes people's lived experiences of events from the perspectives of participants. They further added that for his explanation lies in the essences of the experiences, which has been confirmed by a large number of people who have all witnessed the phenomenon.

4.2. Population and sampling

Purposive sampling, a feature of qualitative research, was used in this study, with participants being selected as the sample based on their assessment of their existence of the desired characteristics exhibited by participants (Cohen et al., 2018). Bernard (2017) also noted, that in addition to required traits being sought, willingness to participate in study, further the capacity to convey views in a coherent, expressive and reflective way by participants is also sought.

Participants were pre-selected based on a set of criteria in this study. According to Moser and Korstjens (2018), criterion sampling is used in phenomenology, in which participants must fulfill required criteria. They further reiterated that the participant's experience with the topic under investigation is the crucial factor. Phenomenological research, on the other hand, must have needed participants to have sufficient perceptions of the phenomena under investigation (Moustakas, 1994). Thus, the researcher gathered the required information from three Physics teachers from two Higher Secondary Schools teaching classes eleven to twelve and four Physics teachers from two Middle Secondary Schools teaching classes nine to ten. For the participant to be anonymous and confidential, participant teachers were labelled as, T1, T2... T7 reads the names of the teacher concerned as T and the numbers 1-7. In all the excerpts, these marks were included.

4.3. Data collection methods and instruments

Since the study targeted the exploration of reflective practices used by Physics teachers, the viable tools employed were face-to-face interviews, post-lesson conferences, document analysis and classroom observations. Like other qualitative research, phenomenological research uses many techniques, including interviews, observations, action research, conversations, focus group meetings, and text analysis (Qutoshi, 2018). One strength of using multiple data sources is it allows the researcher to verify and cross-check results.

4.3.1. Classroom observation

Halim et al. (2018) characterized classroom observation as being present in the classroom for the purpose of observation and reflection in order

to learn. They further asserted that observation of the classroom consists of evaluating and noting important events in the classroom. The study used observational protocol (Creswell, 2009) to record descriptive notes. Later, the notes were summarized and organized into an overall picture of events, circumstances and context.

Each observation of the lesson was accompanied by a post-lesson conference with the concerned teachers. The post-conference happened immediately after the lesson. In the post-lesson conference, a set of questions were asked where participants had to discuss about the progress of lesson delivery and participants were asked how they would conduct the class differently if they had to re-teach the same lesson. Questions from the post-lesson conference were adopted from the thesis by Daker & Latchanna (2017, p. 94).

4.3.2. Semi-structured interview

According to Miles and Gilbert (2005), semi-structured interviews are conversations that lead to the resolution of issues necessary for the accomplishment of the objectives. Saunders et al. (2009) found that interviewing is important to answer research questions for the achievement of a goal. Hence, a semi-structured face-to-face interview with seven Physics teachers were involved in this study to explore reflective practices, components that guides the selection of the particular strategies/ or methods and challenges associated with it. This method was the primary source of data for this study and questions were adopted from the thesis by Daker and Latchanna (2017, p. 94). it was used to elicit the research questions that focus on a selection of particular strategies, reflective practices used and challenges while employing reflective approaches.

Researchers were careful not to ask closed or yes/no questions and avoided interrupting while replying to the questions. After the interview, the researchers thanked everyone and gave the interviewee an opportunity to ask any questions they had regarding the interview or the research. All the interviews were performed in English and audiotaped since the medium of instructions is English for the schools in Bhutan. Each interview lasted for an average of 90 minutes. Each interviewee was given a transcript of the interview later on. The transcript was read and checked for an accurate record of interview information.

4.3.3. Document analysis

According to Creswell and Creswell (2018), qualitative documents such as public documents (e.g. newspaper, minutes of the meeting, and official reports) or private documents (e.g. personal journal diaries, letters, and e-mails) are there for the research process. Moreover, as a part of the research project, documents might have multiple purposes. In this study, documents such as the Science Curriculum Framework of Class PP-XII, textbooks, notebooks and daily lesson plans of Physics teachers were analyzed.

Bowen (2009) suggested five basic roles of documentary content: First the documents should describe the settings in which participants work. Second, documents serve as a guide for asking follow-up inquiries and making observations. Third, further research data is provided as additional knowledge. Fourth, documents provide a means of assessing growth and development. Finally, documents can be examined for the purpose of validating findings or supporting information from other sources. The analysis of the documents process started by reading each document, for example, the Science Curriculum Framework of Cass PP-XII , Physics teacher's lesson plans and the students' notebook, and noted the words or sentences that indicated reflective teaching practices. Then researchers coded the words or sentences that appeared as reflective practices.

4.4. The analysis process

The data for this study was initially analyzed according to the data source, which involved sorting and combining the data collected through the data collecting method. Data analysis along with data collection was an ongoing method for this study. The researcher can undertake elementary data analysis while collecting and analyzing data at the same time (Creswell, 2012).

The analysis procedure, however, was stringent because it mandated no loss of the viewpoints of the participants, the transcripts were read and re-read line by line. Manual coding was the primary measure taken during the study to organize, categorize and make sense of the data. Finally, Words, phrases, sentences or paragraphs were bound for color codes.

The review of the document process started with the reading of each document such as the Science Curriculum Framework of Class PP-XII which guides curriculum organization and content, lesson plans framed by Physics teachers every day, and notebooks maintained by students. The words or phrases suggesting reflective practices were noted. Then researchers coded the words or phrases that have emerged as practices of reflection. The results from various data sources were compared and analyzed for similar trends after the conclusion of the research, which can be regarded as important findings of the report. It was verified by the researcher as relevant outcomes. Once it was confirmed, the researcher collapsed the themes that emerged from the different data sources.

4.5. Validity and reliability

Creswell (2009) contends that many perceptions in terms of definition, terms and procedures exist regarding the importance of validation in qualitative research. In his words: *"Qualitative validity means that the researcher checks the accuracy of the findings by employing certain procedures while qualitative reliability indicates the researcher's approach is consistent across different researchers and different projects"* (p.190). This is equivalent to reliability, and is consistent with data gathering methods or analysis processes provide consistent results over time by the same or various observers (Daker & Latchanna, 2017).

According to Denzin (2012) the application of many techniques, or triangulation, shows an effort to obtain a comprehensive knowledge of the phenomena under consideration and further one can never grasp an objective reality. Moreover, it is a mechanism for substantiating evidence to shed light on the theme or insights from various sources (Creswell, 2009). Within this context, data was collected for this study using various data sources or methods of data collection such as class observations with post-lesson conference, Semi-structure interview and Document analysis. The class observation accompanied by post-lesson conference and semi-structured aided researchers to draw lived experiences of the participants. Lastly the documents analysis reinforced to check and confirm the lived experiences of the participants.

5. Results

This section presents the results generated from the qualitative data, based on teachers' face-to-face semi-structured interviews, classroom observations, post-lesson conferences, and document analysis. Overall three themes were generated: Physics teachers' reflective practices, factors promoting reflective approaches and challenges Physics teachers face in using reflective practices.

The data analysis revealed three sub-themes and each of the themes is discussed below.

5.1. Physics teachers' reflective practices

Physics teachers were asked about reflective practices they used. The data analysis revealed three sub themes from the first theme of Physics teachers' reflective practices: self-reflection, different strategies and skills, and feedback.

5.1.1. Self-reflection

Reflecting mentally and analyzing one's teaching is an important component of the teaching and learning process. Reflecting personally at the mental level is termed as self-reflection in this study. Analysis of data from the interview transcripts indicated that participants T1, T3, and T4 reflect mentally during the process of teaching and learning. For example, T1 said, "*my reflection is completely informal and I reflect on a personal level*". Likewise, T3 and T4 stated that they do self-analysis/evaluation and mental reflection. Additionally, T4 used reflective practices such as self-assessment and peer teaching.

In this way, the participants of the study were

found to be engaging in informal reflection such as personal self-analysis, and mental reflection. They informed that they undertake such reflective practices to look for ways and means to deliver the lesson meaningfully and at the same time to bring improvement to their classroom practices. However, the participants noted that they do not resort to any specific reflective practices, yet they reflect personally to improve their future lessons.

5.1.2. Different strategies and skills

To elicit reflective practices used by employing different teaching strategies, participants were made to share diverse teaching and learning methods used so that participants gauge the effectiveness of strategies and skills by reflecting on it. Most of the participants are of the view that they mostly used the lecture method. Alternatively, they also used other methods such as group work, presentations by students, and practical. For instance, T1 said:

"In my case, I always make use of the lecture method, where my input is always more and in some cases in rare cases I also go with the group work presentation and I also make use of ICT wherever it is needed."

T3 and T5 stated that they mostly use the lecture method, however, sometimes they also use other methods such as group work, presentation, and question-answer sessions. When asked what guided the selection of particular strategies and methods, T2 said "*We do not use specific strategy or method, we just use any type of the strategy whatever comes to our mind while we are in the process of teaching. Hence, I don't focus on a single strategy or skill*". T2 further added, "*sometimes I use a demonstration, I also use activity-based teaching. So, simultaneously, teachers use different strategies while teaching. We do not fix on a single strategy or method*". Data from the documents like lesson plans by Physics teachers and notebooks maintained by students clearly indicated that participants do not restrict to one particular strategy or skill. Different strategies and skills assess the needs and suitability of students learning, thereby promoting reflective practices of Physics teachers. Moreover, the researcher's notes from classroom observation showed that participants incorporated various strategies and skills for evaluating the effectiveness of teaching.

5.1.3. Feedback

When asked about different reflective practices, few participants stated getting students' feedback on their teaching. T7 mentioned "*I usually video record, get students' feedback and sometimes reflect through assessment of data and test scores. I also reflect our teaching through peer observation and micro-teaching but it happens on a few occasions only*". Additionally, T7 said he uses video recording, assessment of data, and test scores from the students and also students' feedback. Similarly, T6 pointed out that he gauges the students' understanding of lessons taught in the following ways:

Reflective approaches in my case is usually to do with enhancing my own classroom practices. For instance, in the process of the lesson, I just collect the perspectives of students whether they understand or not. Sometimes I check students' understanding of the lesson through a simple class test. Through the test, if the students do well, then I get the feeling that I have done well. Sometimes if students are not able to perform well then that is the indication that my lesson might have not gone well. Therefore, I usually prepare some sort of remedies for the future.

Some participants asserted that they employ different activities for students in the class. Simultaneously, they also give appropriate feedback to students for their future learning. Correspondingly, researcher's notes from classroom observation indicated that participants mainly rely on asking questions during the process of teaching. They also provided required feedback on the responses of the students. Hence during the teaching and learning process, participants made frequent use of question and answer sessions to provide feedback. Participants asked questions to check their comprehension of the lesson by students. Moreover, it was observed in that analysis of document such as notebooks maintained by students that participants also provided feedback following appropriate rubrics with criteria on classwork and homework.

5.2. Factors Promoting Reflective Practices

This theme discusses the factors that promoted reflective practices. The analysis of data revealed three significant subthemes that promoted reflective practices and thinking abilities of students: Class activities, class questions, and responses by students.

5.2.1. Class activities

Qualitative data revealed that participants resort to varied strategies to promote reflective practices and enhance the reflective thinking of students. For example, T2 and T4 believed that if they provide activities in the class, it promotes reflective practices of teachers and reflective thinking abilities of the students. Besides, T2 also stressed that the use of the three-two-one method promoted students' reflective abilities as they are expected to list three things they learned, two things that they have not learned in the lesson, and one thing that they want to learn in the future lesson.

The participants felt that by assigning activities, teachers and students can evaluate whether the delivery of the lesson was satisfactory or not. Likewise, during post- lesson conference, participants were asked how they would conduct the class differently if they had to re-teach the same lesson. Few participants expressed that they would include more activities (T2, T3 and T7) as activities allow students to think. Likewise, some of the participants expressed that they will make their future lessons more student-centered by incorporating more activities. Students are also expected to utilize real-life examples to demonstrate a concept or lesson, or to look for further information in the library for that topic (T2 and T4). Researchers' notes from classroom observation also unveiled teachers assign various activities in the class to evaluate students' understanding, so that teachers can reflect on the effectiveness of the activities assigned. Documents like lesson plans and notebooks contain activities particularly numerical questions. Science curriculum framework from classes PP-XII also requires students are also required to use Mathematics and computational thinking and carrying out STEM activities.

5.2.2. Class questions

Asking questions in the class is essential to enhance reflective thinking. The way questions are asked and the types of questions asked have a critical role in making the lesson meaningful and as well as in enhancing reflective practices. The findings of this study indicated that classroom questioning was used frequently in the class. For example, the participants remarked that they use both formal and informal questions to check students' understanding of the lesson and to promote students' reflective thinking as shared by T1:

"In my case, I always use questions in informal and formal ways during the delivery of the lesson. Time and again, I ask questions to the students, and when students give an answer, it also indicates to us that they are following the concepts. So, in my case, I always use the questions, and not only is that one practice that I have in fact also used questioning during the interview or viva session."

Besides, questions were also used to recap lessons. Accordingly, students are also made to ask questions. Such techniques were also used to track students' understanding of the lesson as well as their level of attention. For instance, T6 explained, *"one thing that promotes reflective thinking ability is I allow students to ask questions"*. Moreover, students are also made to share their thoughts on the day's lesson. In sum, the participants mostly asked questions and made students share their opinions at the end of the lesson as a way to facilitate reflective practices and the thinking abilities of the students. Further analysis of documents such as lesson plans and notebook maintained by students also revealed that participants incorporated questions in the lesson. Similarly, Science curriculum framework from classes PP- XII requires asking questions and defining problem under scientific methods and engineering practices for fulfilling certain learning objectives.

5.2.3. Responses by the students

Data indicated that most of the participants opined that the responses from students motivated them to reflect on the lesson taught. For example,

T3, T4, and T5 voiced that students' responses and attitudes while teaching makes them reflect on their teaching and learning process. T3 and T5 said that students' responses determine how the lesson was delivered. For example, if students respond and explain well, it is an indication that the teaching was effective and vice versa.

Similarly, T4 shared that when students exhibited enthusiasm in learning by being active, it is an indication that the teaching was excellent. Similarly, class passivity indicates that the teaching may not have been as successful as it should be. In this line, the participants felt that the responses and attitudes exhibited by students in the class promoted reflective practices. In addition, researcher's of class observation indicated that students sometimes responded in groups to teacher's questions. On the contrary, there were some students in the group who did not respond to teacher's questions, indicating that the lesson was not well received by learners.

5.3. Challenges Physics teachers' face in using reflective practices

Participants believe that reflective practice is essential, however, interview data unveiled some of the challenges associated with reflective practices. The data analysis revealed three challenges that the Physics teachers' face in using reflective practices which included lack of resources, time limitation and workload.

5.3.1. Lack of resources

Participants stated that lack of resources hinder reflective practices. For example, participants mentioned that teachers need adequate resources to promote reflective practices. Likewise, internet services are crucial as they aid in locating the information that is relevant for the effective teaching of content which facilitates reflective practices. To illustrate the point, T1 explains as follows:

"Another factor that can affect reflective practices is resources and if we don't have it, we cannot do anything. And especially during this time of the year I think what the school needs is good internet service. So, if the internet service is very slow, I think it doesn't help. Because we need internet services for additional information related to the content. So, I think to have good reflective practices, we also need to have resources."

Hence, participants felt that resources are needed for promoting reflective practices. In the words of T2, lack of resources impacts teaching as teachers are not able to apply different methods and strategies. To employ different teaching strategies, relevant and adequate resources are needed. This makes teachers resort only to the lecture method. One participant further specifically mentioned that teachers need specific resources and facilities such as internet as it helps in planning interactive lessons. Seeking diverse information from the internet for good teaching and learning process is crucial, therefore use of the internet and IT resources while teaching facilitates reflective practices where participants reflect on the effectiveness of the teaching and learning process. Therefore, a lack of resources acts as a hindrance to promoting reflective practices.

5.3.2. Time constraint

The qualitative data revealed time limitation as another factor that impeded reflective practices. For instance, T1 stated that it is difficult to practice reflective practices due to limited time as reflective practice requires more time.

"I think the limits may be time constraints. Every time we reflect too much in the class, especially on the student's part, if we ask them to reflect frequently, we may sometimes land up nowhere. Sometimes students fail to answer, and we may lose time. However, if the teachers talk and provide the content directly, then it saves time."

As a result, participants felt that they could not focus on reflective practices. Moreover, heavy content obstructed them to practice reflection as teachers rushed to cover the syllabus. In this way, all participants felt that they focused more on the content than on reflective practices. One of the factors that hampered reflective practice was the bulky syllabus as revealed by T6, *"the coverage of syllabus and mandate to complete content on time despite students' pace of learning is seen*

as a difficulty to practice reflective practices". Moreover, participants find themselves involved in correcting students work such as homework, class work and project work, etc. which takes away lot of their time. Hence, the participants expressed that these factors inhibited them from promoting reflective practices in the classroom.

5.3.3. Workload

Participants expressed concern about handling many periods and due to huge classroom burden, their reflective practices are largely impacted. For instance, during the interviews when participants were asked about the challenges of reflective practices, T1 shared his view in taking many subjects as an obstacle as stated:

"If the teacher is burdened with so many periods like for this school now. To be honest, again, we have many periods where we are burdened with a considerable number of periods. With a lot of periods and a heavy workload, I think we get little time to do the reflection."

Similarly, T7 asserted that he is also burdened with a considerable number of periods and different subjects that they are made to teach due to which they are not able to find time for reflective practice.

In Bhutan, Physics teachers are made to teach general science subjects from classes seven to eight. If Physics teachers are placed in Higher Secondary Schools, they teach both classes eleven to twelve and lower science classes, ultimately leading to overburdening them with many subjects to teach and as a result, they find it difficult to manage time. Additionally, participants were responsible for twenty-two to thirty periods per week, each lasting between forty and fifty minutes. Thus, having to teach many subjects in different classes hampers teachers from practicing reflection

6. Discussion

The results consisting of three major themes are explained in the context of previous literature. The Physics teachers' reflective practices are discussed under three sub-themes, namely self-reflection, different strategies and skills and feedback as detailed below.

6.1. Physics teachers' reflective practices

6.1.1. Self-reflection

The finding of the study indicated that few participants performed self-reflection at the mental level. They shared that during the process of teaching and learning, reflection done is at the mental level. Self-reflection was used to find the ways and means to deliver the lesson meaningfully. This corroborates the findings of Johns (2009), who said that reflection is a process where one takes responsibility in critically examining the practice. Akin to finding the ways and means to deliver the lesson meaningfully by the study, necessary modification of actions is emphasized by participants in the study. This is consistent with the definition of reflection by Nguyen et al. (2014) where reflection is a process of focusing on the change of outcome by critically examining one's plans and executions.

Literature also suggests that reflection should allow people to remain open to change while performing activities (Kidd & Czerniawski, 2010; Yuen Lie Lim, 2011). Further, Daker and latchanna (2017) stated that reflection in teaching consists of deliberate recall and remembrance for assessment and decision making. This was also evident in the findings of this study where participants always thought about improving the teaching and finding ways and means to deliver the lesson meaningfully.

6.1.2. Different strategies and skills

Most of the participants expressed their views stating that strategies and skills used in the classroom are mostly dominated by lecture methods with other methods like group work, presentation, assigning activities, and questioning. This could be because of the time constraint and heavy workload where Physics teachers mostly focused on the coverage of the syllabus. Further working in small groups for presentations in the class can make students take responsibility, thereby, critical thinking is developed by students working with interest (Falk-Ross & Hurst, 2009). The finding of this study showed that after group work students are made to present their work in the class, thus, students seriously perform their work.

This study indicated that participants predominantly used lecture method, however, participants were also engaged in other methods like group work, presentation, activities, and ICT depending on the topic and content. Documents like lesson plans by Physics teachers and notebooks maintained by students clearly indicated that participants do not restrict to one particular strategy or skill. The researcher's note of observation revealed that physics teachers evaluate the effectiveness of teaching thereby promoting reflective practices. Different strategies and skills evaluate the needs and effectiveness of students learning, thereby promoting reflective practices of Physics teachers. This suggested that better teaching of Physics involves a thorough understanding of the subject, as well as suitable pedagogies to enhance teaching and learning (Milner-Bolotin, 2016). This brings us to the conclusion that effective teaching and learning are affected by many factors such as different strategies, skills and activities.

6.1.3. Feedback

Few participants of the study emphasize on the inclusion of feedback sessions by video recording, assessment of data, and test scores of the students and directly seeking students' feedback on their lessons. Such practice allowed teachers to modify their lessons for students' better understanding and clarity. This finding of the study aligns with the finding of the study by Naseer et al. (2020) where teachers incorporate feedback sessions in the class to improve their lessons.

Analysis of document such as notebooks maintained by students indicated that participants also provided feedback following appropriate rubrics with criteria on classwork and homework. Feedback sessions were introduced into the teaching and learning by gathering students' perspectives; also, class tests were done to determine if students had grasped the concept taught or not. If pupils do not do well, teachers devise a solution. Asking questions in class to assess if students have comprehended the topic was also a kind of feedback by participants from the researcher's note of observation. This finding concurs with the finding by Tok and Dolapçioglu (2013), who conveyed the idea that educators should be receptive to their students' viewpoints and include them in decision-making.

6.2. Factors promoting reflective practices

The factors that promote reflective practices are discussed under three sub-themes, namely: class activities, class questions and responses by students.

6.2.1. Class activities

In this study, class activities consist of group activities and individual activities. According to a study that looked at ways to model critical thinking in middle and high school students, class activity and small-group inquiry circles were excellent tactics for promoting critical and reflective thinking (Falk-Ross & Hurst, 2009). Such claims were evident in this study where some participants shared that they assign group activity as it allows students to discuss and critically reflect on the tasks before the presentation. As they have to present their work, students tend to take responsibility for their work by critically thinking and discussing. The participants indicated that assigning activities in the class leads to developing reflective thinking for both teachers and students and students begin to take responsibility for their learning.

Similar to that of Tok and Dolapçioglu (2013), who stated that in order to implement learner-centered instruction, teachers must consider individual needs during the teaching process and cater to students of all levels by adding a variety of activities. They expressed that teachers should be open to students' opinions, and involving students in decision-making. Furthermore, according to Olaya Mesa (2018), when teachers are motivated and include various activities, students will be inspired as well, and as a result, students will have a favorable attitude about the activities in class. Such findings were even noted in this study whereby teachers stated that they conduct activities to motivate students towards their learning. Documents such as notebooks maintained by students revealed that teachers assigned different numerical problems

as activities, further occasionally group activities were assigned. Even during class observation students were assigned with activities of solving numerical problems whereby teachers can gauge students' interest and participation thereby triggering teacher's reflection. The Science curriculum framework from classes PP-XII requires students are also required to use Mathematics and computational thinking and carry out STEM activities (Department of Curriculum and Professional Development , 2022).

6.2.2. Class questions

In both teacher-centered and student-centered learning, classroom questioning is an important component to facilitate thinking (Falk-Ross & Hurst, 2009). A study by Utha (2015) on "Formative Assessment practices in Bhutanese Secondary Schools and its impact on the Quality of Education" with teachers revealed that questioning is an integral tool for many reasons. Asking questions measure students' understanding of the lesson, motivates low achievers and helps grab students' attention. Further, it checks the fulfillment of lesson objectives by teachers. Supporting Utha (2015), the present study's finding showed that participants asked questions formally and informally numerous times to check for understanding of the concept.

Findings from this study also indicated that participants asked a variety of questions during class observation. Further, participants asked questions to recapitulate the lesson taught. According to the participants, recapitulating the lesson taught helps develop students' reflective thinking abilities. This finding is similar to that of Falk-Ross and Hurst (2009), who stated that asking questions during the lesson triggers reflection. One way of doing it is by letting students express their queries and support their queries with a positive attitude (Higgins, 2015). This was evident in this study as few teachers provided a platform for students to share and ask questions as it is an important tool to build students' reflective ability. Science curriculum framework from classes PP- XII requires asking questions and defining problem under scientific methods and engineering practices for fulfilling certain learning objectives (Department of Curriculum and Professional Development, 2022).

6.2.3. Responses by the students

Participants shared that questions allow them to reflect on students' responses and students' attitude allow them to determine the effectiveness of their teaching. For example, if students participate and if they are proactive in the class, teachers assume that they are teaching well. On the other hand, if students do not show enthusiasm in the class, teachers assume that they may have to change their teaching skills or strategy. Hence, reflective teachers concentrate on the attitudes of students towards learning (Ashraf et al., 2016). Further, Impedovo and Malik (2016) also pointed out that reflective practitioners practice different strategies to consider behaviors of the children and to keep an everyday record of important events.

Reflection can take place not only at an individual level but also in a group. Krutka et al. (2014) suggested that reflection done with a peer helps people as they refine, develop, and promote teaching skills from diverse perceptions. Teachers' need for being professional is contributed by factors such as diversity of students, objectives, and contexts (Çimer et al., 2013). Hence, the finding from this study agrees with Krutka et al. (2014) as responses by a group of students and attitudes of students during classroom teaching and activities makes the participants of this study reflect on their teaching considering numerous views and perspectives.

6.3. Challenges Physics teachers' face in using reflective practices

The challenges Physics Teachers face in using reflective practice are discussed under three sub-themes, namely lack of resources, time constraint and workload as detailed below.

6.3.1. Lack of resources

Rashidi and Javidanmehr (2012) shared frustration regarding factors such as rules and regulations of institutions and schools impeding

reflective practices. Further they stated that financial restrictions and a scarcity of textbooks are other stumbling blocks for reflective practices. Linking to this, data revealed that the participants were not happy with the speed of the internet as it obstructed them in searching for additional resources and information related to the content. Hence participants were forced to use lecture method thereby neglecting their reflective practices. This concludes that technology has a crucial role in promoting reflective practices.

It appears that in parallel with Tajik and Ranjbar (2017), lack of chances for instructors to upgrade and autonomy was categorized as self-directional issues, as well as institutional issues such as diverse and overcrowded classes, were reported in their study. Several participants in this study also mentioned resources as a major constraint besides crowded classrooms. Especially lack of adequate computers was mentioned as a lack of resources, which in turn hampered reflective practices by not being able to plan interactive lesson plans.

6.3.2. Time constraint

One of the findings of this study showed that the teachers rush to complete the prescribed content within the stipulated time. Few participants stated that they failed to promote reflective practices since they focus more on the coverage of the content. This makes the teachers deliver the content directly. A finding of this study coheres with that of Tok and Dolapçıoğlu (2013) who upon exploring reflective practices in Turkish primary school teachers emphasized the bulky curriculum and packed classrooms acted as impediments to instructors engaging in reflective exercises. Furthermore, a study by Kano et al. (2017) indicated that due to a scarcity of time, teachers are unable to model reflective behavior in pupils.

Tajik and Ranjbar (2017) specified that institutional issues such as institutions policy act as obstructions since teachers have to complete prescribed amounts of content within the given time. As a result, teachers do not have ample time to perform reflective teaching. The finding of this study reported that teachers focus on coverage of the content rather than reflective practices. Participants also mentioned that they need to cover the content on time and correction of students' notebooks and project work impedes the practice of reflective practices. The finding corroborates teachers' maximum time is used up in correcting students' work, hence teachers get inadequate time (Ashraf & Rarieya,2008). This brings to the conclusion that factors such as lack of time inhibit teachers' reflective practices.

6.3.3. Work load

In this study, several different subjects shouldered by teachers are considered as workload. Thus, the heavy workload shouldered by participants act as an impeding factor in reflective practices. Tajik and Ranjbar (2017) pointed out self-directional problem that hampered reflective practice, their study identified a lack of interest and a severe workload. However, participants of this study did not express their lack of interest in reflective practice. The teacher respondents of the study by Minott (2010) strongly also agreed that they are involved in either additional tasks or were assigned with prescribed teaching hours.

As evident from the findings, teachers deal with many subjects. They are even made to teach science for lower classes apart from Physics. Therefore, a constant reflection on their teaching seems very limited. Further few of the participants argued that if teachers are provided with a single subject or discipline, detailed reflection on the subject is possible. This resembles the finding made by Wangdi (2016), who stated that workload and a lack of time were two factors that hampered reflective practices. He further added that reflecting and using reflective practices was not feasible during the lesson.

7. Conclusions

Reflective practice provides an avenue for teachers to constantly review and improve their practices to effectively counter the needs of their students. Teachers focusing on reflective practices constantly update and expand their professional knowledge to meet the increasing need of diverse

students. Reflective practices are a process where teachers consider what is currently done, why it is being done and how well students are learning. Reflective practices of Physics teachers have been explored in this study. As per the findings, three broad themes with nine sub themes have been revealed from the study. The following conclusions can be drawn from the present study.

Physics teachers practiced diverse reflective practices which include self-reflection and reflecting while incorporating different teaching strategies and skills. Teachers also focused more on lecture methods although they practice different teaching skills and strategies sporadically. As a part of reflective practices, extensive feedback was given to students and at the same time, teachers collected feedback from students. Physics teachers also asked questions to gauge the comprehension of the content being taught thereby promoting reflective practices.

Reflective approaches are determined by three factors: classroom activities, teacher-asked questions, and students' responses. Classroom activities are assigned to promote the reflective practices of students, students' responses clearly indicated whether the lesson taught in the class is effective or not. Finally, teachers also encountered several challenges while engaging in reflective practices in the class including lack of access to good internet services and IT infrastructures for gathering additional information for better learning, inadequate time and tremendous workload. Thus, these challenges have greatly impacted the reflective practices of teachers.

8. Limitations and recommendations

The limitation of the study is in terms of research sites selection. This study selected research sites as per the researcher's convenience. Thus, all the four schools included in the study are from the eastern part of Bhutan. Another inadequacy is with regard to the lack of prior studies done in Bhutan. The literature studies involved in this study were based on research conducted mostly in other countries, therefore, the context remains different. Thus, to make the result more reliable, further research can be undertaken by gathering data from wider parts of nation.

Ethical consideration

The researchers had obtained the necessary clearance from relevant authorities and officials to conduct the study.

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