

Physics Teachers' Reflective Practices in Middle and Higher Secondary Schools: A Case Study

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Abstract

Reflective practices are an essential component of teaching and learning that aid teachers in becoming aware of their professional expertise and how they educate to promote critical assessment. Studies conducted in Bhutan revealed that teachers in Bhutan are confined to teaching technicalities than reflective practices. The study explored the reflective practices of physics teachers of Higher Secondary and Middle Secondary schools in Bhutan. The study employed a case study, wherein the case study comprises a detailed analysis to provide an exploration of the situation and processes involved in the phenomena. The study collected physics teachers of Higher Secondary and Middle Secondary schools' perceptions of reflective practices and their teaching experiences impacting reflective practices. Data collection comprised qualitative interviews with 7 physics teachers. Findings revealed that physics teachers employed reflection-in-action and reflection-on-action. Physics teachers differentiated reflection-in-action from reflection-on-action. Furthermore, physics teachers employed reflective practices and demonstrated an inconsistent frequency of reflective practices. It was recommended, among others, for the quality of application of reflective practices in schools, some policy guidelines should be formulated to guide the implementation process by respective stakeholders. In addition, the results of this study are expected to contribute to the body of knowledge on the reflective practices of physics teachers that apply to the local and international context.

Keywords: *Reflective practices, Physics teachers, Reflection-in-action, Reflection-on-action, Teachers' experiences*

1. Introduction

There are several difficulties in teaching in the 21st century [21]. It is attributed to factors such as the diversity of learners, pedagogical innovations, and requirements of the latest skills and strategies like problem-solving skills and creativity [10]. Therefore, the difficulties associated with teaching demand teachers question their teaching practices to improve learning performance [28]. Reflective practices play a paramount role in effective teaching and learning. Moreover, the implementation of reflective practices in large classes is

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complicated in the beginning and requires considerable effort in the middle however, when students exhibit a significant result, in the end, complications experienced tend to be nullified [24]. Reflective practices by the practitioner should continuously relate to effective teaching, thereby improving curriculum and understanding the competence of teachers and students, resulting in promoting professional development [33].

The Ministry of Education in Bhutan encourages teachers to incorporate reflective practices. However, research on reflective practices in schools in the Bhutanese context is limited, and few studies are focusing on reflective practices in the Bhutanese higher education setting. Moreover, no written policy guides teachers' reflective practices in schools across Bhutan. For example, a study by Wangdi [49] revealed that at the school level there is no written policy to guide the reflective practices of teachers and these are further compromised owing to workload and teachers' multitasking. Although teachers in Bhutan use reflective techniques, including peer and school leader monitoring of lessons and collecting student feedback in classrooms, they face difficulty in implementing reflective practices, impacting the quality of teaching and learning [47].

This study explored the reflective practices of physics middle and higher-secondary physics teachers. The Science curriculum in Bhutan was reformed in 2008 considering the advancement of digital technologies and change from the traditional silo-based approach to consolidative STEM education [13]. The reason for choosing physics teachers as a participant in the study was the considerable importance the Royal Government of Bhutan places on STEM (Science, Technology, Engineering, and Mathematics) subjects [36]. Moreover, the importance of STEM subjects is emphasized in building human resources with adequate scientific knowledge and facilitating a developmental process in the country.

Despite numerous advantages of reflective practices in the course of the teaching and learning process. Teachers in Bhutan lack in-depth and systematic knowledge in conducting reflective practices. Numerous studies pointed out that teachers' reflective practices lie at low and medium levels [6]. Similarly, teachers in Bhutan confine the teaching and learning process to technical teaching than to reflective teaching [49]. His study showed that teachers focus on teaching technicalities including the application of knowledge in the classroom, effectiveness of teaching-learning resources, teaching techniques, and procedures. Furthermore, a study by Pokhrel [35] indicated that most teachers in secondary schools make use of different teaching strategies, possess competent content knowledge, and provide timely feedback, however not all teachers are equipped with appropriate reflective models and practices. Therefore, Bhutanese teachers need to employ systematic and various reflective practices in a classroom setting apart from using varied teaching strategies, competent content knowledge, and fair assessment. Consequently, this study investigates the reflective practices of physics teachers in Higher and Middle Secondary schools.

2. Research Questions

Since the study is to find out the reflective practices of physics teachers in Higher Secondary School and Middle Secondary school, this study aims to address the following research questions:

- a. What is meant by reflection-in-action and reflection-on-action by physics teachers?
- b. What is the frequency of reflective practices by the physics teachers?

- c. How do the reflective practices of physics teachers differ from the teaching experiences?

3. Review of Related Literature

3.1. Theoretical underpinnings

It is crucial to investigate teachers' reflective practices since there is a comprehensible relationship between students' outcomes and teachers' reflective practices. Therefore, it remains imperative to explore about reflective practices of teachers to investigate underlying beliefs and philosophies in the teaching and learning process. This Reflective thinking can be attributed to John Dewey's and Donald Schon's thoughts [24]. Further, a large number of studies are inspired by John Dewey and Donald Schon wherein they suggested that learning is a collaboration of theory with practice and experience with introspection [34]. Moreover, John Dewey is referred to as the founding figure of reflective practices in education [32] [20]. Important contributions have been made by John Dewey and Donald Schon in the field of reflective thinking and reflective practices [19]. Taken together, hence conclusions were drawn wherein John Dewey and Donald Schon contributed and provided a strong theoretical framework in the field of reflection in education.

3.2. John Dewey's outlook on reflection and reflective practice

John Dewey used the terms "reflection," "reflective thought," and "reflective thinking" almost a century ago [31]. Dewey provided one of the most widely accepted descriptions of reflective thinking, however, scholars claimed that his description was limited to rational thought and decision-making [18] where he ignored the construction of knowledge through intuitive feeling and emotions [20]. This criticism, however, seems to disregard Dewey's viewpoints on the development of the self and his understanding of how emotions and intuitive feelings relate to knowledge [45]. To significantly understand the importance of it, Dewey did not prefer decision-making and reasoning over intuitive feelings and emotions, in contrast, he viewed the construction of knowledge as the use of intuitive feelings and emotions [18].

Dewey [14] distinguished between two ideas when defining the term "reflection": one is accepting a concept with little or no consideration of the evidence, and the other is looking for the proper evidence to support one's opinions. In a later passage, he refers to "reflective thought," which is the active, persistent, and rigorous evaluation of any opinion or purported body of knowledge in light of the justifications for it as well as the conclusions that follow. Dewey described reflection as a profound interpretive process that promotes conscientious judgment below. Stoller below highlighted that reflective thinking involves changing oneself with an environment within the field of practice. In essence, reflection consists of a systematic process of questioning existing values, assumptions, and perspectives that form a base for people's actions, decisions, and judgments [26].

3.3. Donald Schon's outlook on reflection and reflective practices.

It was Dewey who bridged a gap between reflective thinking and practical implementation, however, Donald Schon suggested that reflection can be done before, during, and after [43]. The reflective practices of Dewey were further divided into reflection-in-action and reflection-on-action [41]. Furthermore, to demonstrate that professional teachers make

decisions with some degree of consciousness, Donald Schon distinguished between reflection-on-action and reflection-in-action [17][34]. Donald Schon described reflective practice as the process of discovering one's theories of action and exercising control over them to improve one's practice [5].

Schön [40] defined the reflective practice as a 'dialogue of thinking and doing through which I become more skillful' (p. 31). Further, he emphasized that reflection is crucial for both looking back on past actions and thinking while carrying out current ones. Consequently, Schon introduced the concepts of "reflection-in-action" and "reflection-on-action". Slade et al. [43] explained that reflection occurring during application is known as reflection-in-action, whereas reflection occurring before and after the application is known as reflection-on-action. Sunra et al. [46] differentiated reflection-in-action and reflection-on-action as follows reflection-in-action according to Schon takes place during the action, it refers to deducing, analyzing, and devising solutions during the action. In contrast, reflection-on-action occurs after the incident has already occurred and is concerned with understanding ourselves and finding the meaning of what we are doing.

3.4 Reflective practices and teachers

The definition of reflective practices is based on components such as deepening one's understanding of self and others, focusing on cognitive, behavioral, and emotional aspects, and finally focusing on the connection between past, present, and future [22]. Fergusson et al. [15] defined reflective practice as a salient skill and method that constructs a learning situation and assures a learning outcome that couples previous experience, specific contexts, and practice guided by theory. Reflective practices were explained by Greenberger [18] as a skill of reflecting on past experiences and as a method of inquiring into the problems of professional experience that is related to the context and also theory-guided. Therefore, it bridges the gap between theory and practice [28].

Reflective practices' basic tenet is that only deliberate reflection on an experience can ensure learning, not experience alone [28]. A study by Pazhoman and Sarkhosh [34] in an Iranian high school revealed that there was no notable relationship between teaching experiences and reflective practices like self-regulation this may be an indication that teachers are aware of the benefits of being reflective and self-regulated in their practices. Further, no significant differences in the three areas of reflective practices and teachers' experiences [2]. A study comparing how qualifications and teachers' experiences impacted reflective practices revealed that teachers possessing higher qualifications and higher experiences have good perceptions of reflective practices [1]. Thus, reflective practices can be impacted by the factors such as teachers' experiences.

Teachers are professional and have unique experiences that can be interpreted in time and context, thus, each teacher has personally built knowledge of what it is to be a professional, to be a teacher, and to be reflective [4]. For a better quality of education, teacher professionalism plays a key role [2]. Reflective practices essentially accelerate professionalism, improving the teaching and learning process. According to Mathew et al. [28], the complexity of teaching requires teachers to evaluate their methods to advance their professional growth and improve students' learning. Further, Mathew and colleagues suggested that reflective practice in practice-based professional learning environments, where employees learn from their own professional experiences rather than through formal education or information transfer, reflective practice is a crucial skill.

4. Methodology

4.1. Research method

This study employed a case study method to seek answers to the research questions. Using a qualitative case study as a research methodology can investigate a phenomenon within a specific setting through several data sources, and it conducts the investigation using several lenses to show the subject's many features of the incident [7]. In a like manner, case studies are methods to illustrate, describe, or investigate phenomena [3]. To provide an exploration of the situation and processes involved in the phenomena, case study research entails a thorough investigation, frequently using empirical data gathered over time from a clearly defined case [37]. This particular study focused on analyzing the reflective practices of Physics teachers of Higher and Middle Secondary schools.

4.2. Population and sampling

Rules of thumb for sample size in the qualitative study consisted of different views by different authors lacking clear rationale that includes the same and varying perspectives, and for the single case studies, it consists of 4 to 30 [42]. In a qualitative study, a small purposively selected sample is employed [30] to increase the depth (as opposed to breadth) of comprehension [32]. Purposive sampling involves choosing the respondents in a way that will produce results that are both accurate and appropriate [23] while also encouraging the use of fewer resources [32]. This study consists of 7 physics teachers in total (4 Physics teachers teaching classes 11 and 12; 3 Physics teachers teaching classes 9 and 10). The participants as physics teachers were chosen since they were ready to participate; furthermore, reflective practices of physics teachers were unexplored in Bhutan. Participants had a minimum Bachelor's Degree in Education specializing in Physics, and only one participant had a Master in Education specializing in Physics.

5. Data Collection Methods and Instruments

Data were collected through non-participant observation followed by post-lesson conferences, face to face semi-structured interviews with the physics teachers.

5.1. Classroom observation

The non-participant observer notes that the researcher's position might not provide a complete picture of the issue without any engagement in human contact in the field, yet the researcher might change the roles based on the case's requirements [9]. Classroom observation was conducted to get information about the real condition in the class. The researcher observed a total of 7 classes, taught by 4 Higher Secondary teachers in classes 11 and 12 and by 4 Middle Secondary Physics teachers in classes 9 and 10. No practical classes conducted in the Physics lab were observed during the data collection period. The class observed mainly consists of lessons in the classroom consisting of activities, lectures, and demonstrations. During the teaching and learning process, the researcher observed elements like reflection-in-action and reflection-on-action. The researcher also observed the frequency of reflective practices and variations in reflective practices concerning teaching experiences. After the classroom observation, each participant was subjected to the post-observation conference, where questions were asked to elicit an understanding of reflection-in-action and reflection-on-action mainly.

5.2. Face-to-face semi-structured interview

DeJonckheere and Vaughn [11] suggested that the major goal of the semi-structured interview is to get information from the key informants who have intimate knowledge of the issue of interest and who have attitudes, perceptions, and beliefs about it. They further noted that this approach entails a conversation between the researcher and participant that is aided by an adaptable interview protocol and additional follow-up questions, probes, and comments. For this study face-to-face, a semi-structured interview was employed. The semi-structured interview was conducted in this study to draw the lived experiences of the participants to explore the case in depth. The interview was scheduled at the convenience of the interviewer and interviewee. About 60 minutes were allotted for each interview. The interview was conducted after class to avoid interfering with the interviewee's class. Thus, those conditions enabled an in-depth understanding of the context. Interviews largely elicited the participants' comprehension of reflection-in-action and reflection-on-action and reflective practices of teachers having varying experiences.

5.3. Data analysis

This study employed thematic analysis. Thematic analysis is a qualitative technique for finding, examining, and reporting patterns in data [8][39]. Moreover, thematic analysis is defined as a descriptive approach that adapts the data reduction to fit with another analysis approach [48]. Besides, thematic analysis of open-ended responses from surveys or transcripts of interviews provides for a comprehensive exploration of the teaching and learning setting than quantitative analysis while also allowing for flexibility and interpretation of the data, however, caution must be exercised to depict the transparency of method to maintain authentic finding [8]. Moreover, thematic analysis according to Scharp and Sanders [39], Braun and Clarke's thematic analysis method is a repetitive process consisting of six steps: gaining familiarity with the data, creating coding categories, producing themes, reviewing themes, defining and naming themes, and finding examples are all steps in the process.

6. The Quality of Research

The following strategies are employed in checking and confirming the validity and reliability of interpretations and findings.

6.1. Triangulation

According to Mays and Pope [29], triangulation is employed in describing the process of comparing the result from two or more data collection approaches or from two or more data sources to confirm and substantiate overall result interpretation. They emphasized that triangulation protects the validity of the study by making up for one method's deficiency with another, moreover agreements between results from two separate methods can reinforce the total conclusions. In addition, the triangulation of different data collection methods contributes to the reliability of the results [44] and the saturation of data [16]. Thus, for this study, two different data collection methods, classroom observation, with post-lesson conferences and face-to-face semi-structured interviews, were used to validate the finding.

6.2. Member Check

Member check is referred to as validation by the respondents, it is considered by many since it establishes credibility [27]. Respondent validation in member checking is performed to check the views shared by the respondent to see if the research is in line with their views [38]. Member checks, in the opinion of Lincoln and Guba [27], give participants and researchers a chance to condense, make clear, talk about, and elaborate on the results of data analysis. The process of member checking was ongoing for this study. While the interview was being performed, the researcher checked and clarified any words, phrases, or viewpoints that were not clear. During the process of transcribing the interview transcripts, the researcher also made sure to double-check the participants' responses, anything that was unclear or in dispute. Following transcription, the researcher distributed the transcripts to the participants.

7. Results

The data analysis, such as face-to-face semi-structured interviews, post-lesson conferences, and, classroom observations, revealed the following themes: i) Reflection-in-action and reflection-on-action by physics teachers, ii) Engagement of physics teachers in reflective practices, iii) Teaching experiences and reflective practices.

7.1. Reflection-in-action and Reflection-on-action by physics teachers

Data from the face-to-face semi-structured interview and post-lesson conference elicit Physics teachers' understanding of reflection-in-action and reflection-on-action. Some participants were not very confident in defining reflection-in-action and reflection-on-action. All participants defined reflection-in-action as a reflection during the teaching process and reflection-on-action as reflecting after the lesson. To illustrate, for example, T1 mentioned that:

To be honest, I don't know the meaning of reflection-in-action and reflection-on-action. Still, if I am to share my understanding of this concept and these two terms, I think reflection-in-action means reflecting on our practices during teaching on the spot. That is what I feel is reflection during instruction. Reflection-on-action means a reflection on what you are doing after the teaching.

Likewise, T6 although not very sure about defining reflection-in-action and reflection-on-action, understood reflection-in-action as a reflection during the teaching process whereby teachers reflect on components that were good and that were not very good in the lesson and degree of understanding of the lesson by students. While the reflection-on-action focus on teachers reflecting after the lesson by integrating elements such as the delivery of the lesson to improve in the future. T6 shared as follows:

Reflection-in-action refers to your reflection on teaching, such as what is going well. What is not going well? How do students perceive your lesson? That could mean reflection-in-action. Then reflection-on-action implies that once the teaching is over, you will reflect on how your classes went. Whether your teaching was up to the expectation as prepared and if things didn't go well, maybe what are some of the things you will have to bring changes for the future, and that could refer to as reflection-on-action.

Data from the post-lesson conference revealed that most of the participants expressed that they will make changes to the lesson if they were to reteach that same lesson. Except for participant T1, all agreed that there would be minor changes in the same lesson if they were to

reteach the same lesson. However, T1 was adamant in his view and asserted that more or less he would have done the same things for the next lesson on the same topic while T3 said, "I would embed video clips in the lesson". Similarly, T7 said:

If I have to teach the same lesson again, I as a teacher will try to bring real-life examples of relative density to the everyday substance that we use in day-to-day life, especially the density of water and the density of oil.

Therefore, most of the participants indicated that they would make specific changes in the lesson if they were to reteach the same lesson, which was categorized as reflection-on-action. Similarly, data from the classroom observation indicated that most of the participants employed reflective practices such as asking questions, conducting activities like numerical problems, and providing timely feedback to tasks assigned during and after the delivery of the lesson. Thus, participants employed both reflection-in-action and reflection-on-action in teaching and learning lessons.

7.2. Engagement of physics teachers in reflective practices

In the interview, to gauge how often Physics teachers reflect during the teaching, participants were asked how often they "reflect in action" during the lessons. To see how frequently participants, perform reflection-on-action, the researcher noted the reflective practices of participants from the class observations.

When participants were asked how often they perform reflection-in-action, all participants contended that they reflect frequently whenever necessary and whenever students seemed confused. T2 specified that he reflects during, and after discussions, quizzes, and class activities. Similarly, T6 indicated that he reflects to ensure that the process goes well as it is a prerequisite for meeting the intended learning objectives. Besides, T2 stated that he reflects during classroom teaching as revealed in the excerpts:

So reflection-in-action during the lessons I think I used to do most of the class during my teaching. I used a discussion, and then sometime after the discussion, we just usually teach. After teaching the few sentences, we then conducted the test quiz and also do some activities in the classes, and sometimes we give immediate feedback.

Similarly, T6 reported:

We should reflect, and reflection-in-action should be done frequently because when we plan, we have so many things to fulfill. Firstly, you have the objectives, then you have a process and, then you will have to look at the student's participation.

Simultaneously, T3 and T4 specified that they perform reflection-in-action two or three times during the lesson. For example, T3 said, "During my delivery of lesson I reflect the around twice or thrice which I say is reflection-in-action".

It was evident from the interview data that all participants performed reflection-in-action, however, only a few specified the process of reflection-in-action. Upon analysis of data from the classroom observations, participants performed diverse reflection-in-action, it was found that participants were assigned some questions as a follow-up activity, especially after lesson delivery. Likewise, few participants summarized their lesson as a follow-up activity. This was done to check students' understanding of the lesson. Only two teachers mentioned that they administrated a class test that facilitated the analysis of data from a test that was categorized as reflection-on-action.

7.3. Teaching experiences and reflective practices of physics teachers

Analysis of the transcript of a post-lesson conference and face-to-face semi-structured interview revealed that participants associated reflection-in-action and reflection-on-action with teaching experience. It was evident that experience leads to greater reflective practices during the teaching and learning process. To illustrate, for instance, T1, who had 13 years of teaching experience remarked:

Regarding today's lesson, I was always seeking and thinking about involving my students. While delivering the content, I asked the questions and expected the answers from the students so that they get involved. So, in a way, I have been reflecting on my practices. What should I do to make the lesson enjoyable? What to say now to make this lesson meaningful?

It was evident that reflections were used in the lesson. In the same way, T2, who has 7 years of teaching experience, shared reflection-in-action and reflection-on-action as follows:

So, in this lesson, I have just seen that after my teaching, I thought that few students understood what the lesson was, and the rest of the students, I believe, were just still in a dilemma and didn't know what they were learning. I believe that in the lesson development part when I am teaching that particular topic and adding some of the activities like multiple choice questions or quiz questions, the student could have learned very well.

Thus, more experienced teachers achieved greater satisfaction with lesson delivery in the class, as well as greater clarity of reflective practices. However, T3, who had less than 1 year of teaching physics mentioned that there were fewer reflective practices in the class and expressed, "I think I didn't get enough time to reflect during the lesson because for the reflective lesson I think it is time-consuming and due to limitation of time". Similar to T4, who had 2 years of experience teaching physics, said, "To be honest, I forgot to reflect, so hopefully I can reflect myself in the next lesson". The above discussion suggested that the number of teaching experiences plays an important role in employing reflective practices during the teaching and learning process. Consequently, this directly impacts the level of satisfaction in delivering the lesson.

8. Discussion

The study suggested that participants were consistent in differentiating reflection-in-action and reflection-on-action. Firstly, the perception of reflection-in-action and reflection-on-action was a consistent finding intensely emerging from almost all interviews, and it is in line with previous research mentions that reflection during the application and reflection before and after the application [43]. Moreover, reflective practices propounded by John Dewey were further divided into reflection-in-action and reflection-on-action [41]. Furthermore, for professional teachers to make decisions with cognizance, it was Donald Schon who differentiated reflection into reflection-in-action and reflection-on-action [17][34].

Participants in the sample agreed that reflection occurs during the teaching and learning process, and participants included reflection-in-action to assess the lessons' strengths and weaknesses. Similarly, almost all participants reflected after lessons. One participant expressed a divergent opinion, claiming that his lesson would remain unchanged even if he taught it again. In contrast, the majority of the participants said they would make modifications if they were to reteach the same topic again. Participants reflected after the lesson to make it meaningful and contextualized by including real-life examples, leading to taking charge of one's actions. The study's findings support Donald Schon's description of

reflective practice as the process of identifying one's theories of action and taking steps to manage them to enhance one's practice [5]. Sunra et al. [46] referred to reflection-in-action relates as inferring, analyzing, and coming up with solutions; reflection-on-action takes place after the incident has already happened and is focused on knowing oneself and determining the significance of one's actions.

Reflective activities involve linking the past, present, and future while also comprehending oneself and others from various perspectives, including cognitive, behavioral, and emotional aspects [22]. Similarly, participants in the study focus on the set of lesson objectives framed to be fulfilled, moreover focusing on the process of teaching and reflecting on the lesson once taught. Mathew et al. [28] recommended that teachers must examine their practices to heighten their professional development and enhance students' learning owing to the complexity of teaching. Additionally, Mathew and colleagues proposed that reflective practices are a practice-based professional learning environment. The study revealed that participants created a professional learning environment such as discussions, organizing quizzes, and asking critical questions during lessons.

Participants consistently created learning environments in the class that are suitable for their context such as assigning numerical activities in the class, asking questions in the middle of the lessons, and summarizing at the end of the lesson. This result agrees with Fergusson et al. [15] that stated that reflective practice is a crucial skill and methodology that creates a learning environment and ensures a learning outcome by fusing prior knowledge, particular situations, and practice informed by theory. Furthermore, Greenberger [18] defined reflective practices as a skill for looking back on prior experiences as well as a theory-driven approach to investigating issues with professional experience that is relevant to the context.

Teachers were aware of the advantages of being reflective, and ultimately self-regulated their practices; there was no significant association between their experience and reflective practices and self-regulation [34]. The three categories of reflective practices and teacher experiences showed no discernible differences [2]. However, this study's findings revealed that the more the number of teaching experiences, the greater degree of reflection, depicting greater clarity of reflective practices. The finding is consistent with Afshar and Farahani [1] who examined the impact of teachers' credentials and experiences on reflective practices and found that teachers with higher qualifications and experience have positive perceptions of reflective practices.

Finally, participants with greater teaching experiences were seen as involved in reflective practices, always seeking to engage students in the teaching and learning process. On the contrary participants, with a smaller number of teaching experiences made less effort to involve students in the teaching and learning process through reflective practices. This is consistent with the research conducted by Latchanna and Daker [25] although not highly significant; however, teachers having more experience seem to be more reflective than others. However, it is not in agreement, which stated that "there is no significant difference between social studies teachers' seniority, workplace and their reflective levels" [21].

9. Conclusion

While reflective practices accelerate teachers to become better professionals, teachers in Bhutan are seen deeply involved in teaching technicalities, thereby focusing less on reflective practices. Teachers in Bhutan are competent professionals, thereby imparting the proper content knowledge. Moreover, teachers exclusively focus on teaching skills and strategies. During the teaching and learning process teachers also evaluate the effectiveness of teaching

and learning resources. However, teachers mostly restrict their effort to their professional development over reflective practices. Therefore, in addition to employing a variety of teaching techniques, the right teaching resources, and fair assessment is crucial for Bhutanese teachers to engage in systematic reflection practices in the classroom.

The finding of the study suggests that Physics teachers incorporated both reflection-in-action and reflection-on-action during the teaching and learning process. Physics teachers can differentiate and define reflection-in-action and reflection-on-action clearly. The study also found that physics teachers' reflection-in-action was inconsistent as some reflected countable times, whereas others reflected frequently so that they can fulfill numerous learning objectives of the lesson. In the same vein, few physics teachers employ a class test to evaluate the comprehension of the lesson, which enables them to analyze the data of the class test. Reflective practices were greatly influenced by the experiences of the teachers; teachers with the most experience regularly engaged in these reflective practices, and the clarity with which they executed these practices was good.

10. Recommendation and Limitation

Research related to reflective practices of physics teachers in Bhutan is extremely limited. Since there is a dearth of research in the field of reflective practices, this presents the biggest difficulty for educators in Bhutan in focusing on reflective practices. The findings of this study are anticipated to add to the pool of knowledge that is pertinent to Bhutan both locally and globally. Further research can be conducted to shed more light on some of the factors that foster and hinder reflective practices of science teachers in general and physics teachers in particular. Moreover, future research can delve into how reflective practices foster the comprehension of the lesson taught by physics teachers. We would imagine that future research on this topic could also include the perspectives of other stakeholders, such as the children taking science and Physics classes, principals, and curriculum developers.

The main objective of this study was to find out the reflective practices of the Physics teachers of Bhutan from the perspectives of selected participants. Given the scope of this study, we were unable to interview a large sample and conduct follow-up interviews to obtain the participant's rich narratives. Future studies can concentrate on increasing the sample size and follow a multiple-stage interview for a rich narrative. Although research can contribute to a pool of knowledge, however, the study's generalizability is limited due to the small sample size and methodology used.

The study suggests Ministry of Education of Bhutan reevaluate the importance placed on reflective practices by offering opportunities for professional development through retreats, conferences, courses, and seminars. Studies revealed that Physics teachers are aware of the significance of reflective practices, but professional development in this area has to be strengthened.

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