Original Article

Challenges faced by the primary science teacher while teaching elements and their symbols in two schools under Monger Dzongkhag

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Abstract: During the inception of modern education in the 1960s, Bhutan did not have her own science curriculum contextualized to suit the learners, therefore the science curriculum was borrowed from India. The department of education could develop and implement the country's first curriculum incorporating Bhutanese culture and traditions. This qualitative research study utilized semi-structured interviews and class observations to investigate the challenges faced by teachers in teaching elements and their symbols to class VI students. The data collected was analyzed through coding and theme identification. This study revealed three key challenges in the teaching process: Lack of resources and limited access to technology, Addressing misconceptions, and Abstract concepts. These challenges shed light on the difficulties teachers encounter when imparting knowledge related to elements and their symbols. Understanding and addressing these challenges is crucial for enhancing the effectiveness of science education at the primary school level. Science is universal where the methods of instruction vary. In Bhutan the quality of science education has improved with concerted effort of curriculum revisions. However, a growing body of data indicates that numerous problems and difficulties have a significant impact on the Bhutanese science curriculum. The Bhutanese science curriculum has been examined by several scholars and has provided a number of suggestions for reformation and improvement. Researchers believe that a child's early exposure to science is crucial to ensuring that they understand the subject effectively when they move on to higher grades. Mooch states that primary education is the foundation of formal education in which the subsequent levels of the nation's education system rest. From the researcher's lived experience of schooling, it is considered that lessons learned early in life will have a bigger impact on students' later lives. In order to build a strong foundation, teachers' competencies are crucial in making students understand the subject matter. The researcher, being a science teacher for 5 years, has taught primary science.

Keywords: qualitative research, semi-structured interviews, challenges, science education

1. INTRODUCTION

During the inception of modern education in the 1960s, Bhutan did not have her own science curriculum contextualized to suit the learners, therefore the science curriculum was borrowed from India [1]. The department of education could develop and implement the country's first curriculum incorporating Bhutanese culture and traditions [2]. Bhutan initiated several science curriculum reforms aligned with the growing demand across the world. The crucial reformation of Bhutanese

science curriculum was undertaken in the 11th five-year plan from the year, with framing of national science curriculum from class PP to 12 and implementation of separated science for class IX [3]. Science is universal where the methods of instruction vary. In Bhutan the quality of science education has improved with concerted effort of curriculum revisions. However, a growing body of data indicates that numerous problems and difficulties have a significant impact on the Bhutanese science curriculum [4]. The Bhutanese science curriculum has been examined by several scholars and has provided a number of suggestions for reformation and improvement [5]. Researchers believe that a child's early exposure to science is crucial to ensuring that they understand the subject effectively when they move on to higher grades. Mooch states that primary education is the foundation of formal education in which the subsequent levels of the nation's education system rest [6]. From the researcher's lived experience of schooling, it is considered that lessons learned early in life will have a bigger impact on students' later lives. In order to build a strong foundation, teachers' competencies are crucial in making students understand the subject matter. The researcher, being a science teacher for 5 years, has taught primary science [7]. The researchers have encountered several challenges in terms of strategies used, content, and classroom management beside others. One of the areas teaching primary science focuses on elements and their symbols [8]. Elements and their symbols are a part of Bhutanese science curriculum from class V onwards and forms the basis for science education in Bhutan as per the national school curriculum [9]. The researcher's experience of teaching primary science over the last five years has enabled the researcher to recognize that teaching elements and their symbols is the most problematic area that consumes a lot of time. The researcher believes that the teaching of elements and their symbols is a growing concern amongst teachers due to their limited knowledge and skills in teaching science and opportunity for content enhancement [10]. The researcher is of the view that the teachers are not able to disseminate the concept and the content effectively due to their limited skills and exposure in the area of the subject competency [11]. This research study intends to find out the challenges and opportunities that the teacher faces in teaching elements and their symbols [12].

2. MATERIALS AND METHODS

Positive and phenomenological, sometimes known as qualitative and quantitative, paradigms have historically been used by academic scholars to approach research studies It forms the foundation for the research and guides us on what tool to be used in order to gather the information for our research. The systematic approach to solving a research topic through collecting data using various approaches, providing an interpretation of the data collected, and drawing inferences from the study data is known as a methodology in research. According to Macdonald, an inadequate study design and methodology results in an unstable foundation for any review, evaluation, or future plan. Thus this underlines the importance of choosing the appropriate research design and methodology to get the actual result for our research. In research, two fundamental methods are used for either approach; quantitative or qualitative. Those researchers who adhere to the scientific paradigm frequently adopt the quantitative approach This method seeks to quantify data, draw conclusions, and generalize findings from a sample of a target population It necessitates a methodical approach to data collection with output in numerical form. Quantitative research also detects objective statistical analysis. The qualitative research method is designed to produce a thorough and detailed account of your observation as a researcher, in contrast to the quantitative approach, which tries to count items to understand what is observed. The data collected can be contextualized and interpreted using the qualitative method. The subjective nature of the qualitative research method necessitates using fewer, more selective respondents. Combining traditional quantitative and qualitative methodologies resulted in a newer methodology. According to Brennen and Moss, combining quantitative and qualitative research methods while simultaneously acknowledging both limits, the mixed methods

approach has the potential to aid researchers in better understanding social relations and their intricacies. The researcher opted for the qualitative method in conducting the study, driven by the nature of the research question that aimed to gain a deep understanding of ideas, experiences, and concepts. Qualitative methods were deemed most appropriate for exploring the complexities and nuances surrounding the challenges and opportunities of teaching science to Class VI students, specifically focusing on the elements and their symbols. By employing qualitative approaches, the researcher strived to gather comprehensive knowledge and insights from the perspectives of Class VI teachers in Monger Dzongkhag. In this study, qualitative inquiry provided the researcher with the flexibility to delve into the lived experiences and unique perspectives of the participating teachers, allowing for a rich and in-depth exploration of the challenges and opportunities encountered in teaching science. The primary objective of the study was to compile a comprehensive account of the opportunities and challenges faced by science teachers when instructing Class VI students on elements and their symbols. By adopting qualitative methods, the researcher aimed to capture the diverse range of experiences and perspectives held by the participating teachers. Through interviews conducted using a semi-structured approach, the researcher provided the participants with the opportunity to openly share their insights, reflections, and strategies employed in their teaching practices. The study focused specifically on Class VI teachers in Monger Dzongkhag, recognizing the significance of contextual factors that could impact the teaching and learning process. By concentrating on this particular group of teachers, the researcher aimed to obtain insights that are relevant and specific to the local educational context, taking into account cultural, pedagogical, and systemic factors that influence the teaching of science. By employing qualitative methods, the researcher was able to capture the complexities and intricacies of the participants' experiences, providing a comprehensive understanding of the challenges they encountered while teaching Class VI students about elements and their symbols. Additionally, the opportunities and strategies identified by the participants shed light on effective instructional practices and pedagogical approaches that can enhance student engagement and learning outcomes in the subject of science.

3. RESULTS AND DISCUSSION

3.1 Teacher's Experience and Qualifications

In a group of respondents, the majority of them possess at least one year of experience in teaching primary science. This indicates that they have a practical understanding of the subject and have been actively engaged in imparting scientific knowledge to young learners. Among the participants, three individuals have obtained a bachelor's degree in primary education from Paro College of Education. This particular degree program is likely to have equipped them with comprehensive pedagogical skills and knowledge specifically tailored for teaching primary-level students. Their degree from Paro College of Education demonstrates their commitment to the field of education and their dedication to becoming skilled educators in primary science. Furthermore, one participant holds a bachelor's degree in education with a focus on biology and chemistry from Samtse College of Education.

3.2 Approaches to Teaching Elements and their symbols

All respondents discussed their approach to teaching elements and their symbols to class six students. Three respondent state that they mostly use group work and the lecture method to teach the concept of teaching elements and their symbol to their children as stated below

"I usually teach periodic table and explaining how it represents all the elements. Then Make them to do a group work to sort the symbols of the elements and present to the class. This I feel that it helps them to collaborate and work as a team".

"I usually make them to do an activity that is given in the textbook on writing symbols and writing name of an elements of a symbol in a group."

In contrast, one respondent suggested an alternative to group work by proposing a game-based activity. The teacher creates cards with element symbols, and students select a card and match it to the corresponding element from a given list.

"I usually make them to play a game in the class where they need to pick a card containing the name of an elements and they find the symbol of an elements." (R4)

All the respondents acknowledged the importance of learning elements and their symbols. Respondent I stated,

"Understanding elements and their symbols is crucial as it forms the basis for understanding the composition and behaviour of matter. It's a fundamental concept in chemistry."

Further Respondent II explained,

"It's part of the curriculum, so we have to cover it. But it's also important for building a foundation of knowledge. The topics are all interlinked up to Class 12, so it's important for them to learn about elements and atoms."

It highlights the significance of learning about elements and their symbols in terms of understanding the composition and behavior of matter, as well as its relevance in building a strong foundation for more advanced concepts in later grades.

3.3 Confidence in Teaching Elements and Their Symbols

All the respondents expressed confidence in their understanding of elements and their symbols, although Respondent II acknowledged the need for additional research due to teaching younger students. The respondent share that the content is simple and they do not have any difficulty in teaching the elements and their symbols to their student. Respondent I mentioned,

"I feel confident in my knowledge of elements and their symbols. I have been teaching this topic for several years. I feel confident in my knowledge of elements, but it's my first time teaching lower grades after long time. So, I still need to do some more research and not assume that they know certain things. I am very comfortable teaching this topic because it is not new to me. We have been teaching elements and their symbols to students, specifically in Class VI where we focus on atomic structures. The curriculum provides us with a limited number of elements, such as helium and hydrogen, which are represented in a simplified periodic table. This makes it easy for teachers to deliver the content and for students to understand."

This illustrates the confidence exhibited by all the respondents regarding their knowledge of elements and their symbols, while also emphasizing the importance of adapting teaching approaches for younger students.

3.4 Challenges of Teaching Elements and Their Symbols

Two respondents highlighted the challenge of teaching abstract concepts related to elements and their symbols. Respondent stated,

"Understanding the atomic structure and the arrangement of elements in the periodic table can be difficult for students."

"Teaching about elements can be tough because we can't physically show all the elements to the students. It's challenging for me to explain what elements are and which materials are not elements. Sometimes, it's confusing for both me and the students to identify certain materials and decide if they are elements or not. This makes teaching about elements a bit tricky and can make it harder for students to understand the difference between elements and non-elements. This quote underscores the difficulty student faced in comprehending complex ideas that are not tangible or easily visualized. Another teacher state that the challenge faced by the teacher is the presence of misconceptions among students regarding molecules and compounds, as well as confusion between atoms and elements. Hr further state that the teacher addresses these misconceptions by investing time in explaining the distinctions between these concepts and providing relevant examples to enhance students' understanding. *One common misconception is that students often confuse molecules with compounds. They tend to think that all elements can form molecules, but that's not the case. I spend a good amount of time explaining the difference between elements and compounds and providing examples to clarify their understanding. Another misconception is related to atoms and elements. Students sometimes think that atoms and elements are the same thing, so I have to make it clear that elements are made up of atoms and explain the concept of atomic number and atomic symbol."*

Another teacher also emphasizes the abstract nature of elements and their symbols, and she seeks to enhance student understanding by utilizing simulation software in the school's ICT lab. However, managing the scheduling becomes challenging since there is only one ICT lab available, and other classes also have ICT periods during the same time slots.

"To teach about elements and their symbol to the student with simulation would be appropriate, So what I found is it was easier for me to take them to the ICT lab, but taking them there, I have to reschedule my subject with other teachers."

In this qualitative research analysis, the field notes from two classroom observations focused on lessons about elements and their symbols are examined. The purpose is to identify common themes and codes that emerge from the observations. The analysis aims to gain insights into the teaching strategies employed by the teachers and their impact on student learning.

3.5 Comparative Analysis of Classroom Observation Field Notes

Two different field notes on classroom observations were conducted, focusing on a lesson about elements and their symbols. A comparative analysis of the two field notes reveals similarities and differences in the observed teaching strategies and instructional approaches. Both observations highlight the importance of introducing the topic of elements and their symbols to the students. The teachers in both instances provided relevant information to establish a clear context for the lesson. Both field notes mention a symbol writing activity where students were required to write down the symbols of different elements. This hands-on activity aimed to reinforce the understanding of element symbols and engaged students in active learning. Both observations emphasize the presence of interactive discussions between the teacher and the students. The teacher encouraged student participation, asked questions, and addressed misconceptions to facilitate a collaborative learning environment. Review and Connection to Prior Knowledge: The first observation note includes a review of previously learned material, allowing students to recall and activate their prior knowledge of elements. In contrast, the second observation note does not mention this review activity. Conclusion and Assessment: The first observation note mentions a conclusion where the teacher summarized the key points covered in the lesson. It also highlights the use of questions for formative assessment. In the second observation note, these elements are not explicitly mentioned. The

similarities in both observations indicate common effective instructional strategies for teaching the topic of elements and their symbols. The incorporation of hands-on activities and interactive discussions demonstrates a student-centered approach to learning. These strategies promote engagement, reinforce understanding, and encourage critical thinking among students. The differences between the two observations highlight variations in instructional practices. The inclusion of a review activity in the first observation note helps establish connections to prior knowledge, which can enhance student comprehension. The explicit mention of a conclusion and formative assessment in the first observation note suggests a deliberate effort to summarize the lesson and assess student learning. These elements contribute to effective lesson closure and ongoing evaluation of student understanding. Overall, both observations reflect positive aspects of teaching, such as topic introduction, hands-on activities, and interactive discussions. However, the first observation note demonstrates additional elements, including a review of prior knowledge and a more explicit conclusion and assessment process. These variations highlight the importance of incorporating different instructional strategies to cater to diverse student needs and maximize learning outcomes.

3.6 Discussion

The analysis of observation and interview data has revealed several challenges faced by teachers when teaching elements and their symbols, which can have a significant impact on the effectiveness of instruction and student learning outcomes [13]. After carefully examining the data and the classroom observation note, three main challenges have been identified in the teaching of elements and their symbols in these two schools one prominent challenge is the limited availability of resources [14]. The interview data highlighted issues such as a scarcity of ICT labs and insufficient materials in science labs [15]. These limitations hinder teachers' ability to provide hands-on experiences and practical demonstrations, which are essential for understanding elements and their symbols. The lack of resources also restricts the variety of teaching methods that can be employed, limiting the engagement and interest of students [16]. The interview data mentioned that not all students have access to mobile phones or other electronic devices. This lack of access can make it challenging for teachers to incorporate technology-based teaching methods or interactive learning resources that enhance the understanding of elements and symbols [17]. Teachers may have to rely on alternative approaches or adapt their teaching strategies to accommodate students with limited technological resources. The data indicated that misconceptions among students present a significant challenge. Students may hold preconceived notions or incorrect understandings about elements and their symbols, which can hinder their learning progress. Teachers need to identify and address these misconceptions through targeted instruction, questioning techniques, and conceptual change strategies [18]. It requires patience, careful explanation, and providing concrete examples to help students unlearn their misconceptions and develop accurate understandings. Abstract concepts poses a significant challenge in teaching and learning [19]. These concepts are often complex and intangible, making them difficult to grasp for students [20]. Teachers face the task of breaking down these abstract ideas into more understandable and relatable forms, using various strategies and techniques. One challenge is finding effective ways to explain abstract concepts in concrete terms [21]. Teachers need to come up with creative examples, analogies, or visual aids that can make these concepts more tangible and relatable for students. Another challenge is assessing students' understanding of abstract concepts. Unlike concrete concepts that can be easily observed or measured, abstract concepts require higher-order thinking and deep comprehension [22]. Furthermore, abstract concepts often require more time and repetition for students to internalize and apply effectively. In summary, the analysis of observation and interview data has identified three main challenges faced by teachers when teaching elements and their symbols in the two schools. Firstly, the limited availability of resources and technology impedes teachers' ability to provide hands-on experiences and utilize

interactive learning resources [23]. This scarcity hinders student engagement and limits the range of teaching methods that can be employed. Additionally, the lack of access to technology among some students further complicates the integration of technology-based teaching strategies. Secondly, addressing misconceptions among students poses a significant challenge [24]. Teachers must identify and address students' preconceived notions or incorrect understandings about elements and their symbols, requiring targeted instruction and conceptual change strategies. Lastly, the abstract nature of the concepts themselves presents a challenge in teaching and learning. Teachers need to find effective ways to explain abstract concepts in concrete terms and provide relatable examples, while also assessing students' understanding of these complex ideas. Overcoming these challenges will require addressing resource limitations, providing professional development opportunities for teachers, and employing innovative instructional strategies that cater to diverse learning needs [25].

4. CONCLUSION

Teaching elements and their symbols to class VI students can be a challenging task for educators. This qualitative research study delved into the specific challenges associated with this topic and aimed to shed light on potential solutions. The findings of the study underscored the importance of addressing three key challenges: the lack of resources and limited access to technology, effectively addressing misconceptions, and developing innovative approaches to teach abstract concepts. Firstly, the lack of resources and limited access to technology emerged as a prominent challenge faced by teachers. Inadequate availability of materials and resources can hinder the effective delivery of lessons on elements and their symbols. Limited access to technology further compounds this challenge, as digital tools and multimedia resources play an increasingly vital role in engaging students and facilitating their understanding. It is crucial for educators, school administrators, and policymakers to work together to address these resource gaps, ensuring that teachers have access to the necessary tools, equipment, and materials needed to deliver engaging and effective lessons. Secondly, the study highlighted the challenge of addressing misconceptions among students. Science education often involves complex concepts, and students may develop misconceptions or inaccurate understandings about elements and their symbols. Teachers must possess a deep understanding of these misconceptions and employ effective instructional strategies to correct them. This may involve targeted interventions, hands-on activities, and interactive discussions that challenge and rectify students' misconceptions. Professional development programs for teachers could also focus on equipping them with the necessary skills and knowledge to identify and address common misconceptions, ultimately enhancing the quality of science education. Lastly, the research study emphasized the challenge of teaching abstract concepts related to elements and their symbols. Abstract concepts can be challenging for students to grasp, as they often require higher-order thinking skills and the ability to visualize and conceptualize ideas. To overcome this challenge, teachers can employ innovative teaching approaches that make use of visual aids, real-world examples, and hands-on experiments. Breaking down complex concepts into simpler, relatable parts can help students develop a deeper understanding and appreciation for the subject matter. By acknowledging and addressing these challenges, educators can enhance the quality of science education at the primary school level. Collaborative efforts among teachers, school administrators, and policymakers are essential to ensure the provision of adequate resources, professional development opportunities, and innovative teaching methodologies. Through these collective efforts, teachers can create an engaging and conducive learning environment that fosters a deep understanding of elements and their symbols among class VI students. Ultimately, such initiatives will lead to better learning outcomes and a lifelong passion for science among young learners.

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