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Teachers' Difficulty in Teaching Classes VII and VIII Sciences in Bhutanese Schools: A Case Study in Gasa, Punakha and Wangdue Phodrang Districts

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Authors' contributions

This study was carried out as a partial fulfillment of Master in Education offered by Samtse College of Education, Royal University of Bhutan. Author NW designed the study, collected the data, analyzed and interpreted the results. Author KU was principal supervisor of this research. Both authors read and approved the final manuscript.

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ABSTRACT

This study aimed at finding out the teachers' difficulty in teaching classes VII and VIII science. The research methodology used in this study is convergent parallel mixed method. A total of 107 Classes IX and X students and 12 science teachers from two higher secondary schools and a middle secondary school were included for the study. Data collection instruments used were survey questionnaires and focus group interview. Survey questionnaire data is analyzed using SPSS, while the recorded interview data is analyzed based on themes. The findings of this study revealed that teachers are facing difficulty in teaching classes VII and VIII science as they are not able to teach contents of science that are not their area of specialization. Therefore, study recommends Ministry of Education, Bhutan to work towards developing bifurcated science: Physics, Chemistry and Biology for Classes VII and VIII.

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Keywords: Integrated study; learning content; teaching difficulties; learning problems; professional competence.

ABBREVIATIONS

REC : Royal Education of Council
CAPSS : Curriculum and Professional Support Section
CTDD : Curriculum and Textbook Development Division
B.Ed. : Bachelor of Education
PGDE : Post Graduate Diploma in Education
SPSS : Statistical Package for Social Sciences
SD : Standard Deviation

1. INTRODUCTION

The Bhutanese science Education was started in early 1960s with the introduction of modern education in Bhutan. In those days, Bhutanese education system did not have her own local curriculum like today. According to Tobgay [1] states that Bhutanese science curriculum was borrowed from India. However, in 1976 the Department of Education drafted the country's first curriculum. The curriculum was developed incorporating the country's culture and traditions. In 1986 another landmark history took place in Bhutanese education system with the establishment of a new division called Curriculum and Textbook Development Division (CTDD). The main function of CTDD was to look after the curriculum affairs.

The study of science in Bhutanese school education system consists of four stages. The first stage starts from class four to six with introduction of general science. In the second stage three science subjects; Biology, Physics and Chemistry are taught as single subject named as general science. Similarly, in third stage for classes VII and VIII, three subjects of science were compiled together and taught as single science. However, in last stage, science is offered separately as Biology, Physics and Chemistry from Class IX onwards. From Class XI, students can choose to either study Biology, Physics and Chemistry as one combination or Maths, Physics and Chemistry. A small number of students also choose to study Biology, Physics, Chemistry and Mathematics.

The major reformation of Bhutanese science curriculum was carried out in the 11th five-year plan (2013 to 2018). The framing of National Science Curriculum Framework for Classes PP to XII was completed in 2012. Since then, Royal Education Council (REC), Bhutan, responsible for taking care of the school curriculum, started reforming science subjects for Classes IV to XII. The reformed general science for Classes IV to VI was implemented in 2013, followed by science for Classes VII and VIII in 2014 and 2015 respectively. The separate science for Classes IX and XI were developed and implemented in 2016. In the following year, three separate sciences for Classes X and XII were implemented.

1.1 Problem Statement

The Bhutanese integrated science for Classes VII and VIII was developed by REC erstwhile Curriculum and Professional Support Section (CAPSS). The implementation of new contextualized integrated science for classes VII and VIII took place in the year 1999 and 2000 respectively. In the process of implementation of contextualized science for classes VII and VIII, teachers, parents and students started pointing out concerns and issues regarding the relevancy of integrated science [2].

This has prompted many researchers to conduct study pertaining to these issues. Sherpa (2007) conducted a study to find out the teachers' perception on integrated science in Bhutan. The study concluded that the science for Classes VII and VIII required to be further improved because teachers teaching integrated science were found professionally challenging in teaching Classes VII and VIII science. Similarly, Tenzin and Lepcha [3] pointed out that science teachers are not able to do their justice in their non-specialized subjects. For instance, a teacher who is specialized in teaching Physics is not able to do justice in teaching Biology and Chemistry.

In Bhutan science teachers are recruited after completion of Bachelor of education (B.Ed.) or post graduate Diploma in education (PGDE) from two colleges of education. In Bachelor of education program, teacher trainees are offered with double degree course and single subject for PGDE. Therefore, none of the science teachers in the field are specialized to teach all three branches of science.

The current science textbooks for Classes VII and VIII were developed by Royal Education Council to address these issues and concerns.

The textbooks consisted of a few chapters from biology, a few from physics and another few from chemistry. The implementation of current science textbooks for classes VII and VIII started from 2014 and 2015 respectively.

Although, the current science textbooks for Classes VII and VIII were designed to address the issues and concerns associated with former integrated science, still science teachers find difficult to teach the topics which are not the subject of their specialization. This was noticed by the researcher while working as a secondary science teacher for almost a decade. Researcher also observed that science teachers in the field are raising the same issues. Therefore, this study is intended to find out the teachers difficulty in teaching classes VII and VIII science which is taught as single subject combining Biology, Physics and Chemistry in single textbook. As a result, this study can contribute for the improvement of science for classes VII and VIII.

2. LITERATURE REVIEW

The textbook contains information about the basic knowledge of the subject. The goal of a teacher is to help students to learn, grow and succeed. However, teachers around the world face difficulties in teaching single science. For instance, a study conducted by Otarigho and Oruese [4] in Warri, Delta State, Nigeria, aimed to find out the reasons for poor teaching and learning of integrated science in lowers secondary schools found out that science teachers lacked methodology of teaching integrated science which could mean that the teachers lack required content knowledge in all three separated science subjects. The data for the study was obtained by using 360 questionnaires to 360 participants from 5 public secondary schools and 5 private secondary schools of Nigeria.

Mizzi [5] conducted a study on the challenges faced by science teachers when teaching outside their subject of specialization. The study concluded that there are considerable differences when teaching within and outside area of expertise. Teachers seem to be more self-confident when teaching within their subject of specialization. Further, the study identified that many teachers teaching single science to students aged between 11-13 expressed similar concern, apprehension and lack of confidence when teaching topics that are not to their area of specialization.

Inadequate background in the subject knowledge is one of the main factors that contributes to teachers' pedagogical content knowledge, self-confidence and attitudes [6]. The study was conducted with the aim to identify some of the challenges faced by teachers that are possibly hindering them from teaching science effectively in junior high schools in Aowin Municipality-Ghana. The study found out that teachers' low self-confidence when teaching their non-specialized subjects is also another factor that hinders the teaching of integrated science. Many teachers (64.3%) teaching integrated science to students at junior high school expressed lack of confidence as a factor that hindered teaching of integrated science in the selected schools of study. However, a study carried out by Gyamfi [7] in Ghana reported other challenges faced by science teachers in teaching single science. These challenges include: loaded content of science, inadequate science teaching materials and equipment and lack of science laboratories for schools.

In regard to Bhutanese integrated science, Tenzin and Lepcha [3] conducted an intensive study on relevancy of integrated science for Classes VII and VIII in Bhutan. The study included 310 teachers and 730 students of middle and higher secondary schools located in various parts of Bhutan. One of the conclusions drawn by the study was that an effective delivery of integrated science is hindered by inadequate knowledge and skills of teachers. The study claims that science teachers are not able to do equal justice in teaching other science subjects because their professional background is subject specific. In addition, in a study by Sherpa [8] reported that science teachers were found professionally challenged while teaching integrated science. The study was conducted at Wangdue Phodrang District. Science teachers of the District were included for the study.

Based on the above discussion, it was concluded that science teachers around the world are facing difficulties in teaching single science for classes VII and VIII. However, studies found out that teachers are able to teach their own specialized subjects without any difficulties. Although, there are many literatures highlighting the teachers' difficulty in teaching single science around the world, there is very limited literature pertaining to teaching of current science for classes VII and VIII in Bhutanese context. All the previous studies carried out pertaining to Bhutanese classes VII and VIII science was based on

previous science which was phased out in 2012 and 2013 respectively. Therefore, it is possible to point out that no study was conducted regarding teachers' difficulty in teaching current classes VII and VIII science in Bhutanese context. In this regard this study has significant scope to make contribution for the improvement of classes VII and VIII science in Bhutan.

3. MATERIALS AND METHODS

This study was carried out using mixed method. Mixed method consists of both qualitative and quantitative approaches. Convergent parallel mixed method is employed to confirm and verify survey findings with interview data. Literature study pointed out that mixed method is the best approach to investigate a problem through multiple ways. Greene [9] states that mixed method is an inquiry approach to investigate the social world that involves more than one way of knowing, along with more than one kind of technique for gathering, analyzing, and representing data. This is supported by Dang [10] who states that mixed method has two significant benefits. Firstly, it provides cross validations by triangulations and secondly, it gains complementary results by using the strength of one method to improve the other method.

3.1 Case Study Research Design

This research has followed a case study research design. A case study is the study of an instance action. The single instance can be an individual, a class, a group, community or an organization. It helps readers to understand more about the real situation of an individual, a group, community or an organization [11].

3.2 Research Site

This study was conducted at three different schools under Gasa, Wangdue Phodrang and Punakha Districts. The research site is selected based on the convenience of the researcher and the proximity to each other.

3.3 Informants

In this study, researcher used a purposive sampling to select the schools. From Bajothang Higher Secondary School, 30 Class X students comprising of 11 males and 19 females were included for the study. Similarly, from Khuruthang Middle Secondary School, 46 Class IX students were selected for the study. Among 46 of them, 27 were female and 19 were male. Lastly 31 Class X students from Bjishong Central School participated in this study. Among 31 of them, 17 were female and 14 were male. Equal number of boys and girls could not be included as none of the sections in schools visited had equal number of boys and girls.

In case of teacher participants, 5 teachers were selected from Bajothang Higher Secondary School consisting of 3 males and 2 females. From Khuruthang Middle Secondary School, 3 teachers consisting of 2 males and 1 female were included. From Bjishong Central School, 4 teachers comprising of 3 males and 1 female participated in this study. However, only four students from each school were selected for the interview based on volunteerism.

3.4 Data Collection Tools

In order to collect data for this case study, survey questionnaires and interview were implemented. These tools were used to gain rich and valid data for the study. The type of interview applied in this study is focus group that was administered through semi-structured questions. The well-planned interview questions contain both open-ended and closed-ended questions to get deeper understandings of the study. Two different focus group, teacher focus group and student focus group was used to gather qualitative data.

3.5 Data Analysis Procedure

The survey questionnaire completed by the teachers and students were documented. In order to analyze data, separate numeric codes were assigned to the data of the both teachers and students. Secondly, data were punched in statistical package for social sciences (SPSS). Third step involved analyzing data using descriptive statistics through measures of mean and standard deviation. The results generated by SPSS was exported to excel for edition of features. The mathematical mean and standard deviation were used to analyze the participants' ratings.

In case of interview data, all the interview were recorded. The recorded interview data were transcribed verbatim. Transcribed data was read several times to identify the codes. Lastly, the codes were merged together to create themes.

4. RESULTS AND DISCUSSION

4.1 Results

For presenting the findings of the interview data, the pseudonym of 'T" and 'S' are used for teachers and students respectively. The acronym is used for easy reference and understanding. The teacher participants expressed mixed response regarding the difficulties in teaching Classes VII and VIII science. While about 50% of them expressed that they do not face any difficulties in teaching Classes VII and VIII science, remaining teacher participants reported that it is difficult to teach the topics which are not their subjects of specialization.

Those group of teachers who do not have any difficulties in teaching Classes VII and VIII expressed that the science for Classes VII and VIII is just basic level of higher science and expert subject teacher is not really required to teach. For instance, one of them pointed out:

> I didn't face much difficulty, as science for Classes VII and VIII is just at basic level. Even if I do sometimes, I seek help from my fellow colleagues specialized in Biology and Chemistry. (T7)

Similarly, another teacher explained:

> Personally, I am fine for the level of subjects. I believe that subject expertise is not really required to teach Classes VII and VIII science. (T2)

However, those group of teachers who face difficulties in teaching Classes VII and VIII pointed out that they face difficulties particularly in teaching some of the topics which they are not specialized in. Further one of the teachers reported that it is a burden to teach the subjects that he or she is not specialized in.

> Yes, I find it difficult to teach other parts from my subject of specialization as I am not aware of terms and principles related to the topics. (T11)

Similar results were obtained from the survey questionnaire data. As reflected in Table 1 the mean rating calculated for the statement; I do not feel comfortable when teaching the topics other than my subject of specialization is (M = 3.92) which falls under high ranking. This rating indicates that teachers face difficulties in teaching non-specialized subjects. It is also clear from the rating that majority of the teachers seek help from competent colleagues whenever they don't understand the topics.

In this same context, it is interesting to note that similar finding is revealed from students' interview data. The student participants expressed mixed response about teachers' competency in teaching Classes VII and VIII science. Among 12 of them, 50% of the participants pointed out that teachers are competent in teaching Classes VII and VIII science. It is evident from the statements made by some of the students during interview. For example, one of the students explained:

> From my opinion, all my science teachers taught us with confident, because I think they are interested in science and they love their subjects. They have passions and enthusiasm to teach us, that's why they are able to deliver the lesson well. (S8)

Similar views were expressed by S9 and S11.

However, another 50% of the participants admitted that teachers were not really competent in teaching Classes VII and VIII science. Participants expressed views as follows:

> I think that my science teacher is not so confident to teach Classes VII and VIII science. For instance, a teacher with chemistry background can teach Chemistry well, but he or she can't teach Physics well. (S2)

> In my opinion, I think some teachers can teach all the science subjects but some of them are not able to teach confidently because they don't have all the ideas of science subjects and some of them are even asking help from other teachers. Teachers are also advising us to get help from other teachers. Therefore, I think it will be better if science teachers were trained to teach all three sciences. (S5)

On the other hand, the survey questionnaires data slightly differed from the findings obtained from interview data. The result is discussed in Table 2.

Table 2 depicts students' ratings on competency of teachers teaching Classes VII and VIII science. All the 8 items in this category received

Table 1. Teachers' rating on difficulty in teaching classes VII and VIII science

Statements	N	Mean	SD	Rank
I find difficult to complete Classes VII and VIII syllabus on time.	12	3.08	1.51	Moderate
I feel comfortable while teaching the subject of my specialization.	12	4.08	1.24	High
I do not feel comfortable when teaching the topics other than my subject of specialization.	12	3.92	1.31	High
I seek help from my friends whenever I don't understand the topics other than my subject of specialization.	12	3.92	1.31	High
Average		3.75	1.28	

Table 2. Students' rating on competency of science teachers in teaching classes VII and VIII science

Statement	Mean	SD	Rank
I understood all the concepts of Classes VII and VIII science taught by my teacher.	3.63	0.95	High
My science teacher taught Chemistry part very well.	3.85	0.95	High
My science teacher taught Physics part very well.	4.01	0.98	Very High
My science teacher taught Biology part very well.	4.97	0.92	Very High
My science teacher taught all Physics, Chemistry and Biology parts with confidence.	4.08	1.04	Very High
I found, my science teachers of Classes VII and VIII has rich content knowledge in physics chapters.	3.8	1.03	High
I found, my science teachers of Classes VII and VIII has rich content knowledge in Chemistry chapters.	3.86	0.93	High
I found my science teachers of Classes VII and VIII has rich content knowledge in Biology chapters.	3.96	1.02	High
Average	4.02	0.88	

the mean in high rank. This suggests that most of the science teachers are competent to teach Classes VII and VIII science. Moreover, average mean of the statements (M = 3.96) also shows that teachers do not face much difficulty in teaching single science. Furthermore, average standard deviation (SD = 0.88) indicates that there is no significant difference in rating of students for all the items. In addition, the ratings also show that science teachers are able to deliver Biology lesson well compared to Physics and Chemistry.

4.2 Discussion

With regard to teaching of Classes VII and VIII science, there are teachers who feel comfortable to teach and there are equal number of teachers who are not confident to teach contents that do not fall under their subjects of specialization. For instance, a teacher with physics background feels incompetent to deliver some of the chemistry lessons. Hence, it is probable that less emphasis is given to the topics that do not relate to their subject of specialization. This may lead to poor development of foundations for higher science.

Moreover, teachers need to explore the topics before teaching and be able to deliver the lesson effectively. However, teachers are generally confident to teach the subjects of their specialization. The finding of this study is closely linked to the previous studies carried out in the Bhutanese context and other countries. For instance, a study conducted by Tenzin and Lepcha [3] reports:

> Teachers with science background feel comfortable only to teach the topics which are closely related to their subject of specialization and therefore, not competent to teach all the three sciences in a combined science.

Further the study reported that effective delivery of Classes VII and VIII science are mainly hindered by inadequate knowledge and skills of the teachers because their professional background is very subject specific and hence

they are not able to do equal justice in teaching of other science subjects. Similar kind of finding was reported by Sherpa [8]. In addition, there are numerous studies carried out in other context which support the findings of the current study. For instance, Mizzi [5] reported that there are considerable differences when teaching within and outside one's area of expertise. Teachers seem to be more self-confident when teaching within their subject of specialism. Further the study claims that many teachers teaching integrated science to students of age 11-13 expressed similar concern, apprehension and lack confidence when teaching topics related to science areas that are not in their area of specialization.

Inadequate background knowledge in all the science subjects is one of the main factors that contributes to the challenges and difficulties of teachers teaching single science. When teachers do not have adequate background knowledge in all the three science subjects, they lack confidence in delivering the lessons [6]. The study further pointed out that when teachers do not have adequate content knowledge it is difficult to transform the content knowledge into suitable activities, analogies and demonstrations, and simulations to enrich the understanding of students.

5. CONCLUSIONS

This study revealed the difficulties of science teachers in teaching non-specialized subjects. For instance, a teacher who is specialized in Chemistry was found incompetent in teaching Physics and Biology. However, teachers are found confident in teaching the subjects of their specialization. This confirmed that the teachers' difficulty in teaching classes VII and VIII science is due to combination of three separated science in single textbook. Therefore, this study recommends Ministry of Education to develop bifurcated science for classes VII and VIII. However, the findings of this study may not be generalized as the study has some limitations. One of the limitations lies in the sample size. Due to limited resources and time the study has included 107 students and 12 teachers only. Moreover, an equal number of male and female could not be arranged for this study.

ETHICAL APPROVAL

The ethical issue in this study is taken into an account by the researchers. Prior to collection of data, written approval to conduct the study in respective schools were obtained from the concerned authority. In addition, consent letters were duly signed by all the participants before completing survey questionnaire and interview.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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