

Secondary Science Students' Attitude Towards Biology in a Higher Secondary School in Punakha Dzongkhag

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Received: 06-05-2022

Revised: 26-07-2022

Accepted: 03-08-2022

ABSTRACT

Identification of students' attitude towards learning and to the subject is essential part of educational research. The main aim of the study was focused on exploring students' level of attitude towards Biology and to find out factors which influence students' attitude towards Biology. To conduct this research, the convergent parallel mixed method approach was employed. For this study, a total of two research instruments such as survey questionnaire and interview were used for 170 student participants and 3 Biology teachers. The Principal Component Analysis (PCA) was used to reduce the item's data to different factors, and the average of each factor items were used in statistical analyses. The significant difference in students' attitude towards Biology based on gender and grades was calculated using independent t-test and ANOVA. Similarly, the qualitative data collected through interview section were transcribed and coded. The thematic analysis was used to generate themes from the data and were triangulated with quantitative findings further augmented with literatures. The result from this study revealed that, the students' grade level have significant influence over students' attitude towards Biology. In all the three components, the higher grades demonstrated more favorable attitude as compared to the lower grades. With regard to gender it was found that both the genders have same attitude level to all the components except for subject preference where female shows more preference towards Biology. Females are more align than the males to Biology compared to Physics and Chemistry. The general attitude of the students was found to be at high and positive level. As positive attitude is necessary for the students, therefore, there is a need to enhance the positive attitude by teachers, parents, and any other relevant education stakeholders. Biology teachers should use more of the practical based lesson so as to make concept understandable to all students irrespective of their difference.

Keywords: Attitude, Biology Learning, Gender, Grade, Mixed Method, Teacher interaction, Practical work, Subject preference

Science education is one of the most important subjects and is receiving much emphasis because of its relevance to students' lives and the universally applicable problem-solving and critical thinking skills it uses and develops. Further, nations are considered to be developed when remarkable achievement is made in Science and technological fields (Faaz & Khan, 2017).

Biology education is one branch of science and has received special attention from educators and researchers because of the rapid progress in

information on life, developmental changes, and relationship with each other on the earth, which continuously influence our everyday lives (Koseoglu & Pehlivan, 2018). Moreover, Biology is a subject with both scientific and social aspects (Pehlivan & Koseoglu, 2010; Yalmanci & Aydin, 2013) and plays

How to cite this article: Jamphel, K. and Kinley. (2022). Secondary Science Students' Attitude Towards Biology in a Higher Secondary School in Punakha Dzongkhag. *Educational Quest: An Int. J. Edu. Appl. Soc. Sci.*, 13(02): 111-118.

Source of Support: None; **Conflict of Interest:** None



a substantial role in attitude towards science (Nasr & Soltani, 2011). Biology provides us with the power to properly identify the key to get an adjustment in this always changing human society (Das, 2020), with a better understanding of nature and causing positive life changes. So, from this perspective, the development of a positive attitude towards Biology should be an important goal for the curriculum developer, the teacher, the students, and the scholar (Usak *et al.* 2009).

However, on examining the related literature, the studies on students' attitude appear to focus more on general science instead of bifurcated science, such as Physics, Chemistry, and Biology (Cavas, 2011; Guden & Timur, 2016; Mubeen & Reid, 2014; Thoe *et al.* 2010; Zangmo *et al.* 2016). Few studies examine this concept in specific science courses such as Krogh (2005) and Angell *et al.* (2004) in Physics and Salta and Tzougraki (2004); and Bennett (2001) in Chemistry. There are only a few research as Spall *et al.* (2004) which focused on students' attitudes towards Biology, further supported by Wang *et al.* (2007) and Yilmaz (2012), that the number of studies dealing with students' attitude towards Biology was quite limited.

Problem statement

Bhutan is also making progress in science education with the introduction of modern education. All the students around the country must learn all the three branches of science till grade X. However, once they complete grade X, they have the option to continue with Biology or leave it depending on their confidence and capabilities, but the other two science subjects are still mandatory for the science stream. A student qualifies to study in the next grade with their choice of a stream based on their academic performance in the national board examination (Bhutan Certificate for Secondary Education, BCSE). As students entered the higher grades, XI and XII, they are without a strong foundation in each science to make the smooth transition because of inadequacies content in the integrated science curriculum and leap in grades with that content (Zangmo *et al.* 2016). Moreover, the teacher-oriented lessons with more rote learning and challenges with the practical to incorporate theory and practical caused certain demotivation in students. Further, the terminologies used in

Biology were difficult and boring for the students (Moses, 2013). The study carried out by Tenzin *et al.* (2006), found that most of the Bhutanese students have scored low marks in Biology. Moreover, the report prepared by the Bhutan Council of School Examination and Assessment (BCSEA) for the three consecutive years (2016, 2015, 2014) showed that students' average scores in grade X Biology fail to achieve sixty percentage indicating under-performance in the subject.

The educational core aspect of the sampled school 'X' is academic, with utmost importance given to the academic-related activities. Moreover, the sampled school 'X' has been awarded the Testimony of Triple Stars on achieving the top position in Higher Secondary Level (Grade XII) for three consecutive years (2012-2014) and has been placed in the top ten performing secondary school for grade X and XII for the year 2010 and 2013, followed by grade XII for the year 2011, 2012, 2014, 2017, and 2018. In addition, the academic performance of the students for past five years range between 63.5% – 76.3% for grade XII, 59.5 % - 74.4% for grade XI, 50.6% - 54.8% for grade X, and 41.7% - 52.2% for grade IX. This indicates that grade XII and XI have a higher percentage in Biology subject than grade X and IX. The variation in students' academic performance across the grades, despite its reputation for the award and the priority provided to the students, little is known about the students' attitude towards Biology. It is important to identify the type of attitude students have towards Biology, which will indeed help them to improve. This study is the first of its type in our context and will serve as baseline data for further research.

An in-depth study is needed to unravel students' attitudes towards Biology. Further, the factors that contribute to the change of students' attitude towards biology need to be examined so as to improve the teaching and learning of Biology in secondary schools.

Therefore, this study aims to identify the level of attitude towards Biology by secondary science students. The study will also help to identify factors that influence students' attitudes towards Biology.

Research Question

The following research questions guides the study and assist in achieving the research aims:

- What are the factors influencing students' attitude towards Biology?
- What is the level of students' attitude towards Biology?
- Is there any influence on students' attitudes based on their characteristics such as gender and grade?
- How teacher as a factor influence students' attitude towards Biology?
- Is there any influence on students' attitudes based on subject preference?
- Is there any influence of practical work on students' attitude towards Biology?

This current study of the students' attitudes towards Biology is important for several reasons. First, the findings of this research will prove valuable to educational leaders, and future curriculum developers, as it provides insight into students' attitudes towards Biology. Second, based on the research findings, teachers can understand the importance of attitude towards Biology and academic achievement, take all motivational steps for increasing the attitude towards Biology. Further, teachers can support the students to eliminate the challenges by recognizing the factors affecting students' attitude change towards the subject. Besides, findings from the study will help the teachers to come up with an innovative way to learn Biology. The finding may also contribute to improving the teaching and learning practices of Biology teachers and students. Lastly, the findings from this study will provide an insight into the attitude level of students towards Biology.

METHODOLOGY

The mixed-methods design adopted was a convergent parallel design where quantitative data and qualitative data were collected, analysed the two components independently, and the results were compared and interpreted together in the same phase (one-phase design) of the research process (Creswell, 2018; Creswell & Pablo-Clark, 2011). The combination of both forms of data provides a better understanding of a research problem than either quantitative or qualitative data by itself (Creswell, 2012; Demir & Pismek, 2018). Moreover, the direct comparison of the two data sets provides the

researchers with a "convergence" of data sources (Creswell, 2014).

An instrument is considered a good measure when the data collection passes the tests of validity and reliability (Dikko, 2016). The questionnaire tool used for this study to collect the quantitative data was adapted from the study carried out by Sangay Zangmo, in the year 2016 to find grade X and XII students' attitude towards science in Thimphu District. Her questionnaire consists of seven dimensions and 60 items which attempts to measure students' attitude towards learning of science and student's attitude towards science.

The content validation for the adapted questionnaire was initially carried out among the mates to check for the inclusion with balanced coverage of all the topics under investigation and later followed with expert involvement to check for double and confusing questions. In addition, the most important type of validity – the construct validation was carried out to ensure that the items in the questionnaire accurately measures the theoretical construct. To measure the reliability of tools in our context and to determine the internal consistency within the items, the adapted tool was already pre-tested with 30 students from higher secondary schools in Thimphu, and the coefficient of reliability was .92. To make the adapted tools more valid and reliable, the study referred to a questionnaire developed by Kubiak *et al.* (2017) with the Cronbach alpha coefficient value of 0.83.

The validity and reliability of the qualitative data greatly depend on the researcher – the main character in the interview session. The questions were based on the issue related to students' attitude, designed from the literature reviews, and formulated based on research objectives. The perspectives collected from students and teachers were converged to establish the themes. The accuracy of the qualitative findings was cross-checked with the participants through member checking. To validate the suitability of each question, a thorough discussion was carried out with the set of subject experts. The interview questions were refined, rephrased, and modified to be clearer to guide the researcher.

RESULTS AND DISCUSSION

The participants for the study were asked to indicate their gender and grades by placing a tick next to the relevant option provided like (Male, Female, and Others) for genders and (Nine, Ten, Eleven, and Twelve) for grades respectively. In total 170 participants (100%) responded to the study. The participants' distribution by gender and grades are presented in Table 1.

Table 1: Participant Distribution by Gender and Grades

Gender	Grade	Frequency	Percent	Cumulative Percent
Male		77	45.3	45.3
Female		93	54.7	100.0
	Nine	40	23.5	23.5
	Ten	45	26.5	50.0
	Eleven	40	23.5	73.5
	Twelve	45	26.5	100.0
Total		170	100.0	

Source: Field data.

Table 1 shows that the independent variable gender with the ratio of female participants (54.7%) more than the male participants (45.3%). Regarding grades, the ratio of grade X and XII participants (26.5%) was more than the grade IX and XI (23.5%) participants.

The Principal Component Analysis (PCA) was conducted on the survey questionnaire before the inferential analysis. The relevancy of items in the survey questionnaire for the PCA was based on the Kaiser-Meyer-Olkin (KMO) test value which should be above the critical value of .60. In this case, the KMO value was .86 which indicates the sample adequacy for PCA. The non-performing items were deleted and the final measurement scale produced six valid components. Component one, Students preference to Biology subject (SPB) comprised of 7 items; component two, Easiness of the subject (EoS) comprised of 5 items; component three, Enjoyment of Biology subject (EIB) comprised of 5 items; components four, Practical work in Biology (PWB) comprised of 3 items; components five, Recording and reporting in Biology (RRB) comprised of 4 items; and component six, Biology teacher interaction (BTI) comprised of 3 items. The mean and standard deviation for each component is shown in the Table 2.

Table 2: The Six Components to Examine Students' Attitude towards Biology

Components	Mean	Std. Deviation
Students Preference to Biology Subject (SPB)	3.75	.85
Easiness of the Subject (EoS)	3.50	.67
Enjoyment in Biology Subject (EIB)	3.93	.63
Practical Work in Biology (PWB)	3.98	.73
Recording and Reporting in Biology (RRB)	3.84	.65
Biology Teacher Interaction (BTI)	4.04	.69
Computed Mean	3.84	

On analyzing the six components generated through the items in the survey questionnaire, the study revealed that the overall attitude of students towards Biology was at a high and positive level. Students liked Biology as they find it fun and interesting, and were related to their life and the environment. For instance, S8 expressed "For me, Biology is a very interesting subject which deals with the study of life and is one of the important subjects for me." Similarly, S2 shared "Biology is a good subject for students as it helps us to know more about our own body."

This opinion shared by students revealed that despite having certain challenges of terminologies and content with biology lessons, yet students find biology enjoyable to them. This result corroborates with a prior finding by Zangmo *et al.* (2016), that grade ten and twelve students' attitude towards science in Thimphu Dzongkhag was at a high level. Similarly, Wang *et al.* (2007), reported that individuals with a high positive attitude towards Biology have higher levels of learning the concept of Biology. As they learn the pleasure and satisfaction derived from the understanding results in attitude change.

However, the study conducted by Atik & Erkoç (2015); Kısoglu (2018); and Usak *et al.* (2009), found that students' attitudes towards Biology were found to be neutral or moderate. The study concluded that improving students' interest in studying Biology will lead to better learning outcomes in Biology. On interacting with teachers' to find out their opinion about the students' perception of Biology, it was found to be fair. For instance, T3 shared, "Looking at the number of students taking Biology, which is

limited, most of the students do not like the subject". Similarly, T1 expressed that "Only a few students opted to take Biology, as students have less idea about their ambition and subject combined with it". Attitude is not inborn, rather it is developed or formed over time. Attitude can be changed or modified based on factors associated with it. In the following sections, three prevalent factors are discussed.

CONCLUSION

The findings of this research revealed that despite differences in gender and grades the general attitude of students' towards Biology was positive and at a high level. The study found that female student prefers Biology more than the male. On referring to the items under this component, it was certain that the future career or job related to Biology was what attracted female students to prefer Biology in their next grade or at their university level. Besides, the study revealed that in all the four components that were used to examine students' attitudes, higher grades have a more favorable attitude towards Biology when compared to lower grades. There was a moderately weak to moderately strong correlation among the components. From the three identified components, the study indicated that the most influential domains to influence students' attitudes towards Biology were practical to work in Biology and Biology teacher interaction. Accordingly, Biology teachers must be aware that there is a certain aspect of students learning in Biology that needs to be improved. In particular, the teacher should provide more opportunities for hands-on activities to get oneself equipped and gain the confidence to learn better. The better engagement of students results in a better attitude to Biology and learning in Biology.

Based on the conclusions and the evidence discussed throughout the report, the following recommendation are drawn for the future researchers:

- ❑ The present study was conducted in one of the government schools. There is a need to carry out a similar study for the private schools to see how the different organization of a school affects the students' attitude towards biology.
- ❑ Higher the positive attitude of students better the result in their academics. So, therefore,

an extended study can be carried out to find out how students' attitude towards Biology is related to their academic achievement.

- ❑ The finding in this study revealed that female students were having more favorable attitude towards biology than male students. Therefore, this topic should be explored to determine any relationship between teacher gender and student (in particular female) attitudes towards Biology.

No study is completely flawless or inclusive of all possible aspects, thus here are some of the limitations identified for this study.

The small number of participants in this study (3 teachers and 170 students) is a limitation as the represented data may not be enough to generalize the result to another context.

The extended time for data collection was underutilized as it was not possible to have in-depth interaction with the teachers and students because of the pandemic and their busy time on online classes. Thus, this study failed to incorporate maximum students' and teachers' voices on how they feel about Biology.

The study is a little skeptical about the honest responses collected from the participants, as there is a tendency to impress the researcher by providing positive attitudes only which indeed conceals the inferable attitudes.

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