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Research Article

Attitudes toward Biodiversity among Senior High School STEM Students and Their Parents: a Comparison

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ABSTRACT

One aim of a higher education institution in Batangas, Philippines, is to mold students into socially responsible citizens who advocate for environmental protection. At present, unparalleled modernization poses risks to the rich biodiversity inherent to the Philippines. As there is proof that the attitude to act on something helps motivate an individual, this study measured the attitudes of DLSL STEM students and their parents toward biodiversity. A descriptive method of research was utilized. A hypothesized model on the relationship between experiences of nature and the willingness to conserve biodiversity was used as the theoretical framework. A validated questionnaire combining items from the Attitude toward Biodiversity survey and the European Commission's Attitudes towards Biodiversity questionnaire was utilized as the data gathering instrument. Findings revealed that the STEM students and their parents have positive knowledge of and attitude towards biodiversity. The profile components did not yield any significant relationship with the attitudes. Parents' attitude towards biodiversity does not affect that of their children, although some other factors influence the students' attitudes towards biodiversity and conservation. An action plan to improve the integration of biodiversity conservation activities into science curricula is put forward based on the study's results.

INTRODUCTION

Biodiversity, known as biological diversity, refers to the variations of living organisms that include diversity in the forms and species of animals and plants and the variability brought about by their respective evolutions in the ecosystems they belong to (YouMatter, 2020). Biodiversity is significant and beneficial to humans in several ways: it provides for a variety of food, medicine, and other basic materials of production, and it is an important component in oxygen production which is necessary for human life. It also helps the different ecosystems survive and adapt to natural and man-made hazards or disasters (National Wildlife Federation, n.d.).

Despite the importance of biodiversity to human life, biodiversity loss is very much evident. Bellard, Marino, and Courchamp (2022) have found that biodiversity has reached an unprecedented crisis in recent years due to rising extinction rates. All these can be attributed to inhumane activities that inevitably damage the environment: destruction of natural habitats, overexploitation of resources, invasions of ecosystems, climate change, and pollution in many forms.

Biodiversity conservation, complex as it may be, primarily requires a positive attitude from an individual to ensure his commitment to its implementation.

As Eriksson, Nordlund, and Westin (2013) affirmed, higher levels of appreciation of the environment and awareness of environmental issues are directly linked to positive attitudes toward preservation and conservation activities (as cited in Eriksson and Klapwijk, 2019).

Both children and young people are constantly perceived, even by environmental experts, to possess the important role of advocating for the preservation of natural resources and the conservation of biodiversity (Morar & Peterlicean, 2012). By providing them with proper environmental education and with opportunities to be involved in conservation activities, the youth can become better advocates of biodiversity and the environment (Šorytė & Pakalniškienė, 2019). As primarily responsible for rearing children and the youth, parents are also seen to play an important role in shaping children's positive attitudes towards biodiversity and conservation activities. For one, Barrable and Booth (2020) have found that parental nature connection positively influences their children. Additionally, it was established that children's connection to nature – which includes the knowledge of, appreciation of, and initiative to take care of it – is strongly predicted by their parents' or guardians' nature connectedness (Passmore et al., 2021).

Some studies have already been conducted about the attitude of students towards biodiversity and biodiversity conservation. For one, Nisiforou and Charalambides (2012) assessed the level of knowledge, attitudes, and behavior toward biodiversity among undergraduate university students in Cyprus. They did so based on the concept that fundamental knowledge and appropriate attitude and behavior towards biodiversity and biodiversity conservation are needed to decrease the threats imposed by humans on biodiversity. They disclosed that although most respondents were unwilling to engage in environmental activities, most possess a positive attitude towards biodiversity. Next, Huang and Lin (2014) assessed and compared the attitudes toward biodiversity of American and Taiwanese undergraduate students. They found that significant differences in their attitudes were attributed to gender and having previous experience taking part in conservation activities. They concluded that knowing the students' attitudes toward biodiversity is important to plan curriculum and instruction. Third, Aivelo (2022) measured the students' attitudes towards biodiversity by letting students conduct science activities on an unloved species – rats. Generally, it was found that students have positive attitudes towards the environment, which is highly correlated with increasing age.

There were also relevant studies about the topic completed in the Philippine setting. First, a recent local study was conducted to measure the perspectives towards biodiversity and its conservation among students of a state college in the Aurora province. Results revealed that the participants had moderate knowledge of biodiversity and had scores that leaned towards the willingness to conserve and protect it. Gender was identified to be one of the predictors of the student's knowledge of biodiversity: females exhibited higher knowledge, while males yielded more positive perspectives toward conservation (Coracero et al., 2022). Next, Ejem and Bello (2013) explored environmental awareness, literacy, and biodiversity conservation

practices among first-year students in a state university on Mindanao Island, one of the country's three major islands. The study revealed that most students are highly aware of environmental concepts such as balance of nature, pollution, stewardship, finiteness of resources, change, interdependence, diversity, and stability. The respondents were already moving towards mastery in terms of environmental knowledge, attitudes, values, and decision-making skills. Lastly, Cruz (2013) presented a study she completed regarding the knowledge, attitude, and environmental conservation practices among students from another state university. Findings revealed that most students possess satisfactory knowledge of and desirable attitude and practices towards conservation. One of the recommendations of her study focused on integrating environmental concepts not only in science but also in other subject areas of the students.

With the current limits in the number of studies assessing students' attitudes towards biodiversity, especially in the Philippines, this study aimed to measure the levels of attitude towards biodiversity among the Senior High School students of a higher education institution (HEI) in Batangas enrolled in the Science, Technology, Engineering, and Mathematics strand. Likewise, as home environment and parental attitude are found to positively impact the attitude and educational achievement of children (Padlick-Field, 2012; Timkey, 2015; Abu-Rabia & Yaari, 2012), the study also measured the attitude of the parents of these students towards biodiversity and made a comparison between the two for any significant difference. It sought to answer the following specific questions:

1. What is the attitude towards biodiversity among the HEI's senior high school STEM students?
2. What is the attitude towards biodiversity among their parents?
3. Is there any significant relationship between the profile of the respondents and their attitudes toward biodiversity?
4. How does the attitude towards biodiversity of the students compare with that of the parents? Is there any significant difference between the two?
5. Does the attitude towards biodiversity of the parents affect that of the students?

The results of this study were confined to the responses of 178 students enrolled in the STEM strand of senior high school for the first semester of SY 2016-2017 and 164 parents (either mother or father) living with them at home.

In accomplishing this study, their attitudes toward biodiversity were measured and analyzed through adapted survey questionnaires devised by Huang and Lin (2014) and the European Commission (2013) in their respective studies.

The study is limited to the measure of the attitudes of the respondents based on the aforementioned evaluation instruments. Although students from the other strands of the academic track of senior high school at the HEI (which include Accountancy, Business and Management; Humanities and Social Sciences and General Academic Strand) were enrolled in some science subjects, they no longer took part in the said

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study.

This study utilized the hypothesized model by Soga et al. (2016) regarding the effects of both direct and vicarious experiences of nature on the willingness of children to take an active part in biodiversity conservation.

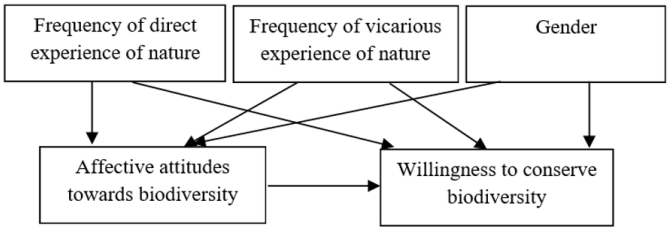

Figure 1. Effect of Experiences to the Willingness to Conserve Biodiversity

Source: Both Direct and Vicarious Experiences of Nature Affect Children's Willingness to Conserve Biodiversity

As the figure shows, the authors hypothesized that children's direct and vicarious experiences with nature affect their affective attitudes towards biodiversity and their willingness to engage in biodiversity conservation. Direct experiences with nature entail the children's actual involvement in nature-oriented activities, while vicarious experiences are those characterized by using multimedia materials such as books, magazines, films, television programs, and the internet so that children get a feel of nature in the absence of actual, physical contact with it. Likewise, the diagram shows that the affective attitudes of children towards biodiversity mediate between both types of experiences with nature and their willingness to participate in conserving biodiversity. Lastly, the authors included gender in the profile of the respondents for its possible confounding effect on the children's affective attitudes and their willingness to conserve biodiversity.

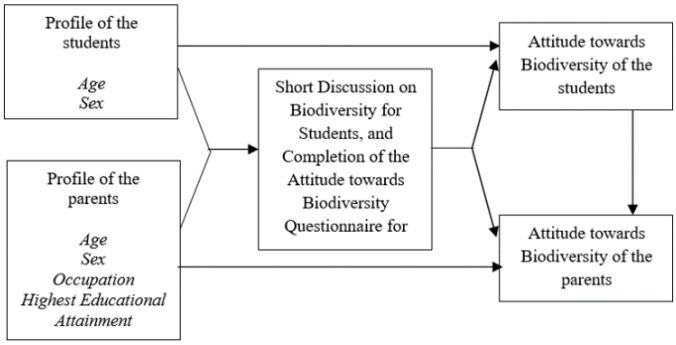

Figure 2. The Conceptual Framework of the Study

Based on the diagram, both the profiles of the students and their parents served as inputs for the study. Components of the profile included age and sex for the students; and age, sex, occupation, and highest educational attainment for the parents. In the first few weeks of the semester, the students had short but comprehensive discussions of biodiversity in the Philippines (including its meaning, importance, threats to biodiversity loss, and the concept of biodiversity conservation) integrated within the unit topic about The Philippine Disaster Situation under their Disaster Readiness and Risk Reduction subject. Consequently, both groups of respondents answered the survey questionnaire to assess their attitude towards biodiversity, which were the study's outputs. The respective attitude levels of both groups were compared to determine significant relationships and to assess if the parents' attitude affects that of their children. Lastly, the profiles of the respondents were correlated with their attitudes toward biodiversity. The results of this study were used to propose recommendations on how to improve the integration of conservation-related topics and activities in the science subjects of the STEM students.

MATERIALS AND METHODS

This study is a descriptive type of research that

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aims to identify trends in a phenomenon or situation. Through descriptive research, hypotheses may be formed for future studies (BusinessDictionary.com, n.d.). This study is also classified as quantitative research. Such a design is appropriate for this undertaking as it assessed and measured the participants' existing attitudes towards biodiversity quantitatively.

2.1 Participants

One hundred seventy-eight senior high school students and 164 parents (either father or mother) currently living with the students at home took part in this study. The students were enrolled in the STEM strand of SHS for the first semester of SY 2016-2017. The unequal ratio between the student- and parent participants was due to the following reasons: some parents had children from both grades 11 and 12 who answered the survey, and some of the student-participants who answered the survey did not return an accomplished survey by their parents as the latter are working abroad - only those currently living with their children were included as participants.

Table 1. Profiles of the Students

Age	Frequency	Percentage
15	2	1.1
16	102	57.3
17	69	38.8
18	5	2.8
Total	178	100.0
Sex	**Frequency**	**Percentage**
male	101	56.7
female	77	43.3
Total	178	100.0

Table 1 presents the profiles of the student participants in terms of age and sex. Most students were 16-year-olds, taking up 57.3 percent of the total respondents. It is expected that most of them would fall at this age, coming fresh out of junior high school. Likewise, most of them are males, accounting for 56.7 percent of the respondents. This result agrees with most findings that men mostly dominate the STEM strand.

Table 2. Profile of the Parents

Age	Frequency	Percentage
early adulthood (18 - 39)	23	14.0
middle adulthood (40 - 60)	133	81.1
late adulthood (above 60)	8	4.9
Total	164	100.0
Sex	**Frequency**	**Percentage**
male	40	24.4
female	124	75.6
Total	164	100.0
Occupation	**Frequency**	**Percentage**
Professionals	44	26.8
associate professionals	46	28.0
skilled office, sales and services staff	12	7.3
office assistance, sales assistant and other maintenance	1	0.6
None	61	37.2
Total	164	100.0
Highest Educational Attainment	**Frequency**	**Percentage**
Undergraduate	25	15.2
College Graduate	110	67.1
Master's Degree Holder	22	13.4
Doctorate Degree Holder	7	4.3
Total	164	100.0

Meanwhile, table 2 shows the parents' profiles in terms of four components: age, sex, occupation, and highest educational attainment. Based on the three age ranges for adults: "early adulthood (18-39), middle adulthood (40-60) and late adulthood (above 60) (Ariola, 2012, pp. 41-42), the majority belong to middle adulthood. Next, more students' mothers participated in this study, taking up 75.6 percent of the total number of parent respondents. Third, in terms of occupation categories adapted from a list by St. Bernard's College (n.d.), data show that the majority of the parents who took part in this study have no work: either

they left the space blank, placed "unemployed," or have listed down "housewife" on the space provided for. Lastly, most parent participants are college graduates, taking up 67.1 percent of the total respondents.

2.2 Data Gathering Procedures

Students and their parents had to complete the questionnaire on their attitudes toward biodiversity and biodiversity conservation. As previously mentioned, during the first week of classes, a short discussion about biodiversity in the Philippines was included in the first unit topic of their Disaster Readiness and Risk Reduction subject. The first unit of the subject talks about the Philippine disaster situation, which is why it is timely to integrate a discussion about the state of biodiversity in the Philippines, and the possible contribution of both natural and man-made disasters to biodiversity loss. The students were asked to complete the survey questionnaire after the discussion. As an added requirement, they took home another copy of the questionnaire and requested one of their parents to fill it out. Submission of the said questionnaire was set for the next meeting.

2.3 Instrument

The instrument is a survey questionnaire about attitudes toward biodiversity, with statements from the items used by Huang and Lin (2014) and the European Commission (2013) in their respective studies. The first part of the questionnaire had blanks allotted for the respondents to supply their profile information. The next part included the statements measuring the participants' attitudes toward biodiversity.

Huang and Lin's (2014) survey questionnaire about attitudes toward biodiversity is a ten-item questionnaire with both positively and negatively stated items intended to measure the extent to which the participant agrees or disagrees with the issues and problems about biodiversity. It uses a five-point frequency scale ranging from strongly disagree (SD) to strongly agree (SA).

The survey questionnaire on attitudes toward biodiversity devised by the European Commission in its Flash Eurobarometer report comprises 13 general questions (seven of which have sub-questions) focusing on general knowledge of biodiversity, awareness of biodiversity, and personal actions to contribute to biodiversity conservation.

All items from Huang and Lin's instrument were included, and only ten (including the sub-questions from some items) from the questionnaire used by the European Commission were adopted. Items were combined, and since modification has been done, validation of the new instrument was accomplished. Thirty STEM students who were not actual respondents of the study were asked to answer the modified questionnaire, and reliability coefficient alpha was utilized to measure its effectiveness statistically. There were 44 items rated: ten from Huang and Lin and ten from the European Commission, with six items with sub-statements. The students were asked to rate their responses to each item on a four-point Likert scale: 4 – Highly Positive, 3 – Positive, 2 – Negative, and 1 – Highly Negative. Results revealed that the 44 items yielded a Cronbach's Alpha value of 0.918. A value of 0.918 is interpreted as having excellent internal consisten-

cy (Statistics How To, 2016). Each item's Individual Cronbach's Alpha values ranged from 0.914 to 0.922. Hence, the 44 items of the validated instrument were all retained for the actual data-gathering phase. Mean scores of the responses of the students and the parents to the survey items were verbally interpreted via the following ranges: 1.00 – 1.74 Highly Negative; 1.75 – 2.49 Negative; 2.50 – 3.24 Positive; and 3.25 – 4.00 Highly Positive.

2.4 Statistical Treatment of Data

Data were interpreted through the following statistical tools: frequency to determine the total number of responses to each item of the questionnaire; arithmetic mean to compute the average scores of the participants in assessing their attitudes towards biodiversity; standard deviation to assess the dispersion of participants responses from the mean scores; Pearson's correlation coefficient to determine any significant relationship between age as a profile component and the attitudes towards biodiversity; chi-square to identify significant relationships between the other profile components which are categorical (sex of both respondents, the occupation and highest educational attainment of parents) and the attitudes towards biodiversity; independent t-test to determine any significant difference between the attitude towards biodiversity of the students and that of their parents; and linear regression to determine if the attitude of the parents affects that of their children. Reliability coefficient alpha was also used since the data-gathering instrument underwent statistical validation because the statements were adopted.

2.5 Ethical Considerations of the Study

Throughout this study, confidentiality and participant information regarding the research were upheld. Before conducting the survey, respondents accomplished an informed consent form comprising the study's aims, the details of the questionnaire, and a list of their rights as participants. As parents also answered the survey, they likewise expressed through the form their approval that their children who are minors are respondents of the study.

The responses of the STEM students and their parents to each item of the pilot-tested questionnaire were tallied, compared, and interpreted.

RESULTS AND DISCUSSION

Table 3. Comparative Table of the Attitudes towards Biodiversity of the STEM Students and Their Parents

Item #	Mean (SD) -Students	Verbal Interpretation	Mean (SD) - Parents	Verbal Interpretation
1	**2.41** (1.03)	Negative	**2.30** (1.00)	Negative
2	**2.13** (0.85)	Negative	**1.93** (0.86)	Negative
3	**2.79** (0.78)	Positive	**2.72** (0.74)	Positive
4	**3.59** (0.49)	Highly Positive	**3.74** (0.57)	Highly Positive
5	**2.98** (0.67)	Positive	**3.07** (0.66)	Positive
6	**2.63** (0.77)	Positive	**2.62** (0.80)	Positive
7	**3.37** (0.77)	Highly Positive	**3.40** (0.62)	Highly Positive
8	**3.07** (0.80)	Positive	**3.16** (0.74)	Positive
9	**2.19** (0.97)	Negative	**2.14** (0.96)	Negative
10	**2.47** (0.78)	Negative	**2.36** (0.70)	Negative
11	**3.40** (0.52)	Highly Positive	**3.62** (0.58)	Highly Positive
12	**3.19** (0.62)	Positive	**3.32** (0.59)	Highly Positive
13 A	**3.45** (0.54)	Highly Positive	**3.58** (0.55)	Highly Positive
B	**3.47** (0.54)	Highly Positive	**3.62** (0.56)	Highly Positive
C	**3.45** (0.53)	Highly Positive	**3.62** (0.55)	Highly Positive
D	**3.47** (0.58)	Highly Positive	**3.57** (0.56)	Highly Positive
E	**3.60** (0.46)	Highly Positive	**3.75** (0.55)	Highly Positive
14 A	**3.62** (0.49)	Highly Positive	**3.71** (0.56)	Highly Positive
B	**3.58** (0.54)	Highly Positive	**3.63** (0.54)	Highly Positive
C	**3.43** (0.62)	Highly Positive	**3.46** (0.58)	Highly Positive
D	**3.27** (0.69)	Highly Positive	**3.38** (0.63)	Highly Positive
E	**3.52** (0.58)	Highly Positive	**3.56** (0.55)	Highly Positive
15 A	**3.48** (0.53)	Highly Positive	**3.61** (0.53)	Highly Positive
B	**3.41** (0.53)	Highly Positive	**3.54** (0.53)	Highly Positive
C	**3.52** (0.52)	Highly Positive	**3.65** (0.58)	Highly Positive
16	**3.35** (0.58)	Highly Positive	**3.46** (0.56)	Highly Positive

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16	**3.35** (0.58)	Highly Positive	**3.46** (0.56)	Highly Positive
17 A	**3.57** (0.52)	Highly Positive	**3.67** (0.54)	Highly Positive
B	**3.68** (0.42)	Highly Positive	**3.79** (0.47)	Highly Positive
C	**3.63** (0.45)	Highly Positive	**3.75** (0.52)	Highly Positive
D	**3.23** (0.77)	Positive	**3.13** (0.70)	Positive
E	**3.59** (0.52)	Highly Positive	**3.68** (0.51)	Highly Positive
F	**3.52** (0.53)	Highly Positive	**3.62** (0.55)	Highly Positive
18 A	**3.45** (0.50)	Highly Positive	**3.60** (0.52)	Highly Positive
B	**3.41** (0.59)	Highly Positive	**3.30** (0.58)	Highly Positive
C	**3.46** (0.53)	Highly Positive	**3.54** (0.52)	Highly Positive
D	**3.46** (0.59)	Highly Positive	**3.56** (0.56)	Highly Positive
E	**3.51** (0.52)	Highly Positive	**3.58** (0.54)	Highly Positive
F	**3.65** (0.48)	Highly Positive	**3.67** (0.53)	Highly Positive
19	**3.30** (0.51)	Highly Positive	**3.35** (0.54)	Highly Positive
20 A	**3.62** (0.53)	Highly Positive	**3.60** (0.50)	Highly Positive
B	**3.25** (0.67)	Highly Positive	**3.21** (0.63)	Positive
C	**2.82** (0.88)	Positive	**2.69** (0.75)	Positive
D	**2.91** (0.78)	Positive	**2.86** (0.77)	Positive
E	**2.87** (0.89)	Positive	**2.79** (0.84)	Positive
TOTAL	**3.27**	**Highly Positive**	**3.32**	**Highly Positive**

Table 3 presents a consolidated comparison of the mean scores acquired by both the STEM students and their parents on a per-item basis. Variably, the mean scores of the students are slightly higher on one item than the parents, and vice-versa. Standard deviation values for both the students' and parents' responses also denote that responses are dispersed close to the mean scores, with values ranging from 0.47 to 1.03 in both sets of participants. Notably, the comparison of the verbal interpretations of their responses was the same on almost all items. As previously mentioned, both had 31 items falling on highly positive, nine items falling on positive, four on negative, and none on highly negative. Other interesting findings are on the similarities of the items incurring the highest and lowest mean scores among the STEM students and their parents. Out of the 44 items, the highest mean scores for the students and the parents can be found on the same item– item 17B, which states, "pollution of air and water threatens biodiversity." Equally, the lowest mean scores for both are found in item 2, which states, "Problems of biodiversity issues should be left to the experts." The students and parents' responses yielded mean scores denoting highly positive attitudes toward biodiversity.

On the one hand, the findings suggest that the students have positive levels of attitude towards biodiversity: most items fall on highly positive and positive. The item with the lowest mean score is stated negatively: Problems of biodiversity issues should be left to the experts (2.13). The result implies that students have a negative attitude towards the notion that biodiversity conservation is merely a responsibility of those in authority. These findings agree with Aivelo (2022) and Nisiforou and Charalambides (2012) that students generally have a positive attitude towards biodiversity. The respondents also agree with the study made by Chua, Giam, Yeo, and Tan (2008) that students who are informed more on biodiversity, biodiversity loss, and biodiversity conservation (which in this study was partly attained through the discussion of the Philippine biodiversity conservation in the students' Disaster Readiness and Risk Reduction subject) will have higher levels of attitude towards biodiversity conservation. Specifically, the result on the item with the highest mean score coincides with the study by Ejem and Bello (2013), who also found that students are highly aware of environmental issues such as pollution and biodiversity loss and are already near mastery of positive environmental attitudes.

On the other hand, the table implies that parents have equally positive levels of attitude towards biodiversity. This finding coincides with the results of the European Commission (2013) report that European adults have high levels of awareness and attitude toward biodiversity. The said report found that nearly all adult Europeans believe that pollution, man-made

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disasters, and climate change (which were also rated by the parent respondents of this study as two of the items with the highest mean scores) are threats to biodiversity.

Table 4. Relationships between Age and Attitudes towards Biodiversity

Indicator	Age			
	r-value	Verbal Interpretation	*p-value*	Verbal Interpretation
Students' Attitude	-.012	Negligible	.874	Not significant
Parents' Attitude	.007	Negligible	.925	Not significant

Table 4 shows the relationships between the ages of the students and parents and their respective attitudes toward biodiversity. Findings show that there is no significant relationship between the said variables. This finding contradicts a previous study conducted by Aivelo (2022), which found that increasing age was a significant predictor for more positive attitudes towards biodiversity, and by Karanth, Kramer, Qian, and Christensen (2008), which found that factors like age were important predictors of participants' attitudes toward conservation initiatives.

Table 5. Relationships between Gender and Attitudes towards Biodiversity of the Students

Profile	Students' Attitude		
	Chi-square value	*p-value*	Verbal Interpretation
Sex	40.186	.551	Not significant

As seen in Table 5, no significant relationship is noted between the sex of the students as males or females and their attitudes toward biodiversity. This finding disagrees with the study by Coracero et al. (2022) and Huang and Lin (2014) that gender and previous experiences in conservation activities relate to students' attitudes toward biodiversity.

Table 6. Relationships between the Other Profile Components of the Parents and their Attitudes towards Biodiversity

Profile	Parents' Attitude		
	Chi-square value	*p-value*	Verbal Interpretation
Gender	36.298	.871	Not significant
Occupation	180.112	.647	Not significant
Educational attainment	156.984	.169	Not significant

Table 6 shows the relationships between the other profile components of the parents with categorical data and their attitude towards biodiversity. Equally, no significant difference among them is noted. The finding contradicts the study's results by Karanth, Kramer, Qian, and Christensen (2008), which found that factors such as professional affiliation and academic degree were important predictors of participants' attitudes toward conservation initiatives.

Table 7. Comparison between the Attitudes towards Biodiversity of the Students and Parents

Group	Mean	*t-value*	*p-value*	Verbal Interpretation
Students	3.32	-1.829	.068	Not significant
Parents	3.27			

Table 7 compares the students' and their parents' respective attitudes towards biodiversity to identify any statistical difference. The values denote that there is no significant difference between the two. This finding contradicts a previous study conducted by Azadani, Karimian, and Moradi (2013), which measured the attitudes toward the environment and environmental issues of secondary school students in Iran. The study's findings revealed that parents' educational

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level influenced the students' appropriate level of information about the environment and environmental issues. Also, a significant relationship exists between students' recognition and their parents' knowledge.

Table 8. Effect of the Parents' Attitude to the Students' Attitude towards Biodiversity

Level of awareness towards biodiversity	Attitude towards Biodiversity of the Students					
	R	Adjusted R^2	Unstandardized Coefficient (Beta)	t-value	p-value	Verbal Interpretation
(Constant)	.06	.003	3.149	13.67	.000	***Significant***
Parents			.052	.74	.460	Not Significant

Table 8 shows that the attitudes toward biodiversity of the parents have no significant effect on their children. This finding disagrees with the studies of Barabble and Booth (2020) and Passmore et al. (2021), that parents' connectedness to nature positively influences their children's attitudes. Additionally, it disagrees with the findings, which stated that children's attitudes toward nature are influenced by family, personal experiences, media, and school (in Eagles & Demare as cited in Ballouard, Brischoux & Bonnet, 2011). It also contradicts a statement by Hill (2014) that parents play an important role in shaping their children's psyche as responsible earth advocates and future citizens. Additionally, the table shows that other factors excluded in this study have significant effects on the student's attitude towards biodiversity based on the result of the p-value, which is less than .05. The r-value of 0.06 represents the simple correlation. It indicates a negligible correlation, while the total variation, which is 3%, is considered low. This result coincides with the finding by Huang and Lin (2014) that various factors affect students' attitudes towards biodiversity, which include socioeconomic factors.

Implications of the Study

The highly positive attitudes toward biodiversity of senior high school students and parents provide a promising opportunity for the higher education institution (HEI) to enact co-curricular and extra-curricular activities geared towards environmental protection and conservation, especially as knowledge and appreciation of biodiversity are already in place. In a recent shift in its administration, the institution now embraces four strategic directions to improve the quality of education it provides. These are stakeholder engagement, social innovation in education, shared humanity, and sustainable futures – the last of which directly relates to taking care of the environment and ensuring that natural resources are used wisely.

Table 9. Proposed Action Plan for Biodiversity-Related Activities in the Senior High School STEM Science Subjects

Goals / Objectives	• to add or integrate more biodiversity awareness and conservation activities in the science subjects taken up by STEM students • to solicit help or assistance from the parents of the STEM students in designing better biodiversity conservation activities within the science subjects
Activities / Strategies	• Review the current syllabi of the science subjects offered in the senior high school STEM strand of De La Salle Lipa. • Make modifications on the syllabi to include biodiversity awareness and biodiversity conservation topics and activities while taking into consideration the required contents as reflected in the DepEd course guides. • Conduct extensive surveys among the parents of STEM students to gather suggestions on some environmental activities conducted in the science subjects. • Initiate small group discussions between science teachers and selected parents in evaluating the pedagogies of the subjects, and in recommending any changes or additions to the way science subjects are taught in the senior high school.

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	• Implement subject-related environmental activities that include the participation of parents in their completion.
Persons Involved	Learning Area Coordinator for Science, Science Area Teachers, Assistant Principal, Selected parents of STEM students
Resources Needed	Copy of the current syllabi of the science subjects, available textbooks and other relevant references, validated survey forms, copy of the current syllabi of the science subjects, required resources for the planned group discussions (venue, AV equipment, food and token for the participants)
Time Frame	starting January 2017
Success Indicators	• Modified science subjects syllabi and course outlines for students that show evidence of integration of biodiversity-related activities • Accomplished survey and group discussions yielding inputs coming from parents to add or modify biodiversity activities in the science subjects • Active participation of the parents in the accomplishment of biodiversity-related activities required of the STEM students

Next, relative to the results of this study detailed in the previous sections, Table 9 presents an action plan or proposal focusing on biodiversity-related activities included as an output of this study. As this study is funded by the higher education institution where it is conducted, the results were used to propose improvements in pedagogy to improve the quality of education offered to students equally. According to Newton (2021), school action plans are particularly important, especially in enacting changes and improvements in school operations. Action plans help identify and address issues that schools want to improve. The action plan proposed in this study recommends adding more biodiversity awareness and conservation activities in science subjects to enhance the students' knowledge, appreciation, and initiative for biodiversity conservation; and soliciting suggestions from parents on how to improve the conduct of science subjects, particularly on conservation activities to make curriculum design more inclusive and collaborative. Such is proposed based on the results that students' attitudes toward biodiversity can still be enhanced in some aspects and that other important factors can enhance students' attitudes towards biodiversity.

Lastly, while no significant relationships were noted between the respective attitudes towards biodiversity of the students and parents and their profile components; and no statistical difference in both groups' attitudes toward biodiversity; the said results imply that appreciation and care for the environment is a constant and universal responsibility of all regardless of age, gender, culture, and race. Human beings are and will always be the stewards of the environment and the advocates of biodiversity conservation.

CONCLUSION AND RECOMMENDATIONS

This paper assessed the attitudes towards biodiversity of students and parents to design improvements in how science subjects are taught to senior high school STEM students. Findings revealed that students were mostly males and aged 16 years old. Most parents in this study were middle-aged mothers, had no job, and were college graduates. Both the students and parents have positive attitudes towards biodiversity as a concept and biodiversity in terms of environmental issues and conservation practices. The profiles of the respondents do not significantly relate to their respective attitudes. No statistically significant difference is determined when the attitudes of both groups are compared. Parents' attitudes are seen to be independent of the students' attitudes. Nonetheless, it was determined that other factors influence the students' attitudes toward biodiversity.

Based on the results of this study, it is recommended that the constructed action plan focusing on

biodiversity-related activities presented in the previous section be considered for implementation by the SHS department of the HEI.

For future similar studies, here are some recommendations: to likewise assess the attitudes towards biodiversity of senior high school students enrolled in the other strands as they too are taking up various science subjects; to assess the extent by which senior high school students have engaged themselves in biodiversity-related or environmental activities in the past and identify lessons learned or some valuable experiences; and as previously identified in this study, to identify other relevant factors that might be influencing the students attitudes toward biodiversity and biodiversity conservation.

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