RESEARCH ARTICLE

The Students' Challenges in Learning Evolution and their Level of Mastery: An Input to An Enhancement Program

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Abstract
Determining the students' mastery level and identifying the challenges encountered by them in learning evolution to provide a basis for developing a program enhancing the students' mastery level is this research's purpose. The quantitative and qualitative research approaches were employed in the conduct of this study. A questionnaire was administered to the respondents who were randomly selected to collect information needed for this study. An interview was also done to further understand and clarify students' responses. It was found that students have an average mastery level in learning evolution which needs further enhancement to achieve the educational aims of a high mastery level. Also, it was proven that students' mastery levels differ if they are grouped according to gender. This means that gender has something to do with their levels of mastering evolution concepts. Despite various educational efforts, students still faced challenges in learning evolution which includes issues with their learning styles, abilities, and interest, the lack of educational resources and materials, and insufficient knowledge of evolution concepts and theories. These challenges implicate their learning, hence, designing a program that best suits the students' needs is required to enhance their mastery level.

Keywords: Evolution; Learning Challenges; Mastery level

Introduction

Biology is one of the subjects in the Senior High School where students are taught about life, the concept of diversity, how organisms interact and how energy is transformed, and evolution. With their exposure to the subject, the students are able to better understand the underlying concepts of Biology (Department of Education [DepEd], 2016).

One of the most important concepts that were discussed in Biology is Evolution. "Relevance, mechanisms, evidence/bases, and theories of evolution" is the content standard for the evolution topic in General Biology as a special subject, while "unifying themes in the study of life" is the content standard for a core subject (Teacher PH, 2021). To be specific, the competencies in teaching evolution cover "explaining how the structural and developmental characteristics and relatedness of DNA sequences are used in classifying living things, identifying the unique/distinctive characteristics of a specific taxon relative to other taxa, and describing species diversity and cladistics, including the types of evidence and procedures that can be used to establish evolutionary relationships" (DepEd, 2016).

Evolution is defined as a slow process of change by which organisms have acquired their distinguishing characteristics. It has been going on since the earth was formed billions of years ago. The more common theories on evolutions are Lamark's theory of Acquired Inheritance and Darwin's Theory of Natural Selection (Murray, 2018). Evolution is described as the change in heritable traits of biological populations over successive generations (Ashraf & Sarfraz, 2016).

Evolutionary theory is continuously developing. New theoretical considerations based on new techniques and empirical data have contributed to a more refined knowledge of how evolution works in the biological world and beyond over the years and decades (Hanish & Eirdosh, 2020). However, It is perceived that learning evolution is contentious since many individuals feel that the notion of evolution contradicts their religious beliefs.

In the context of learning evolution, public opposition to learning appears to have become greater even if the quality of the evidence supporting evolution has improved significantly since the discovery of DNA. Students' resistance has been seen to be framed in religious terms, and teachers may be hesitant to confront religious concepts in class (Nelson, 2008). A study in the United States of America has proved that students'

religious beliefs are a great predictor of their acceptance and understanding of evolution and its concepts. (Rissler, Duncan & Caruso, 2014).

Correspondingly, students begin to form long-term beliefs about creation at an early age. Many other studies have found that young students develop and maintain naive or folk beliefs as well as evolution concepts. When young students form opinions, they tend to hold on to them, opposing explanations that differ from their own (Nadelson & Culp, 2009). It tails to the conflict to embrace the teaching of theories of evolutions and frequently sparks classroom discussions. This phenomenon is explained by the study that describes people's conception. It presents that Students' conception is separated into two categories: preconception and concept assimilation. Preconception refers to the idea or knowledge that a pupil has before they begin the learning process. Individuals formed an understanding known as concept assimilation as a result of the learning process, which ideally led to concept mastery. Students, on the other hand, tended to have trouble absorbing their conceptions after learning, resulting in misunderstandings being labeled as lack-of-conceptions. Students who retained misconceptions were unaware of them and did nothing to correct them (Putri, Rahman, & Priyandoko, 2017).

It is also noted that even though evolution is the basic unifying concept of biology, it is a field of research filled with controversy. This is a fundamentally social struggle, not a scientific one, and regrettably, many groups have a strong stake in sowing doubt and misunderstanding regarding evolution. When teaching evolution, a scientific instructor is certain to encounter misconceptions about the subject that pupils have picked up from pop culture, the news media, and, in some circumstances, other science classrooms (Bouquet, 2016).

The study by Moore, Brooks, and Cotner (2011) determined how societal associations affect the students' thoughts on evolution. It further investigated what factors influence students' attitudes toward evolution where they found that the students consider their religion and personal relationships are the two topmost factors. Moreover, the study identified religion, family, peers, teachers, school authorities, and the media as the sources of students' learning evolution.

In another study, parents' viewpoints on evolution are found to affect students' attitudes toward learning evolution as the more that the parents are having negative perceptions of evolution, the more the students reject learning it. This would mean that students, at an early age, are inculcated with negative information about evolution, hence, the rejection and distrust of its concepts (Bramschreiber, 2014).

Whatever the causes of the learning evolution conflict, it is considered to be complicated, varied, and difficult to resolve. Accepting or rejecting evolution is a difficult decision to make; each individual has their own set of experiences, beliefs, and worldviews to consider (Talbot,

Zeegan, & Ogden, 2020). On the other hand, the National Science Teachers Association (NSTA) strongly supports the position that evolution is a major unifying concept in science and should be emphasized in K–12 science education frameworks and curricula Students will lack the scientific literacy necessary to be well-informed citizens and college-ready if evolution is not taught (National Science Teaching Association, n.d.).

Although students' performance was not very impressive and found to be poor, it is underlined that evolution must be taught in public schools. As emphasized, understanding evolution is critical for coping with twenty-first-century microbiological challenges. We must educate the next generation of scientists to provide them with the information and abilities needed to develop novel treatments for antibiotic-resistant bacteria, emerging viruses, and other hazardous microbes (Kahn, 2007).

Despite the clear manifestations in various literature indicating that evolution is a fundamentally relevant field of Biology, it was not given enough emphasis in the curriculum, especially in the Philippines. In the Philippines' Senior High School, evolution was allotted little emphasis and sadly offered only to that science-related strand. Evolutionary theory research focuses mostly on students' beliefs and notions, as well as their conceptual comprehension. Even now, it is unclear if evolutionary theory is receiving the attention it needs. The researchers came to the conclusion that it is critical to establish teaching methods that increase students' motivation to learn about evolution, particularly in cultural contexts. More importantly, fostering a school climate that acknowledges the theological and cultural debates around evolution might help students gain a better understanding of the subject. Some research stated that pedagogical emphasis on human instances is an effective and interesting strategy to teach key evolution concepts, despite being a contentious issue. As a result, determining the pupils' degree of comprehension of evolution and the factors that influence it is critical and important. This is the very reason why this study was conducted.

Research Questions

Because there are limited studies on the content and pedagogical approaches to evolution and its importance in the educational programs, this study will be conducted with the goal of determining the students' mastery level in learning evolution, their profiles, and the problems they encountered in learning evolution so that a program can be developed to improve their mastery level. Answers to the following questions were sought to fulfill this research's aims.

1. What is the profile of the students in terms of:
    1.1. age;
    1.2. gender;
    1.3. Senior High School Track/Strand enrolled; and
    1.4. religious affiliation?
2. What is the students' level of mastery of evolution?

3. Do students' mastery levels of evolution significantly differ when they are grouped according to:
   3.1. age,
   3.2. gender,
   3.3. Senior High School Track/Strand enrolled in, and
   3.4. religious affiliation?
4. What challenges do students encounter when learning evolution?

Methods

This present study employed a combination of quantitative and qualitative research designs. A total of 384 Senior High School students in the Schools Division of Palawan in the Philippines, were randomly selected and served as this research's respondents. This research employed various data gathering modes such as limited face-to-face interviews, calls, and online modes in gathering the needed information for this study. The researchers used their self-developed questionnaire to determine the respondents' profile and their level of mastery in evolution. At the same time, the researchers used an interview guide in gathering the challenges encountered by the students in learning evolution. After gathering the required information, the researchers carefully tabulated the responses and analyzed them using descriptive (frequency, percentage, mean & Standard Deviation) and inferential (t-test) statistics. On the other hand, a thematic analysis was used to collect qualitative responses from the respondents.

Results and discussion

Table 1 describes the respondents' characteristics as to age, gender, Senior High School tracks/strand, and religious affiliation. Majority of the student-respondents are aged 17 (f = 120; % = 31.2) and 18 (f = 101; % = 26.2). Meanwhile, more than half of the respondents is composed of female (f = 229; % = 59.5) while male (f = 142; % = 36.9) and LGBTQ+ (f = 14; % = 3.6) comprises the rest. Most of the student-respondents are enrolled in Academic Track particularly under Strands - Humanities and Social Sciences (f = 99; % = 25.7), Science Technology Engineering and Mathematics (f = 92; % = 23.9), General Academic Strand (f = 78; % = 20.3), and Accountancy Business and Management (f = 53; % = 13.8). Finally, majority of the respondents are Roman Catholic (f = 216; % = 56.1).

Students' profile

Table 1. Characteristics of the student-respondents

Age	Frequency	Percentage
15 years old	20	5.2
16 years old	67	17.4
17 years old	120	31.2
18 years old	101	26.2
19 years old	47	12.2
20 years old	19	4.9
21 years old and above	11	2.9
Total	385	100

Gender	Frequency	Percent
Male	142	36.9
Female	229	59.5
LGBTQ+	14	3.6
Total	385	100

SHS Track/Strand	Frequency	Percent
Accountancy, Business, and Management	53	13.8
General Academic Strand	78	20.3
Humanities and Social Sciences	99	25.7
Science, Technology, Engineering, and Mathematics	92	23.9
Technical-Vocational-Livelihood	62	16
Arts and Design	1	0.3
Total	385	100

Religious Affiliation	Frequency	Percent
Roman Catholic	216	56.1
Islam	35	9.1
Protestant	134	34.8
Total	385	100

Students' mastery level in Evolution

Table 2. Students' mastery level in Evolution

	Mean	Std. Deviation	Descriptive Equivalent
Mastery Level	41.74	24.012	Average Mastery

The mastery or achievement level designed by the Philippines' Department of Education, as per DepEd Memorandum 160 s. 2012, was adopted in interpreting the student's level of mastery in evolution. The mean of 41.74 and a standard deviation of 24.012, as shown in Table 2, implies that students have an average mastery level in evolution. Hence, an effort to increase the students' mastery level is a must.

Analysis of Students' mastery levels per profiles

Table 3. Difference on the students' mastery levels based on their profiles

		Sum of Squares	df	Mean Square	f	Sig.
Age	Between Groups	14.002	5	2.8	1.563	0.17
	Within Groups	661.262	369	1.792		
	Total	675.264	374			
Gender	Between Groups	3.885	5	0.777	2.731	0.019
	Within Groups	104.985	369	0.285		
	Total	108.869	374			
SHS Track / Strand	Between Groups	21.56	5	4.312	1.35	0.243
	Within Groups	1178.989	369	3.195		
	Total	1200.549	374			
Religious Affiliation	Between Groups	0.912	5	0.182	0.208	0.959
	Within Groups	323.685	369	0.877		
	Total	324.597	374			

The Analysis of Variance (ANOVA) on the difference between the students' mastery levels, when grouped according to age, gender, Senior High School Track/Strand and religious affiliation is shown in Table 3. It is revealed that the p-values for students' age [p = 0.17], track/strands enrolled in [p = 0.243], and religious affiliation (p = 0.959) are greater than the alpha level of significance [α = 0.05] which means there is no sufficient evidence to reject the null hypotheses. Thus, the student's level of mastery in evolution does not significantly differ when grouped according to their age, Senior High School Track/Strand, and religious affiliation. On the contrary, students' gender, having a p-value [p = 0.019] less than the alpha level of significance [α = 0.05], suggests that there is sufficient evidence to reject the null hypothesis. Therefore, the student's mastery levels in evolution significantly differ based on their gender. These findings disputed the findings of Rissler, Duncan and Caruso (2014) as in their study, students' level understanding and acceptance of evolution are predicted by their religious beliefs, and exposure to science subjects.

Challenges encountered by the students in learning evolution

Table 4. Students' encountered challenges in learning Evolution

Theme 1: Issue on students' learning style, ability, and interest
Quoted responses:
"The main challenges that the students have encountered are self-studying, poor internet connection, lack of sleep and time to answer all the modules due to the great number of activities, distractions, and lack of focus."
"It's kinda hard for me to grasp the information about the theory of hardy Weinberg"
"It's to keep in touch in every topic/lesson because the lesson about evolution requires attention and focus for you to understand it thoroughly."
"My lack of understanding in evolution"
"I think that the main problem is to maintain the interest of our students."

"The challenges, problems or issues that I have encountered in learning evolution is that not having enough concentration and motivation on learning and understanding evolution"

Theme 2: Lack of learning resources

Quoted responses:
"The challenges I have encountered in learning evolution are lack of learning resources such as books and internet signal and availability. Also, the topic itself covers a lot of areas which need further understanding and time to learn."
"Lack of time and not enough source of information"

Theme 3: Unfamiliarity with the theories and concepts of evolution
Quoted responses:
"The problem I have encountered in learning evolution are the words that are unfamiliar and not easy to understand"
"There are theories and terms I am not familiar with, thus making it difficult for me to understand the lesson and questions."
"I have struggled in learning because I have no background or any idea about evolution since this was the first time that it was introduced to me."
"That I don't know what's the other topic all about"
"In learning evolution, some parts are hard to understand because of complicated explanation."
"There are terms that I'm not familiar with. Some of the terms are hard to understand, and lack of example is a challenge for me too."
"I didn't remember what I have learned about the topic, unfamiliarity of the other words and topic, didn't study lot about evolution which cause me to not know what to answer in the questions"
"Most of the topics covered, especially the theories and names, are facts that I don't know of. Maybe because those are topics and lessons to be covered and tackled on in the future"

Understanding the challenges encountered by the students in learning evolution would be necessary for formulating possible intervention programs in improving their mastery level. Table 4 presents the students' encountered

challenges where three themes emerged namely (1) Issue on students' style, ability, and interest, (2) Lack of learning resources, and (3) Unfamiliarity with the theories and concepts of evolution. Students' learning styles, interests, and abilities seemed to pose challenges in learning evolution among students. Students' learning style, as shown in the following students' responses played a significant role in their mastery of the evolution:

"The main challenges that the students have encountered are self-studying, poor internet connection, lack of sleep and time to answer all the modules due to the great number of activities, distractions, and lack of focus," and

"The challenges, problems or issues that I have encountered in learning evolution is that not having enough concentration and motivation on learning and understanding evolution"

Meanwhile, as shown in the following statements, students' ability and interests must be given enough consideration as it also emerged to cause negative implications on students' mastery level:

"My lack of understanding in evolution,"

"I think that the main problem is to maintain the interest of our students," and

"It's kinda hard for me to grasp the information about the theory of hardy Weinberg"

The lacking or insufficiency of learning materials about evolution topics could also be detrimental to mastering evolution as mentioned by the respondents ("The challenges I have encountered in learning evolution are lack of learning resources such as books and internet signal and availability," and "Lack of time and not enough source of information").

The last theme that emerged from the students' responses to the challenges encountered is the Unfamiliarity with the theories and concepts of evolution. Indeed, being unfamiliar or lacking enough knowledge on a particular subject matter would pose a great challenge in understanding a concept such as evolution. As mentioned by some of the respondents, words, theories, and concepts of evolution are unfamiliar to them and some were already forgotten by them. Similarly, some responses imply that their encounter with the concept of evolution is not enough for them to master it. Below are some of the students' notable responses:

"I did not remember what I have learned about the topic, unfamiliarity of the other words and topic didn't study a lot about evolution which cause me to not know what to answer in the questions",

"I have struggled in learning because I have no background or any idea about evolution since this was the first time that it was introduced to me,"

"That I don't know what's the other topic all about," and

"In learning evolution, some parts are hard to understand because of complicated explanation."

Conclusions

This study's main objective was to determine the students' mastery level in learning evolution and identify the challenges they encounter as they learn the subject or concept. The findings of this study will provide a basis for developing a program that enhances students' mastery levels. It will then help educators in designing a program that would promote higher students' understanding and mastery of the evolution subject or concept.

This study's findings underscore the following: (1) students have an average mastery level in evolution, (2) the students' mastery levels in learning Evolution are significant when they have grouped according to gender, (3) students when grouped according to age, the Senior High School Track/Strand they are enrolled in, and their religious affiliation posed no significant difference in their mastery levels in learning Evolution, and (4) students primarily encountered three emerging challenges that affects their learning evolution subject or concepts, specifically, the issue on students' style, ability, and interest, lack of learning resources and unfamiliarity with the theories and concepts of evolution.

Since the students' mastery levels in learning Evolution are only at average, this would imply that a great effort to increase students' mastery should be done as educational institutions' aim is that competencies in every subject must be mastered by the students. As students' mastery levels differ if they are grouped based on gender, it is imperative to have a clearer look at other factors affecting such differences. Furthermore, the identified challenges that the students encountered in learning Evolution that including their learning style, abilities, and interests, the lack of learning resources and materials, and their unfamiliarity with the theories and concepts of evolution, could be a basis in designing a program enhancing students' mastery level. It is therefore recommended to assess students' learning needs and styles to properly design an enhancement program best suited to them. The school must also address the identified lacking educational materials and resources on evolution.

Acknowledgement

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