Exploring the Factors Influencing the Performance in Biology of Senior High School Students at University of Mindanao, Philippines

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Abstract. **This study used a sequential exploratory strategy of a mixed-method research design aimed to explore the factors and this also aimed to determine the extent of relationship between these factors and performance of Senior High School students in biology. Factor analysis was employed to develop the instrument derived from the interview of the informants for data analysis. The predictor variables were tested whether these predict the performance of student in Biology. Result revealed five factors namely: teaching approach, student-related factors, teaching strategy, teacher's motivation, and learning resources. The respondent' mean level of agreement of these factors have an agree qualitative description which means it is oftentimes true for them. Students' performance in biology was also determine. Grade 11 have a very satisfactory rating while Grade 12 obtain an outstanding qualitative description. Using Spearman's rho correlation, all factors are not significantly correlated with the students' performance in biology.**

Keywords**: factors of performance; senior high school students in Biology; performance in Biology; sequential exploratory research; Davao del Norte**

I. BACKGROUND OF THE STUDY

Biology always plays a vital component to one's education. It is a key element student need to learn and master in order to cope with the complexity of other disciplines in the Senior High School curriculum. However, recent standing of Biology proficiency among Filipinos is deteriorating and at par compared to neighboring ASEAN countries (Afe, 2001).

Knowing that teachers are known to have an essential influence on the academic success of students, they also play a critical role in educational success because they are highly responsible for interpreting educational policies and principles into practical actions during interaction with students. Learning and teaching depend mainly on teachers, no wonder an effective teacher was intellectualized as one who yields desired results in the course of his teaching duties (Uchefuna, 2001). Moreover, the effect of teacher effectiveness on student learning results as reflected in the academic success of students has been the subject of numerous research (Schacter and Thum, 2004; Adediwura and Tayo, 2007; Adu and Olatundum, 2007). One study suggests that effective teaching is an important predictor of the performance of students. Effective teachers should therefore produce students with higher academic skills (Ajao, 2001).

The Trends in Mathematics and Science Survey (TIMSS) alone which was conducted five years ago revealed unsatisfactory results; the Philippines ranked 42nd in Science out of 45 countries that were tested. Hence, the above accounts provide a framework of information into this study that will look into the factors that affect National Achievement Test (Barrientos, 2015). The current state of biological education in the Philippines, especially at the level of basic education, is lagging elsewhere in the world. The results of the Trends International Math and Science Study (TIMSS) put the Philippines in disadvantaged positions among the participating nations. In TIMSS, the Philippines ranked almost at the bottom of the list of 17 nations which took part in this large-scale evaluation of educational achievement (Langat, 2015).

Nevertheless, the Department of Education (DepEd), Philippines has identified problems that coincide with the country's current tertiary school curriculum (Talisayon et. al, 2006). Unqualified and poorly trained teachers, inadequate facilities, and dilapidated instructional materials are among the school-related factors found. In Panabo City, Davao del Norte, Philippines, no study on the factors influencing the performance of senior high school students in biology was published.

Statement of the Problem

This study aimed to explore the factors influencing the performance of Senior High School students in biology. This was also conducted to determine if there was a relationship between the factors and biology performance of Senior High School students.

Specifically, this study sought to answer the following objectives:

1. What are the factors influencing the performance of Senior High School students in biology?
2. What is the level of agreement on the factors that link to the performance of Senior High School students in biology?

3. What is the level of performance of Senior High School students in biology?
4. Is there a significant relationship between the factors and performance of Senior High School students in biology?

Hypothesis

The hypotheses were tested at 0.05 level of significance:

Ho. There is no significant relationship between the factors influencing performance and the performance of Senior High School students in Biology.

Theoretical and Conceptual Framework

This study is anchored on following theories: Sigmund Freud's theory in Martin Ford's Motivational System Theory, Bandura's Social Cognitive Theory, Gagne's Theory of Acquisition of Knowledge, and Piaget's Theory of Constructivism.

According to Sigmund Freud's theory in Martin Ford's Motivational System Theory (MST), the framework focuses on the individual as the unit of analysis, but embeds the individual in the biological, social, and environmental context that are crucial to development. MST attempts to describe the development of the person-in-context, in much the same way a biologist might describe an individual plant and its relation to its immediate ecological niche, as well as the larger ecosystem in which it resides (Campbell, 2007). The formula for this theory signifies that actual performance and competence are the results of a motivated, skillful, and biological capability of a person interacting with a responsive environment (Ford, 1992). The motivational system theory does not try to organize the various motivation constructs from different theories into one model. The main constructs are self-efficacy beliefs, the role of expectancy, and goal orientation. The formula suggests that in any behavior episode, there were four major prerequisites for effective functioning: motivation, skill, biological structure, and responsive environment.

Bandura who strongly lays emphasis on one's cognition, suggests that the mind is an active force that constructs one's reality selectively, encodes information, performs behavior based on values and expectations and impose structure on its own actions. It is by understanding the processes involved in building reality that people's behavior can be understood, predicted and changed. In view of the theory, the academic performance of the student is a product of the interaction of his personality and therefore of his study behavior based on his expectations of the results of his actions.

Bandura's theory of social learning stresses the importance of observing and modeling other people's behaviors, attitudes and emotional reactions. Bandura stated that learning would be extremely difficult, not to mention dangerous, if people only had to rely on the effects of their own actions to inform them what to do. Fortunately, most human behavior is observed by modeling: by observing others, one has an idea of how new behaviors are performed and this coded information serves as a guide for action later on. The theory of social learning explains the continuous reciprocal interaction between cognitive, behavioral, and environmental influences of human behavior.

Theory of Gagne's acquisition of knowledge states that an important foundation of education is the establishment of a high reminder of the learning ability. Teaching biology involves understanding the very essence of students in order to dispel their misconceptions and fears that hinder their biological growth due to the nature of most biology, a student must achieve a certain level of mastery in the unit before he can move on to the next unit. As argued by Albert et. al, (2014), if the student knows no key material, he or she must pass through this part of the unit until he or she understands it satisfactorily

In addition, one of the difficulties in teaching all types of students lies in the student's ability to grasp new concepts and make learning lasting for those whose assimilation rates are not as fast as expected (Alos et. al, 2015). It is often the teacher that gives his students the atmosphere to learn. The study is thus supported by Dewey's theory, which states that learning is an active social process gained through lifelong learning activities and first-hand experiences. This notation requires teachers to offer a variety of activities in which students can discuss and generate ideas to reach a common understanding on a subject. In this manner, students have an equal opportunity to communicate by arguing and confirming ideas that have been raised.

In addition, this study is also adopted by Piaget's Theory of Constructivism, which states that people produce knowledge and form meaning based on their experiences that impact learning, because teachers need to develop a curriculum plan that enhances their student's logical and conceptual development. Clearly, teachers must emphasize the important role that experiences or links to the adjacent atmosphere play in student education. The role of the teacher is very important instead of giving a lecture, the teacher in this theory functions as a facilitator whose role is to help the student in his or her own understanding, this removes the focus from the teacher and the lecture and affects the student and his or her learning. Teachers who follow Piaget 's constructivism theory must challenge the student by making them effective critical thinkers, not just a teacher but also a mentor, consultant and coach. Some teachers' strategies include working together with students and helping to answer each other's questions. Another strategy involves appointing a student to be the expert on a subject and teaching the class. Finally, students can work in groups or pairs and research controversial topics to be presented to the class (Alos et. al, 2015). The result of this study indicated that theory of constructivism is a valid factor of students' performance.

Shown in Figure 1 is the conceptual framework of the study. The independent variables of this study are the teaching approach, student-related factors, teaching strategy, teachers' motivation, and learning resources. Meanwhile, the dependent variable of this study is the students' performance in biology.

Independent Variable Dependent Variable

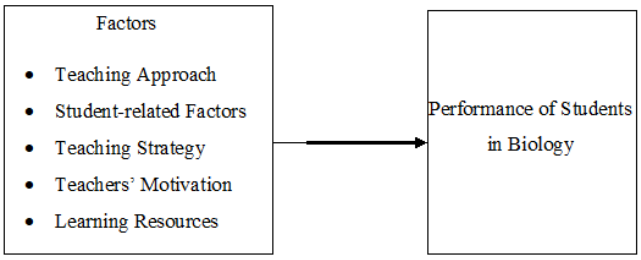

Figure 1. The Conceptual Paradigm Showing the Variables of the Study

II. METHOD

Research design: This study used a sequential exploratory strategy of a mixed-method research design. This exploratory research initially employed a qualitative design which is the most appropriate approach in describing the experiences of the senior high school students. In qualitative research, Creswell (2009) stressed out that the quest to understanding the nature of the investigation by entering the field of perception of participants, seeing how they experience, live, and display the situation, and looking for the meaning of the participants` experiences. Additionally, a sequential exploratory mixed method is a design of validating both qualitative and quantitative methods.

Research Respondents and Informants Selection and Sampling Procedure:

*Qualitative Phase***.** The purposive sampling was utilized in choosing the participants who are information-rich. It also presents multiple perspectives of individuals to represent and display different dimensions (Creswell, 2009). The Key Informants consisted of twelve teachers of Biology. The teachers were identified with only those teaching experience in handling Biology subjects for at least 5 years to assure the reliability and validity of their lived experiences teaching the subject. *Quantitative Phase.* The quantitative phase used random sampling. The respondents of this study were the students in Grade 11 and 12 with a large number of samples approximately 300 students. These respondents are the beneficiaries of the K to 12 curricula since its implementation.

Research instrument: Following the standard procedure in instrumentation, an interview guide and questionnaire were used in this study. Hence, an interview guide was compromised of open-ended questions to explore the factors that are associated with the performance of students in the Biology subject. The instrument was modified, critiqued, and enhanced by three expert validators. Based on the qualitative analysis, a questionnaire was formulated as a research instrument to collect the data quantitatively pertaining to the factors that are associated to the academic performance of Senior High School Students in Biology subject. The questionnaire was likewise validated by three experts. Pilot testing was executed to ascertain the reliability of the instrument to be used for collecting data by administering it to 20 Grade 11 and 12 students who were not included in the actual quantitative respondents. The data were then analyzed for reliability testing. The computed Cronbach`s alpha formula was determined with 0.880 computed test of reliability which means the instrument is highly reliable.

Data analysis: All statistical analysis of the qualitative and quantitative results was analyzed and computed. For qualitative phase, thematic analysis was done to identify the themes from the answers undergone from the in-depth interview (IDI). The following are the statistical tools utilized in this quantitative research: EFA was used to determine whether the item is part of any of the five factors, the factor loading was set at 0.3 as the inclusion criteria. The mean was used to determine the mean level of agreement on the factors that link to the performance of Senior High School students in biology. Spearman's Rho was used to test the significant relationship of the factors and students' performance in biology

III. RESULTS AND DISCUSSION

This chapter presents the results of the data gathered from the field through in-depth interview (IDI) with the key informants in the qualitative phase. It included teacher's responses given during IDI and it discloses factors influencing performance of Senior High School students' academic standing in Biology. It also elaborates further the results of the study which yielded answers to the following research questions: what are the factors influencing the performance of senior high school students in Biology? Information from the field in the actual setting was revealed in this study. It included teachers' responses of the Senior High School Biology teachers in the In-Depth Interview (IDI) to the above research question.

This chapter also presents the results of the quantitative data. It also discusses further the results of the study which yielded answers to the following research questions: what is the level of agreement on the factors that link to the performance of Senior High School students in biology? what is the level of performance of Senior High School students in biology? and is there a significant relationship between the factors and performance of Senior High School students in biology? Information from the study in the classroom setting was revealed in this study. It included students' responses of the Senior High School students.

Factors Influencing the Performance of Senior High School Students in Biology

When asked about the factors affecting the performance of senior high school students in Biology, the following themes emerged as presented in Table 1. Based on the responses of the participants, performance in Biology in this study is attributed to teaching approach, student-related factors, teaching strategy, teacher's motivation, and learning resources.

Teaching approach

The data elicited from the informants mentioned that there are reasonable features that teaching approach has contributed to the students' understanding and learning the lessons in Biology. The teachers find ways to catch the attention, discuss the lesson from simple to complex manner, motivate the students to get maximum participation from them and if necessary, go back to the basic. Informants narrated that:

> *"*In order for the students to learn from the subject he/she should find ways or approach in order to catch the attention of the students for them to learn." (KII#1).

> "In teaching Biology, I do believe and practice, you have to start in the simple before you present the complex or else you lose everything. "(KII#2)

In an excerpt from Key Informant Interview 1 and 2 as exhibited in the statements, it can be noted that the student lacks comprehension which constitutes the creation of the emerging theme. For students who lack comprehension, they tend to find difficulty in understanding the entire discussion. Some empirical results confirm that students' performance is better in those groups that received innovative teaching approach (Gandia and Montagud, 2011).

Furthermore, knowing the idea that learners learn in different ways is the same as teachers teach in different ways. In fact, an effective teaching approach requires flexibility, creativity, and responsibility in order to provide an instructional environment which is able to respond to the learner's individual needs and the attainment of good academic achievement and learning outcomes. Additionally, most students learn best when the style of presentation is aligned with their preferred learning ability. It is important therefore for teachers to understand the students' learning styles and also for students to understand their own learning preferences (Fayombo, 2014).

Student-related factors

Considering that student is the center of the educative process, the student-related factors support significantly to the whole academic success of any individual in the teaching-learning process. Student-related factors consider the student's retention and student's interest.

As it is narrated:

> "In my experience, one of the major factors that affect the academic performance of my students in Biology is their level of retention of previous knowledge and basic concepts." (KII#3)

> "The interest of the students because I believed that if they are interested to learn, there would be no difficult subject if they are interested in learning." (KII#8)

Student's retention contributed to the student's academic success in Biology class. This refers to student's personal factors such as self-confidence, attitude, and behavior may impact how students approach learning such as effort, problem-solving abilities, study habits, and critical thinking within that discipline.

To facilitate learning, it is therefore important that educators familiarize themselves with student attitudes and associated behaviors, as well as the factors that may influence these attitudes (Hansen and Birol, 2014). The evidences disclose the notion that the higher the student's curiosity is, the better they will perform in the class

Student's interest plays an important role in the performance of the learners. It is presented in the evidences below that the student's interest in the lesson or the subject, in general, it contributed to their academic success in Biology. Most especially, if the students are already advanced and good in the Biology lesson, they tend not to pay much focus and attention anymore to the subject because they are already good at it.

Teaching strategy

The activities, class exercise, and drills as part of teaching strategy are backing the claim of Biology lesson as factors influencing to the students' academic performance in Biology. Informants revealed that teaching strategies like task-based activities and board works are very important in the classroom setting. Thus, strategies like activating prior knowledge, understanding and comprehending the processes of Biology lesson and applying it can be enjoyable and task-based activities. As informants cited:

> "Teacher's strategies are very important in connecting their previous knowledge to the new knowledge which the teacher will be introducing to the students." (KII#1)

> "The teacher must deliver the lessons well in order for the students to easily catch up with the lessons. The teacher must use various strategies that suit the learning style of the students especially in learning biology with this the students can perform well in class." (KII#4)

In an excerpt from Key Informant Interview 1 and 4 as exhibited in the statements, it can be noted that the teacher's strategies are effective to the students' performance which constitutes the creation of the emerging theme. For students who lack retention, they tend to find difficulty in remembering the previous knowledge and be motivated.

Result shows that teacher experience teaching strategies as related predictor of the learner's academic

success. As to the teaching-learning process, the data elicited from the informants reveal that there were reasonable features that teaching strategy has contributed to the students' learning and understanding the Biology lessons. In the study of Ayap (2007) that the teacher in the classroom is the central figure who provides the structure within which the students can learn. In fact, the way the teacher presents an activity or concept, strongly influences the way the learners react to it. An effective teacher utilizes a variety of techniques and strategies to develop productive discipline and to motivate learners. Nagler (2016) in his study concluded that teaching strategies are not correlated with biology achievement but further stated that good teaching strategies resulted in more positive attitude and lesser anxiety towards biology.

Teacher's motivation

Teacher's motivation plays a very vital role in the promotion of teaching and learning excellence. Basically, teachers who are motivated are more likely to motivate students to learn in the classroom. Teacher motivation is fundamental to teaching and learning process. Motivation leads to satisfaction because a profoundly energetic educators are fulfilled. The fulfillment increment as the inspiration level towards the job assumes a simple imperative part in upgrading the level of educators' satisfaction (Khan *et al.,* 2017). Informants expressed the statement saying:

> "The teacher must be a good motivator especially if the student hates biology. Lastly, the teacher and student must have a good rapport to each other but with the limitations, in this way the students tend to love the subject and trust the teacher. The teacher should not so strict to the students allowing the students to listen and respect the teacher that leads to good performance in biology class." (KII#4).

> "The teacher should be really good in motivating the students for them to learn effectively and be cooperative because if the teacher is so good in motivation the students, the students will be able to give their best and the teacher will be able to let his/her students go to for their respective shells and know their skills and abilities." (KII#10)

In an excerpt from Key Informant Interview 4 and 10 as exhibited in the statements, it can be noted that the teacher's motivation is effective to the students' performance which constitutes the creation of the emerging theme. For students who lack motivation, they tend to find difficulty in coping and understanding the lessons.

According to the investigations prior accomplishment is also significantly related to perceived competence and performance, suggesting that biology learners who do well on test then perceive themselves as able learners, which promotes more academic success. This research also imparts the result of the study that students are knowledgeable enough, participative, motivated, and they know how to communicate well with their students. Most importantly, it supports the qualitative result which shows that there is a high response in terms of the students' performance in the classroom (Akey, 2006).

Learning environment

Learning resources are one of the considerations the researcher finds it practical to note in this study. Inclusions of learning resources are laboratory rooms, equipment, apparatus, and technology. Just as students' interest and behaviors are impacted by their learning resources, teachers also are influenced by the facilities within which they work (McGowen, 2007). As informants cited:

> "One factor is related to the limited resources, especially when teaching Biology. It is very needed to have an adequate and availability of resources like for example teaching about cells. Simple illustrations are not enough for them to fully understand the topic which can affect their performance in the class." (KII#5)

> "The resources are lacking in our school. We do not have a microscope, that is use for studying a cell. Other laboratory equipment also is not available since our school is very small." (KII#6)

Level of agreement on the Factors that are linked to the Performance in Biology of Senior High School Students

Results revealed that the respondents agree that the following factors: teaching approach, teaching strategy, teacher's motivation, and learning resources are linked to the biology performance while they moderately agree on student-related factors. In teaching approach, the mean level of agreement is 4.18. Result implies that it is oftentimes true that this factor has contributed to the students' performance in Biology. The respondents are able to experience favorable instructional pedagogy in Biology class and have the sufficient understanding of the concepts presented in the lesson. They agree on the ideas that their teachers improvise means to attract their attention for them to learn better the topics.

The student-related factors have the lowest mean level of agreement of 3.44. The data show that it is sometimes true that students-related factors such as students' retention and interest do not greatly affect their performance in biology. Meanwhile, teaching strategy is found to be the fourth high mean level of agreement with 4.04. This means that the respondents' level of agreement to this factor is oftentimes true for them. On the other hand, the teacher's motivation has a mean level of agreement of 4.16. This indicates that the students have recognized an adequate level of agreement and it is oftentimes true to them the idea that this factor has contributed to their biology performance. Learning resources gets the highest mean level of agreement among the other five

factors which is 4.19. This plainly claims that the respondents have perceived an oftentimes true in the learning resources.

Table 1. Level of agreement of the factors that are linked to performance in Biology

Factors	Level of Agreement (Mean)	Std. Deviation	Qualitative Description
Teaching approach	4.18	0.11	Agree
Students-related factors	3.44	0.10	Moderately Agree
Teaching strategy	4.04	0.06	Agree
Teacher's motivation	4.16	0.07	Agree
Learning resources	4.19	0.67	Agree

Students Performance in Biology in terms of Grades

Both Grade 11 students have a very satisfactory rating. However, Grade 12 students obtain an outstanding qualitative description. The respondents' overall performance in biology is 89.56 with the standard deviation of 1.87. This simply implies that respondents obtain a very satisfactory rating. Furthermore, such result suggests that the respondents at this level have developed the fundamental knowledge and skills and core understandings in biology.

Table 2. Performance of SHS in Biology in terms of their Grades

Variable	Mean	Std. Deviation	Qualitative Description
UMPC: Grade 11	87.95	6.72	Very Satisfactory
UMPC: Grade 12	91.67	4.90	Outstanding
UMTC: Grade 11	87.74	3.47	Very Satisfactory
UMTC: Grade 12	90.90	2.39	Outstanding

Relationship between the Identified Factors and Performance in Biology of Senior High School Students

In teaching approach, result shows that the p-value is 0.649 which is greater than 0.05. This means that there is no significant relationship between teaching approach and students' performance in biology among the respondents. There is also no correlation between students-related factors and their performance in Biology because the students-related factors have an r-value of 0.024 with the p-value of 0.672. In the past study, about the student-related factors and performance in science. The study revealed that there was no significant statistical correlation between the intervention and an answering increase in the perception of science by students as interesting and remembering (Benjamin, 2014).

Table 3. Relationship between the identified factors and performance of Senior High School students in Biology

Statement indicators	r-value	p-value	Decision over Ho
Teaching Approach	0.026	0.649	Failed to reject
Student-related Factors	0.024	0.672	Failed to reject
Teaching Strategy	-0.009	0.879	Failed to reject
Teacher's Motivation	0.026	0.648	Failed to reject
Learning Resources	-0.013	0.815	Failed to reject

Meanwhile, teaching strategy has an r-value of -0.009 with the probability value of 0.879. This means that there is no significant relationship between teaching strategy and students' performance in biology among the respondents. In the study of Özcan (2003) found no significant relationship about investigation on teaching strategies on the learning of the skills of the science process. It confirmed that there is no significant relationship between teacher-related factors like personality traits, teaching skills and teaching materials, and student performance in biology. The performance of the students in biology is therefore not affected by teacher-related factors. On the other hand, a number of studies had revealed that matches between students' learning styles and instructional strategies did not affect the students' learning performance (Akdemir and Koszalka, 2008; Fayombo, 2015). The matter about linking learning style with teaching techniques and its effects to academic achievement of students remains to be inconclusive, thus further study needs to be done to justify this claim.

In teacher's motivation, result shows that the p-value (0.648) is greater than 0.05. This means that there is no significant relationship between teacher's motivation and students' performance in Biology among the respondents. In support, Zuelke (2008) findings showed no significant relationship in the mean scores of students taught by teachers with varying years of experience, qualification and teaching practices in the eighth grade. Moreover, Ibe et. al, (2016) show that there is no significant difference between the mean student achievement scores taught by teachers' motivation of biology. Furthermore, the result of this study affirms Mahler et. al, (2018) speculations which emphasizes that their results do not reveal a relationship between the self-efficacy of teachers and the performance of students.

Lastly, learning resources has an r-value of -0.013 with the probability value of 0.815. This means that there is no significant relationship between learning resources and students' performance in biology among the respondents. In Nigeria, the results of the laboratory facilities analysis and academic performance show that the analyzed data revealed that no significant relationship exists between the extent to which laboratory facilities are used and the academic performance of students in chemistry (Neji and Nuoha, 2015).

Another study of Egbona (2002), show that the availability of instructional materials has no significant relationship with academic performance of students. He concluded that they should be made available as they facilitate the learning process of teaching. Similarly, the study of Koroye (2016) showed that infrastructure facilities, school equipment, and instructional materials have no significant influence on the academic performance of students. Thus, the result implies that all of the factors does not have a significant relationship maybe because the students were thinking on their academic performance not the performance in biology.

IV. CONCLUSION

Based on the findings, there were five identified factors influencing the performance of students in biology namely: teaching approach; student-related factors; teaching strategy; teacher's motivation; and learning resources.

Also, the mean level of agreement of the students agree on the factors, such as teaching approach, teaching strategy, teacher's motivation, and learning resources. However, the mean level of agreement of student in students-related factors moderately agree on that factor. This means that the first four factors in biology performance are oftentimes true for them.

Furthermore, the performance of the students in biology are in terms of their grades. Grade 11 students have a very satisfactory rating that means they performed in the class proficiently. Meanwhile, Grade 12 students obtain an outstanding qualitative description and this means that the students performed in the class proficiently.

Overall, the author concluded that factors influencing performance of Senior High School students in Biology has no significant relationship in their performance. This result signified that there were no factor influencing academic performance of Senior High School students in Biology.

V. RECOMMENDATIONS

Based on the results and conclusions mentioned, the following recommendations are hereby suggested:

Since the result showed a low mean level of agreement when it comes to student-related factors, have a more exposure to any biology experiment that is why they have a hard time performing in biology class.

Biology teachers may be suggested for using of research articles in the subject to be included in their arsenal of teaching strategy of biology teaching of schools. Thus, this study may motivate those who are into instruction and accept and employ biology research.

Further study on factors influencing the performance in teaching biology would cover other factors that are not included in this study. Moreover, to conduct another study in other subjects in the curriculum such as other branch of Sciences. Lastly, it is recommended that another grade level will be use as the respondents.

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