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Learners' Conceptual Understanding in Biology and Self-regulated Learning Skills: Inputs for a Proposed Module Development

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A B S T R A C T

This study aimed at determining the learners' conceptual understanding in Biology and their self- regulated learning skills as measured by Conceptual Understanding Test (CUT) (r=.81) and Self- regulated Learning Questionnaire (SRLQ) (r=.92) and to develop a module in Biology to address the knowledge gap of Grade 11 learners in the Second Congressional District of the Schools Division of Iloilo. The results showed that learners' conceptual understanding did not met expectations and was described as "not mastered". This means that there is a learning gap in terms of their conceptual understanding in Biology. However, in general, Grade 11 STEM learners were self-regulated. The results also showed that the learners are able to plan for and articulate what the course wants to accomplish, monitor progress and interference regarding the subject's goal, control change by implementing specific strategies when things are not going as planned, and reflect on what worked and what can be better done next time. Their self-regulated learning skills are multi-causal; it can be through peer influence, the school, the community, or the way they were taught at home. There is, however, a need to better enhance their self-regulated learning skills in order to improve their academic performance in school. The inputs drawn from the results of the study include the production of a most appropriate instructional material on cell engagement, cell reproduction, and cellular energy. The content of the module shall be based on the Junior High School Science (Living Things and Their Environment) competencies. To make it more engaging, the module shall be equipped with different tasks and activities that promote self-regulation among the incoming Grade 12 learners.

Keywords: Conceptual Understanding, Biology, Self-regulated Learning Skills, Iloilo, Philippines

INTRODUCTION

Background of the Study

In teaching Biology, it is essential to tailor curriculum materials and instructional strategies to suit the abilities and contexts of diverse learners. Teachers should aim to provide concrete and practical applications of scientific concepts. They are encouraged to be knowledgeable in effective teaching strategies and innovative in developing interventions to enhance teaching impact. Furthermore, understanding learners' learning gaps and their self-regulated learning skills is crucial to address deficiencies and prepare them for acquiring new knowledge efficiently. Assessment results should inform the creation of supplementary learning modules to support the teaching and learning process.

The Philippine education system introduced a new curriculum in the 2012-2013 school year, emphasizing a learner-centered approach like inquiry-based learning. This approach aims to develop students' cognitive, affective, and psychomotor domains through the teaching of concepts and skills. However, implementing Biology courses at the junior high school level poses several challenges for Science teachers, including ensuring educators' mastery of content and overcoming resource limitations as part of the K to 12 program (Lo & Hew, 2017).

The learners in junior high school demonstrate an enduring understanding of the big ideas of Science (i.e., Life Science, Physical Science, and Earth and Space Science). The characteristics of these enduring understandings are: endure value beyond the classroom, reside at the heart of the discipline, require unlocking of abstract ideas, and offer the potential for engaging students (Wiggins & McTighe, 2005).

The Key Stage standards for grades 11 and 12 emphasize acquiring skills in gathering scientific and technological information on global issues impacting their country. Students are encouraged to develop scientific attitudes to promote innovation and problem-solving, and to prepare for future paths in education or careers such as employment or entrepreneurship. There is a crucial emphasis on developing self-regulated learning skills to effectively handle the curriculum's demands. Challenges include ensuring uniform implementation of the curriculum, addressing resource constraints in biology education, and improving students' study habits and abilities in self-regulated learning.

In response to the evolving curriculum demands, learners are increasingly encouraged to develop self-regulated learning skills, which involve setting goals and independently managing, monitoring, and adjusting their learning strategies (Pintrich, 2000; Zimmerman, 1989). Paris and Paris (2001) emphasize this approach, highlighting personal control in learning processes. Moreover, there is a need to evaluate how effectively educational

programs are implemented by teachers, especially in delivering the Biology curriculum in Junior High Schools and assessing students' proficiency in STEM subjects. Challenges include varying teacher expertise, limited teaching time and resources such as labs, and insufficient hands-on activities crucial for enhancing biological research potential.

As a Biology teacher, it's observed that the science curriculum is inconsistently taught due to time and resource constraints. Many students lack study habits, focus, motivation, self-discipline, and self-regulated learning skills, especially in the STEM strand, where many students do not come from a science-focused curriculum. This underscores the importance of further research into students' understanding of Biology and their ability to regulate their learning as they progress academically.

Theoretical and Conceptual Frameworks

This study draws on three key theories to support its framework: Bandura's Social Learning Theory, Zimmerman's Self-Regulated Learning Theory, and the Constructivist Theory advocated by Bruner along with Ausubel's Meaningful Reception Learning.

Bandura's theory emphasizes learning through observation and modeling, highlighting the reciprocal interaction between cognitive, behavioral, and environmental factors. Zimmerman's (1989) theory defines self-regulated learners as actively engaged in their own learning process through metacognitive, motivational, and behavioral strategies. Bruner's constructivism posits that learners construct new knowledge based on existing understanding, encouraging active discovery and learning by doing. Ausubel's (1968) theory stresses meaningful reception learning, where new information is integrated with existing knowledge for deeper understanding and problem-solving (Al Tamimi, 2012).

The study underscored the importance of understanding learners' cultural and personal contexts to enhance science education and ensure meaningful learning outcomes. This study was based on the concept that there is a need to assess the knowledge in Biology of Grade 11 STEM through an aptitude test and their self-regulated learning skills. The relationship among these study variables is presented in Figure 1.

Figure 1

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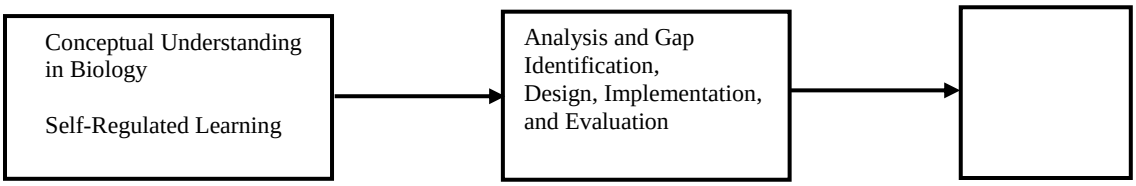

Statement of the Problem

Generally, this study assessed the knowledge of Grade 11 learners in Biology and their Self-regulated Learning Skills, who were enrolled in the Science, Technology, Engineering and Mathematics (STEM) strand during the second semester of academic year 2018-2019. Consequently, the study intended to gather inputs eventually for the development of a module.

Specifically, it sought to answer the following questions:

1. What is the level of conceptual understanding of grade 11 STEM learners in Biology?

2. What self-regulated learning skills do learners in grade 11 STEM possess?

3. What are the gaps and barriers related to the conceptual understanding and self-regulated learning skills of the Grade 11 learners in Biology?

4. What inputs can be drawn from the results of the study for the development of a proposed module?

METHODOLOGY

This study employed a descriptive research design. The respondents included 130 randomly selected Grade 11 STEM students from different schools in the second congressional district of Iloilo.

One researcher-made instrument and one adapted questionnaire were employed to gather relevant data for the study. These research instruments were meticulously prepared based on the prescribed competencies prescribed in the K to 12 basic education curriculum. They also underwent validity and reliability procedures.

The researcher-made instrument, Conceptual Understanding Test (CUT), consists of 80 items test (20 items allotted for the competencies of each grade level) that covers all the topics in the Junior High School Biology (Living Things and Their Environment). Using KR 20, it registered a reliability coefficient of .081.

On the other hand, the Self-Regulated Learning Questionnaire (SRLQ), adapted from the Self-Regulation Questionnaire of Gaumer, Erickson, A.S. et al. (2015), was modified and contextualized by the researcher. It consists of 40-item self-regulation questions. The questions are further divided into

four (4) parts, namely: planning, controlling, monitoring, and reflection, each consisting of ten (10) items respectively. Using Cronbach's alpha for the self-regulated learning questionnaire, the testing resulted to a reliability coefficient of .92.

The study commenced with obtaining permission from the Schools Division Superintendent to conduct research. After approval, the researcher coordinated with school principals to schedule participation from various schools. Subsequently, arrangements were made with teachers to administer a conceptual understanding test and self-regulated learning questionnaire to grade 11 STEM learners. Pilot testing was conducted to ensure questionnaire reliability before actual data collection. During data gathering, learners completed the Conceptual Understanding Test (CUT) and Self-Regulated Learning Questionnaire (SRLQ) within approximately one and a half hours. Collected data were then encoded, organized, and analyzed for the study's purposes.

Descriptive statistics were employed to describe and interpret the results of the study. Specifically, frequency count, percentage, mean, and standard deviation were used.

RESULTS AND DISCUSSION

Level of Conceptual Understanding in Biology of Grade 11 STEM Learners

The first question of the study sought to describe the level of conceptual understanding of grade-11 STEM learners in Biology in the secondary schools in the second congressional district in the Schools Division of Iloilo.

Results in Table 1 show the conceptual understanding of Grade11 STEM learners in Biology in the secondary schools in the second congressional district in the division of Iloilo was Not Mastered/ Did Not Meet Expectations and described as Very Low Mastery Level. This rating of students would mean that they were not able to master the lessons taught during their junior high school Biology (Living Things and Their Environment) subject. There is a total of 130 participants of the study. As shown in table 3, the distribution of scores based on the Conceptual Understanding Test (CUT) in biology, only one (1) percent got the score between 60-63 which is described as Slightly Mastered and ninety-nine (99) percent of the learners got a score below 60, which did not meet the expectations and described as Not Mastered or Very Low Mastery Level. Therefore, the result simply shows that the majority of the learners have difficulty in the subject of Biology; they have inadequate knowledge with regard to their Junior High School Biology. Their very low level of concept understanding may be due to their low retention span, poor study habits, lack of interest, lack of resources, or teacher factors. This result simply implies that there are factors that contribute to the learner's level of conceptual understanding of Biology.

Table 1

Conceptual Understanding in Biology of Grade 11 STEM Learners

Score	Frequency	Percentage	Description
72-80	0	0	Highly Mastered
68-71	0	0	Mastered
64-67	0	0	Moderately Mastered
60-63	1	1.00	Slightly Mastered
0-60	129	99.00	Not Mastered

Note: * Mean was described as follows: 72-80 = Highly Mastered; 68-71= Mastered; 64-67= Moderately Mastered; 60-63= Slightly Mastered; Below 60= Not Mastered/ Did Not Meet Expectations.

Barquilla (2020) suggested that a student's grasp of concepts refers to their receptiveness to the teacher's instruction on the concept, involving actions such as experiencing or conceptualizing. Cimer (2012) emphasized that learning should extend beyond mere memorization and application of formulas, urging for a deeper understanding to solve problems effectively. Research findings in science education can facilitate this deeper understanding.

The development of conceptual understanding in a subject significantly enhances student learning, encompassing the ability to make informed decisions, exercise sound judgment, and comprehend events in one's surroundings (Schweingruber, 2012). Unlike knowledge, which involves basic insights and abilities, understanding unfolds through various perspectives and contexts.

To assess students' conceptual understanding, teachers should shift from algorithmic to conceptual questions, which are more complex and demand higher-order thinking. These questions require students to explain unfamiliar phenomena, adapt explanations to new situations, identify underlying concepts to apply algorithms, visualize systems, and draw conclusions, as noted by McNeill and Krajcik (2008). Understanding also involves connecting new information with existing knowledge and integrating new challenges into one's mental framework. A student demonstrates true understanding when they can articulate, interpret, and apply concepts, while also offering critical perspectives, empathizing with others' viewpoints, and understanding their own cognitive biases (Wiggins and McTighe, 2005).

Additionally, as shown in Table 2, the conceptual understanding of Grade 11 STEM learners in Biology in Iloilo's secondary schools is generally below mastery level across all topics assessed. This indicates that students have not achieved a passing score based on the Department of Education's criteria and the Conceptual Understanding Test used in the assessment. This underscores a significant learning gap in their understanding of Science (Living Things and Their Environment) at the junior high school level.

Moreover, it is important to note that since the learners have a very low knowledge in Biology, as shown in the result of the assessment, a learning gap was identified in terms of their conceptual understanding. Furthermore, Concept Understanding means students acquisition of scientific conception as a result of their active interaction with their lessons. In this study, it is measured by a researcher-made concept understanding test in Biology.

Table 2

Conceptual Understanding in Biology of Grade 11 STEM learners Across Topics

Scale	No. of Items	Mean PS	Qualitative Rating	Qualitative Description
Overall	80	46.36	Not Mastered	
Grade 7 Living Things and Their Environment				
From Cell to Organisms	6	41.80	Not Mastered	Very Low Mastery Level
Plant and Animal Cell	4	47.12	Not Mastered	Very Low Mastery Level
Living Things other than Plants and Animals	2	55.00	Not Mastered	Very Low Mastery Level
The Continuity of Life	2	40.77	Not Mastered	Very Low Mastery Level
Interactions	6	56.41	Not Mastered	Very Low Mastery Level
Grade 8 Living Things and Their Environment				
Digestive System	2	37.69	Not Mastered	Very Low Mastery Level
Nutrition and Wellness	4	48.97	Not Mastered	Very Low Mastery Level
Cell Reproduction	4	39.81	Not Mastered	Very Low Mastery Level
Genetics	2	53.46	Not Mastered	Very Low Mastery Level
Biodiversity	4	36.93	Not Mastered	Very Low Mastery Level
Interactions	4	43.08	Not Mastered	Very Low Mastery Level
Grade 9 Living Things and Their Environment				
Respiratory and Circulatory Systems Working with Other Organ Systems	6	52.18	Not Mastered	Very Low Mastery Level
Heredity: Inheritance and Variation	2	54.62	Not Mastered	Very Low Mastery Level
Biodiversity and Evolution	4	37.69	Not Mastered	Very Low Mastery Level
Ecosystem: Life Energy	8	47.50	Not Mastered	Very Low Mastery Level
Grade 10 Living Things and Their Environment				
Coordinated Functions of the Nervous, Endocrine, and Reproductive Systems	6	43.46	Not Mastered	Very Low Mastery Level
Heredity	4	44.23	Not Mastered	Very Low Mastery Level
Evolution	6	44.62	Not Mastered	Very Low Mastery Level
Ecosystem	4	44.62	Not Mastered	Very Low Mastery Level

Overall	80	46.36	Not Mastered	Very Low Mastery Level

Note: Mean was described as follows: 72-80 = Highly Mastered; 68-71= Mastered; 64-67= Moderately Mastered; 60-63= Slightly Mastered; Below 60= Not Mastered/ Did Not Meet Expectations.

Learners Self-Regulated Learning Skills

As shown in Table 3, the self-regulated learning skills of Grade 11 STEM was rated as "Self-regulated" (*M*=2.93, *SD*= .78). This means that the learners possess the self-regulated learning skills. Therefore, the results of this study showed that the learners are rated best in terms of their self-regulation skills. In the context of education and learning, self-regulation refers to a student's application of self-directed processes and behaviors that lead to the attainment of goals. Self-regulation of learning encompasses creating a plan, selecting learning strategies, and then monitoring progress and adjusting as needed.

Self-regulated learning deals with "how individuals set learning goals and control, monitor, and regulate their behaviors in response to specific environmental conditions to meet those goals" (Pintrich, 2000; Zimmerman, 2009). The Self-Regulation Questionnaire is designed to measure a student's proficiency in the four essential components of self-regulation, which are: (1) Plan for and articulate what you want to accomplish, (2) Immediately monitor progress and interference regarding your goal, (3) Control change by implementing specific strategies when things are not going as planned, and (4) Reflect on what worked and what you can do better next time. Although rated as "self-regulated" there is a need to enhance their self-regulated learning skills to further develop and exhibit self- discipline in terms of learning the way they want, and learning the fastest they could.

Table 3

Overall Self-regulated Learning Skills of Grade 11 STEM Learners

Statements	SD	Mean	Description
Overall	.78	2.93	Self-Regulated

Note: Mean was described as follows:3.50-4.0= Very Self-regulated; 2.51-3.50=Self-regulated; 1.51-2.50 Moderately self-regulated; and 1.0-1.5= Not Self-regulated

Fortunately, the learners, in general, are described as self-regulated based on the result of the assessment of their self-regulated learning skills, as presented in Table 6 below. Thus, based on this result, the researcher believes that the incorporation of the self-regulation process in the preparation of the learning material is necessary.

As shown in Table 4, Grade 11 STEM learners' mean scores were described as follows: planning, self-regulated (*M*=2.78, *SD*= .74); monitoring, self-regulated (*M*= 2.90, *SD*= .76); controlling, self-regulated (*M*= 2.96, *SD*= .78); and reflection, self-regulated (*M*= 3.09, *SD*= .82). This implies that the learners nowadays are self-regulated and if they are given the chance to work independently, they can manage to plan on which strategy they are going to use in order to acquire learning. They manage to control their learning by doing their task and submitting it on time. They monitor their progress through the teacher's feedback, and they try their best to improve as they go on learning. And they even reflect on their own performance.

Table 4

Mean Per Area of Self-Regulation among Grade 11 STEM Learners

Area	SD	Mean	Description
Planning	.74	2.78	Self-regulated
Monitoring	.76	2.90	Self-regulated
Controlling	.78	2.96	Self-regulated
Reflection	.82	3.09	Self-regulated

Note: Mean was described as follows: 3.5-4.0= Very Self-regulated; 2.51-3.50=Self-regulated; 1.51-2.50 Moderately self-regulated; and 1.0-1.50= Not Self-regulated

Table 5 shows the mean rating of the learners in terms of planning, they are regulated based on the following criteria: planning of outputs, they are self-regulated (*M*=2.77, *SD*= .73), in term of creating the study plan, they are self-regulated (*M*=2.56, *SD*=.75), in terms of considering all the things needed, they are self-regulated (*M*=2.72, *SD*=.79), in terms of having a goal and planning how to reach it, they are self-regulated (*M*=3.09, *SD*=.70), in terms of making plans to help them reach their goals, they are self-regulated (*M*=2.95, *SD*=.76), in terms of setting strict time frames for all activities, they are self- regulated (*M*=2.42, *SD*=.75), in terms of being systematic in planning, they are self-regulated (*M*=2.51, *SD*=.76), in terms of solving problems using a plan they are self-regulated (*M*=2.65, *SD*=.80), in terms of planning own learning, they are self-regulated (*M*=2.78,*SD*=.73) and in terms of accomplishing goals, they are self-regulated (*M*=2.89, *SD*=.66). This implies that the Grade 11 learners are Self-regulated, they are capable of

planning. The result showed that the Grade 11 learners are self-regulated in terms of planning. Previous research found that both self-monitoring and effort regulation training resulted in achievement.

Table 5

Mean on Self-Regulation in Terms of Planning among Grade 11 STEM Learners

No. Item	N	Standard Deviation	Mean	Qualitative Description
1. Plan out projects	130	.73	2.77	Self-Regulated
2. Create a study plan	130	.75	2.56	Self-Regulated
3. Consider all the things that need	130	.79	2.72	Self-Regulated
4. Have a goal. Plan on how to reach it	130	.70	3.09	Self-Regulated
5. Make plans to help reach goals	130	.76	2.95	Self-Regulated
6. Set strict time frames for all activities	130	.75	2.42	Self-Regulated
7. Systematic in planning	130	.76	2.51	Self-Regulated
8. Solve problems using a plan	130	.80	2.65	Self-Regulated
9. Plan own learnings	130	.73	2.78	Self-Regulated
10. Accomplish goals	130	.66	2.89	Self-Regulated

Note: Mean was described as follows: 3.5-4.0= Very Self-regulated; 2.51-3.50=Self-regulated; 1.51-2.50 Moderately self-regulated; and 1.0-1.50= Not Self-regulated

Numerous research revealed that higher achievers use more self-regulatory strategies, control their physical environment to meet their needs, seek help when needed, and use time management skills. Limited research, however, was conducted specifically in an information system course context. In one study conducted to investigate students' motivation and use of learning strategies in a business information systems course and a microcomputer applications course, no relationship was found between any of the learning strategies and course grade (Chalupa & Chen, in press). Effective learners are self-regulating, analyzing task requirements, setting productive goals, and selecting, adapting, or inventing strategies to achieve their objectives.

Table 6 shows the mean in terms of monitoring. It was revealed that the Grade 11 learners are self-regulated in terms of monitoring. In keeping track of how projects are going, they are self-regulated (*M*=2.72, *SD*=.75), in terms of awareness of responsibilities, they are self-regulated (*M*=3.11, *SD*=.74), in terms of tracking progress in reaching goals, they are self-regulated (*M*=2.85, *SD*=.74), in terms of knowing what academic progress are at given any time, they are self-regulated (*M*=2.78, *SD*=.72),in terms of identifying things need to accomplish daily, they are self-regulated (*M*=2.80,*SD*=0.78), in terms of setting a specific time for study, they are self-regulated (*M*=2.70,*SD*=.82) in terms of having a good management skills, they are self-regulated (*M*=2.57,*SD*=.69), in terms of monitoring interference towards goal, they are self-regulated (*M*=2.63,*SD*=.69) in terms of paying attention, they are self-regulated (*M*=2.88, *SD*=.77) in terms of estimating how much time it will take to complete homework, they are self-regulated (*M*=2.77, *SD*=.85). The result showed that the Grade 11 learners are self- regulated in terms of monitoring their performance. Although there are data suggesting that monitoring and regulation are often fused in actual performance (Pressley & Afflerbach, 1995), measures have been developed that focus more on regulation and control of cognition than on monitoring. Three general methods have been used to assess regulation: think-aloud protocols, self-report questionnaires, and interviews. These learners also monitor progress as they work thorough the task, managing intrusive emotions and waning motivation as well as adjusting strategies processed to foster success. These are the students who ask questions, take notes, and allocate their time and resources in ways that help them to be in charge of their own learning (Paris & Paris, 2001).

Moreover, the performance control or volitional phase, consists of the skilled and strategic processes that occur during the learning process. These skilled and strategic processes include but are not limited to attention, affect, and monitoring of action. Self-regulated learning skills and strategies, such as time management, task strategies, and help seeking, are associated with the performance control phase.

Table 6

Mean on Self-Regulation in Terms of Monitoring among Grade 11 STEM Learners

No. Item	N	Standard Deviation	Mean	Qualitative Description
11. Keep track of how projects are going	130	0.75	2.72	Self-Regulated
12. Aware of responsibilities	130	0.74	3.11	Self-Regulated

13. Track progress for reaching goal	130	0.74	2.85	Self-Regulated
14. Know what academic progress are at any given time	130	0.72	2.78	Self-Regulated
15. Identify things need to accomplish daily	130	0.78	2.80	Self-Regulated
16. Set a specific time for study	130	0.82	2.70	Self-Regulated
17. Have good management skills	130	0.69	2.57	Self-Regulated
18. Monitor interference towards goals	130	0.69	2.63	Self-Regulated
19. Pay attention	130	0.77	2.88	Self-Regulated
20. Estimate how much time it will take to complete homework.	130	0.85	2.77	Self-Regulated

Note: Mean was described as follows: 3.5-4.0= Very Self-regulated; 2.51-3.50=Self-regulated; 1.51-2.50 Moderately self-regulated; and 1.0-1.50= Not Self-regulated

Table 7 shows the average mean in controlling. It was revealed that the Grade 11 learners are self-regulated in terms of controlling. In thinking before you act they are self-regulated (*M*=2.78,*SD*=.82) in terms of doing what it takes to get homework done on time they are self-regulated (*M*=2.85,*SD*=.75) in terms of making choices to succeed, even when they aren't enjoyable they are self-regulated (*M*=2.77,*SD*=.79) in terms of things aren't going right, do something about it they are self-regulated (*M*=2.81, *SD*=.74) in terms of keeping trying as many different possibilities as necessary to succeed they are self-regulated (*M*=2.81,*SD*=.79) In terms of maintaining focus on project that takes a long time to complete they are self-regulated (*M*=2.55.*SD*=.79) in terms of managing time well they are self-regulated (*M*=2.62,*SD*=.76) in terms of being a self-discipline individual they are self-regulated (*M*=2.62,*SD*=.75) In terms of prioritizing work they are self-regulated (*M*=2.80,*SD*=.78) in terms of resisting temptations they are self-regulated (*M*=2.78,*SD*=.82). the result reveals that the Grade 11 learners are self- regulated in terms of controlling. The learners also possess good decision-making skills, they know which task to prioritize, and they are self-disciplined. They have a very good focus on their goals. They can also manage their time well and can resist temptations in order to finish the task in a given period of time. This is relevant to the fact that various strategies have been developed to foster self-directed learning. For instance, Smedley (2007) offered a set of strategies that may assist self-directed learning readiness: creating a supportive learning environment, providing construction feedback, encouraging self-assessment, using self-reflection, providing opportunities to engage in their own learning processes, and developing goal orientation values. These strategies may be helpful for teacher educators who consider taking a step towards fostering students' self-directed learning and helping students to survive and thrive in this information age.

Table 7

Mean on Self-Regulation in Terms of Controlling among Grade 11 STEM Learners

No. Item	N	Standard Deviation	Mean	Qualitative Description
21 Think before acting	130	0.82	2.78	Self-Regulated
22. Do what it takes to get homework done on time	130	0.75	2.85	Self-Regulated
23. Make choices to succeed, even when they aren't enjoyable	130	0.79	2.77	Self-Regulated
24. As soon as things aren't going right, do something about it	130	0.74	2.81	Self-Regulated
25. Keep trying as many different possibilities as necessary to succeed	130	0.79	2.91	Self-Regulated
26. Maintaining focus on projects that take a long time to complete	130	0.79	2.55	Self-Regulated
27. Manage time well	130	0.76	2.62	Self-Regulated
28. Self-disciplined individual	130	0.75	2.72	Self-Regulated
29. Prioritize work	130	0.78	2.80	Self-Regulated
30. Resist temptations	130	0.82	2.78	Self-Regulated

Note: Mean was described as follows: 3.5-4.0= Very Self-regulated; 2.51-3.50=Self-regulated; 1.51-2.50 Moderately self-regulated; and 1.0-1.50= Not Self-regulated

Table 8 shows the average mean in terms of self-reflection. The result showed that the Grade 11 learners are self-regulated in terms of self-reflection. When behind work, it is best to reflect about it, they are self-regulated (*M*=2.74,*SD*=72) in terms of thinking about how well on doing on assignments, they are self-regulated (*M*=2.78,*SD*=76) in terms of feeling a sense of accomplishing when everything is done on time, they are self-regulated (*M*=2.98,*SD*=86) in terms of thinking about how well you've done in the past when you set new goals, they are self-regulated (*M*=2.98,*SD*=84) in terms of trying to learn from mistakes, they are self-regulated (*M*=2.96,*SD*=88) in terms of keep making the same mistakes over and over again, they are self-regulated (*M*=2.65,*SD*=1.04) in terms of looking for possible solutions, they are self-regulated (*M*=2.86,*SD*=75) in terms of being confident in ability to search out information, they are self-regulated (*M*=2.89,*SD*=79) in terms of finding several different possibilities when you want to change something, they are self-regulated (*M*=2.66,*SD*=75) in terms of having trouble remembering all the things needed to be accomplished, they are self-regulated (*M*= 2.62,*SD*=79). The learners, therefore, are self-regulated in terms of self-reflection.

Table 8

Mean of Self-Regulation in Terms of Self- Reflection Among Grade 11 STEM Learners

No. Item	N	Standard Deviation	Mean	Qualitative Description
31. When behind work, it is best to reflect about it	130	0.72	2.74	Self-Regulated
32. Think about how well on doing on assignments	130	0.76	2.78	Self-Regulated
33. Feel a sense of accomplishment when everything is done on time	130	0.86	2.98	Self-Regulated
34. Think about how well you've done in the past when you set new goals	130	0.84	2.98	Self-Regulated
35. Try to learn from mistakes	130	0.88	2.96	Self-Regulated
36. Keep making the same mistakes over and over again	130	1.04	2.65	Self-Regulated
37. As soon as there is a problem or challenge, Start looking for possible solutions	130	0.75	2.86	Self-Regulated
38. Confident in ability to search out information	130	0.79	2.89	Self-Regulated
39. Usually find several different possibilities when you want to change something	130	0.75	2.66	Self-Regulated
40. Having trouble remembering all the things needed to accomplish	130	0.79	2.62	Self-Regulated

Note: Mean was described as follows: 3.5-4.0= Very Self-regulated; 2.51-3.50=Self-regulated; 1.51-2.50 Moderately self-regulated; and 1.0-1.50= Not Self-regulated

Self-regulated learning skills and strategies such as self-evaluation may be associated with the self-reflection phase. This notion of SDL is further supported by Slater (2018), who argued that self-directed learning exists along a continuum; it is present in each person to some degree, and students differ in their readiness for self-directed learning. Self-regulated learners take on challenging task, practice their learning, develop a deep understanding of the learning material, and exert extra effort, which leads to academic success (Perry, 2002).

The necessity for learners to become self-reliant, self-disciplined, and self-confident in their ability to direct their own learning is becoming increasingly important in today's society. Self-directed learning (SDL) refers to the capacity of learners to plan, implement, and evaluate their own learning activities (Merriam, Caffallera, & Baurngarter, 2007). That is, SDL contextualizes the process in which the learner takes the initiative and responsible for setting his/her own learning goals, identifying and addressing gaps in his/her own learning goals, identifying resources, selecting and carrying out learning strategies and evaluating his/her own learning (Loyens et al., 2008). In a similar vein, McGrath and Guglielmo (2014) explicated self-directed learning (SDL) as an effective mode of learning for individuals to possess in the information age as it underscores the capacity of an individual to cope with constant changes. Given the high speed of information changes in the society, individual must learn how to direct themselves in acquiring information and knowledge to be able to survive and compete with others.

Gaps and Barriers Related to Learners Conceptual Understanding in Biology and their Self- Regulated Learning Skills

Based on the results of the assessment of the learners conceptual understanding in biology and their self-regulated learning skills, several gaps and barriers were identified which served as bases for the development of an instructional materials. The result of the study revealed that the Grade -11 learners have a very low level of conceptual understanding in Biology, or they were not able to master the competencies in their Junior High School Science subject, specifically the Living Things and Their Environment or they were not able to meet the expectations, this simply means that they have inadequate knowledge, understanding and competence in the content related to Biology (Living Things and Their Environment, having the least mastered components among the topics included in the instrument. Adequacy is attributed to disintegrated treatment of lessons. "Learner must repeat or practice what he learned in order to remember and must be able to put together the parts of the task and perceive it as meaningful" as the principle of

learning dictates in order to learn. It means also that learners should find application and relevance of basic concepts learned from the different lessons throughout the course and to apply to their real lives.

In terms of their self- regulated learning skills however, the result of the assessment showed that the Grade 11 STEM learners are self-regulated. This means that they possess the skills in planning, monitoring, controlling and self-reflection. However, although they are self- regulated, there is a need to further develop their self- regulated learning skills in order to enhance and apply it for faster learning acquisition.

CONCLUSIONS

Based on the findings, the following conclusions were drawn:

The result simply shows that the majority of the learners have difficulty in the subject of Biology; they have inadequate knowledge with regard to their Junior High School Biology. Their very low level of concept understanding may be due to their low retention span, poor study habits, lack of interest, lack of resources, or teacher factors. This result simply implies that there are factors that contribute to the learner's level of conceptual understanding of Biology.

However, the results also showed that the learners are able to plan for and articulate what the course wants to accomplish, monitor progress and interference regarding the subject's goal, control change by implementing specific strategies when things are not going as planned, and reflect on what worked and what can be better done next time. Perhaps the Grade 11 learners nowadays are already mature and responsible in terms of doing their tasks in school. Their self-regulated learning skills are multi-causal; it can be through peer influence, the school, the community, or the way they were taught at home. There is, however, a need to better enhance their self-regulated learning skills in order to improve their academic performance in the school.

The gaps identified regarding the learners' conceptual understanding of Biology served as the basis for proposing the development of a supplementary module. There is also a need to enhance their self-regulated learning skills. The most appropriate instructional material to come up with has something to do with cell engagement, cell reproduction, and cellular energy. The content of the module shall be based on the Junior High School Science (Living Things and Their Environment) competencies. This module shall also address the knowledge gap on the topics identified as pre-requisites to the General Biology 1 subject of the Senior High School Science, Technology, Engineering, and Mathematics strand. To make it more engaging, the module shall be equipped with different tasks and activities that promote self-regulation among the incoming Grade 12 learners. The instructional material shall likewise promote Zimmerman's phases of self-regulation that includes planning, monitoring, controlling and self-refection. It follows the three phases of Zimmermann's Self- Regulated learning processes.

RECOMMENDATIONS

Based on the findings and conclusions of the study, the following recommendations are advanced:

Curriculum Planners. They could better plan for localized content, strategy, and activities to suit the needs of the learners, like self-regulated learning.

School Administrators. They may be able to generate informed decisions toward better integration or implementation of Biology subjects in the Senior High School.

Biology Teachers. They may be able to design and plan activities appropriate to the learners.

Students. They may use the instructional material on Cells as their guide to supplement and enhance their learning of biology concepts, skills and values.

Other Researchers. May they use the results of this study as baseline information for future research endeavors, particularly in the division of Iloilo.

Science Educators from other schools. This study may offer a visionary approach for teachers to make the teaching-learning process congruent to a certain educational framework, and further, this study can provide insights into how teachers may develop assessments too in Biology and create appropriate instructional material based on the result of the assessment.

Non-Biology Science Teachers. The instructional material as output of the Assessment may be useful to non-Biology teachers who will be teaching General Biology subjects.

Policy Makers. This study may be helpful in creating a most sound policy in addressing the needs of the learners.

DepEd Officials. They may realize the importance of the instructional materials like the module and the need for them to support it.

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