International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

Instructional Engagement and Cognitive Understanding in Mapping Self-Paced Directed Modules in Chemistry

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Abstract: ***The self-learning module is a set of instructions with content that facilitates mastery of a body of knowledge designed where the students learn at their own pace and monitor their own learning. This study aimed to assess the effectiveness of the designed self-paced directed module in Chemistry that integrated instructional engagement and cognitive understanding of the students. This study utilized a quantitative descriptive developmental method where the researcher tried out and tested the designed self-paced module using an experimental research design. Teacher-made pre-test and post-test instruments were administered to assess the student's cognitive understanding before and after the treatment. This study involved ninety (90) Grade 8 students of Bignay National High School taking up Chemistry during the Third Quarter of the school year 2021-2022. Results revealed that the respondents manifested behavioral engagement, emotional engagement, and cognitive engagement. In the post-performance, the respondents' level was below average in knowledge retrieval, comprehension, and analysis while they were low in knowledge utilization. The content of the designed self-paced directed module as to learning resources, learning activities, objectives and assessment were perceived as effective. Based on the findings, it was concluded that there is no significant relationship between instructional management and cognitive performance of the students; and no significant relationship exists between assessment of the module and cognitive performance except in knowledge retrieval, objectives and directions. Moreover. It was concluded that there is a significant difference on the pre- and post-performance of the respondents. It is then recommended that designed self-paced directed module must include the four levels of understanding in formative assessment and evaluate the result to determine the appropriate remediation and intervention need for student improvement.***

Keywords: self-paced directed module; instructional engagement; cognitive understanding

1. Introduction

The self-learning module is a set of instructions with content that facilitates mastery of a body of knowledge designed where the students learn at their own pace and monitor their own learning.Modulardistance learning was implemented during the new normal. DepEd prepared Self-Learning Modules for education's new normal. The Department of Education (2021) assured the public that around 26 million enrolled learners will receive enhanced quality self-learning modules (SLMs) for School Year 2021-2022. DepEd Usec. San Antonio emphasized the improvements made in the quality assurance process of the Department for the learning resources as early as January 2021. The Bureau of Learning Delivery (BLD) also prioritized the SLM Enhancement, which aimed to generate improved versions of the materials and provide teachers with support through Notes to Teachers. Some experts carefully analyzed and reviewed the modules within the standard of the DepEd Regional Office 4A and Learning Management Division CALABARZON and pivot Learners' Material focusing from access to quality. This module is prepared for all grade levels in all learning areas for the learners to easily learn all the lessons in every subject. The components of this PIVOT are aligned with the objectives. The components of the PIVOT 4a Module are Introduction, Development, Engagement, and Assimilation. This module contains the essential minimum learning competencies and a guide to understanding the MELCS.

Issues were encountered in the use of modules such as instructions or confusion of students on the modules and complaints on understanding the module (Alvarez, 2021). Another issue that resurfaced are the identified errors in the content of the module. This issue in Mindanao is not an isolated case because this is experienced everywhere in the public schools in the Philippines. The Quarterly Science Mean Percentage Score of Grade 8 students last school year reports the following results: First Quarter- 58.07; Second Quarter-54.55; Third Quarter- 53.43; Fourth Quarter- 58.42;

Based on these results, the Grade 8 students' performance was just within the average level. especially in the third quarter period.The researcher observed that the students find difficulty in studying the modules prescribed by the DepEd considering that these modules are not customized to the needs and interests of the learners because these factors matter to motivate the learners to engage in the learning process. The researcher believes that the learning resources and learning activities in the modules should be within the level, interest, and needs of the learner because these will support in the development of learning among the students. This situation drives the researcher to develop a module designed for self-paced learning of the students that integrates student engagement and cognitive understanding. This module was designed with content, objectives and directions that are appropriate for the student's self-directed learning.

In this study, three types of learning engagement were incorporated in the designed self-paced directed module.

The learning resources and activities provided in the module offer opportunities for the students to engage during the learning process. Behavioral engagementrefers to students' persistence, effort, attention, participation, and involvement in accomplishing learning tasks and mastering skills required in Chemistry. Cognitive engagement is the students' cognitive effort to construct knowledge and solve tasks in lessons in Chemistry using domain-specific knowledge. Emotional engagement describes students' affective reactions showing interest and enjoyment in studying enthusiastically and valuing learning in a distance learning modality.

The four levels of cognitive understanding include knowledgeretrieval, comprehension, analysis, andknowledge utilization.Knowledge retrieval involves recalling information from permanent memory. At this level of understanding, students are merely calling up facts, sequences, or processes exactly as they have been stored. Comprehension requires identifying what is important to remember and placing that information into appropriate categories. The first skill of comprehension, synthesis, requires the identification of the most important components of the concept and deletion of any that are insignificant and extraneous. The analysis involves matching, classifying, error analysis, generalizing and specifying. By engaging in these processes, learners can use what they are learning to create new insights and invent ways of using what they have learned in new situations. The final level of cognitive processes, knowledgeutilization or using knowledge involves decision making, problem solving, experimental inquiry, and investigation. Decision-making involves weighing of options to determine the most appropriate course of action. Problem-solving includes the identification of and analysis of the problem. Experimental inquiry involves generalizing hypotheses about physical or psychological phenomena, creating experiments and analyzing the results. The investigation involves past, present, or future events. It requires logical arguments.

The content, objective, and directions in the self-paced module are carefully designed to facilitate independent learning without or no support at all from the teacher. The content of the module should include learning resources, learning activities and assessment that will all support in achieving the expected learning outcomes. They must provide opportunities for the students to engage in the learning process and that will enhance their cognitive understanding.

2. Literature Review

Instructional Engagement

There are three levels of pupil engagement namely: Behavioral engagement- represented by good behavior in the learning environment; Emotional engagement - where children like and value what they are doing; and Cognitive engagement- a psychological state where the student puts in a lot of effort to understand a lesson (View Sonic Library, 2021).

Behavioral engagement is defined in a variety of ways, including participation in academic and learning tasks. Students' perseverance, effort, attention, participation, and involvement can be observed and inferred; It is the sub-dimension of engagement that reflects students' observable behaviors in multimedia learning material (MLM), such as performing activities, tasks, conscious navigation, marking important points, and duration of the interaction with MLM. Physical signs of a learner's interest in the material. It can be determined by looking at discussion posts, completed assignments, page views, and occasionally total grades in a course. Behavioral engagement is explained as the student which includes student persistence, effort, behavior on a learning task and their contribution towards their own learning. Recent research has characterized behavioral engagement as student involvement, effort, attention, persistence, and positive behavior toward the learning activity (IG Global, 2022). According to the study of Wara&Aloka's (2018), secondary school pupils in Kenya thought that their emotional engagement in the learning process was sufficient. The research also showed a strong correlation between academic success and emotional involvement, which prompted researchers to draw the conclusion that emotional engagement positively influenced academic performance.

Cognitive engagement had been identified as a major part of overall learning engagement. The degree to which students are prepared and competent to handle the current learning task is referred to as cognitive engagement. This involves the level of effort and persistence pupils are willing to put forth when working on the assignment. This speaks to students' drive and commitment to their study. It also includes their capacity for self-control, desire to achieve individual educational objectives, and degree to which they take responsibility for their own learning. According to them, cognitive engagement in the classroom may be defined as a psychological state in which students make a lot of effort to fully understand a topic and who persevere in studying for a long time (Rotgans& Schmidt, 2011).

Cognitive Understanding

Cognitive understanding is an interesting learning theory that focuses on thought. In order to help students understand a concept or subject they are having trouble with, cognition urges them to "think about their thinking." The term "mental action or process of acquiring knowledge and understanding through experience and the senses" is used to describe cognition. In essence, it is the capacity to observe, react, process, comprehend, store, and retrieve data in order to make judgments and respond appropriately (Cambridge, 2021). Marzano (2008) explains the four levels of cognitive processes including knowledgeretrieval, comprehension, analysis,andknowledge utilization.Knowledge retrieval aims to return material in a structured style that is consistent with human cognitive processes as opposed to just lists of data points. Knowledge is described as the behaviors and test circumstances that place an emphasis on remembering concepts, materials, or phenomena through recognition or recall. Comprehension refers to the responses that demonstrate a knowledge of a communication's literal message. This demonstrates the student's capacity for interpretation, extrapolation, and translation. The rearranging of concepts occurs during interpretation (inferences, generalization or summaries). Analysis involves

ability in understanding unstated assumptions, separating facts from hypotheses, separating conclusions from statements that support them, identifying the facts or assumptions that are crucial to a main thesis or the argument supporting that thesis, and separating cause-and-effect relationships from other sequential relationships are all part of analysis. The final level of cognitive processes, knowledge utilization or applying gathered information to solve problems, create new things, and manage challenging circumstances. If knowledge is not put to use to address issues, it is of no use. As a result, a knowledge repository's effectiveness needs to be evaluated.

Self-Paced Directed Module

Simbulan (2011) in Cabar (2014) defined module as a collection of ready-mades, self-directed educational materials that may be used by individuals or groups of people at their own pace. Sejpal (2020) shared the following module traits; The learning module should be independent, self-contained, self-instructional, well defined, and have a clearly defined objective. It should also take individual differences into account and use a variety of learning materials. It should also involve active learner participation, immediate reinforcement of responses, mastery of evaluation strategy, and work evaluation.

The present study focuses on the components of the self-paced directed module such as content, objective and directions. The content of a module includes learning resources and learning activities. and assessment. Teaching and learning resources are the tools used to convey and transmit the required educational content in the context of classes, which is an institutionalized type of teaching and learning. Textbooks, software, pertinent reading materials, movies, and recordings are examples of learning resources (Busljeta, 2013).

Learning resources are mostly any device that makes learning easier for both teachers and pupils. Every person has different learning requirements and learning preferences. Similar to this, every instructor employs various teaching and learning tools that point to the efficacy of the teaching process. Learning resources are more than that; they can be summed up as a variety of tools that give teachers the chance to instruct pupils successfully so as to make the learning process simpler for them (Savery, 2015). Learning activities enable students to engage with and develop their skills, knowledge and understandings in different ways. Meaningful activities engage students in active, constructive, intentional, authentic, and cooperative ways. Several studies reviewed by Ates&Erilmaz (2011) found in their evaluation of several research that students who engage in hands-on learning outperform those who follow standard, text-based curricula, have better knowledge and replace their false beliefs with true ones, and have more favorable views toward science. Additionally, they support student freedom, foster problem-solving creativity, and enhance communication and reading skills in particular. When chemistry students perform, measure, record data, and come to their own conclusions as opposed to being handed the answers in the module, they learn chemistry more effectively. According to Miller (2020), assessment is unquestionably a component of efforts to execute successful teaching in a distance learning context. REAL criteria, which stand for R- readiness, E- endurance, A-assessed, and L- leverage to make such judgments, may be taken into account to guarantee that the fundamentals are being evaluated. In order to promote student learning, assessment is a continuous process that involves acquiring, examining, and interpreting data; reflecting on the results; and making decisions that are well-informed and consistent. A statement of learning objectives is a characteristic of most modules. They describe the information, abilities, and attitudes the instructor intends to impart. They ought to be expressed in terms of the behavior of the learner. Additionally, objectives aid students in their own evaluation (Acuram, 2015). Instead of being course-wide goals, these objectives should be specific results related to each individual module. What is required of students in each module should be stated to them directly and in unambiguous terms. Making sure that the module outcomes and the assessment for the same module are correctly aligned is crucial. Miller explains that, depending on what is being evaluated, teachers may be able to take these tasks and divide them into smaller tasks or performance items to be performed over time or all at once. As performance tasks frequently evaluate numerous standards, they can be divided into distinct minitasks that evaluate each distinct standard or learning objective. Directions that are clear, concise, timed and observable can help ensure student compliance (Fuhrman, 2020). By making directions observable will make easy for the teacher to identify which students are following directions and which are not by making them visible. Additionally, observable instructions give students explicit action steps so they understand exactly what is required of them and how to do the assignment.

3. Methodology

This study utilized quantitative descriptive developmental research method. It is descriptive because it describes the characteristics of variables under study. Specifically, this study is experimental in nature because it determined the effect of the designed self-paced directed module in Chemistry integrating instructional engagement and cognitive understanding to one group of Grade 8 students for comparative performance in the pre- and post- assessment. The descriptive method of research refers to the category of research that sought to learn more about a phenomenon's current state. This type of research aims to provide an accurate profile of situations, people or events (Rahi, 2017).

Part of the developmental process in the study was the test of significant effect results of the modules to students' cognitive understanding of lessons in Chemistry. According to Mehran (2017), in developmental research, the same objects are repeatedly observed across time, and the results of two distinct but related longitudinal investigations are compared.

Furthermore, the statistical tests for significant differences were used after scores in the pre and post-test were gathered.

The study included the participation of ninety (90) Grade 8 students composed 55 males and 35 females in Bignay National High School, Division of Quezon during the

academic year 2021-2022. Most of the students used smartphone, cable TV and basic cellphone in independent learning. The study used self-paced directed module as a device in Chemistry during the third quarter of the said year.

The ninety (90) Grade 8 students in a population of 115 were selected as respondents using the purposive sampling technique. This sampling technique also known as selective sampling was employed because the selection was based on purpose according to their modular learning mode that is independent learning or modular distance learning.

Lesson exemplars, survey questionnaire, pre- and post-assessment test and the designed self-paced directed module in Chemistry were the instruments used in the study.

Lesson Title, Most Essential Learning Competencies with Objectives, Content, Learning Phases or Learning Activities, Assessment and Reflection are the six components of the lesson exemplars. The two topics covered in these 10 days lessons are Physical Changes in Solid, Liquid, and Gas and The Three Subatomic Particles.

The survey questionnaire was divided into two sections: the extent of manifestation of engagement pertains to students' behavior and participation in academic tasks and consists of six questions; their attitudes toward the subject they are studying and their mental effort and connection during the course of their learning process, both with seven questions with a total of twenty questions; and perception of the respondents on the components of the designed self-paced directed modules as to content with fifteen questions, as to objectives and directions with 10 questions each. This instrument was pilot tested to students in other schools who are not included in the study.

The post-test items come in four levels that measure their cognitive understanding as in knowledge retrieval, comprehension, analysis and knowledge utilization. Each level consists of five questions. This is used to measure their cognition after studying the self-paced directed module.

Self-paced directed module contains three component parts: Content, which includes learning resources, learning activities and assessment; Objectives and Directions. Learning Activities are composed of four parts: Introduction, Development, Engagement and Assimilation. In Introduction, review or recall of the previous lesson, pre-test on student's prior knowledge about the lesson and priming activities that encourages students be motivated on the lessons were included in presenting the learning competencies and learning outcomes. It was followed by Development part includes discussion of the lessons and developmental activities that develops and master the skills or competencies in the lesson. In the part of Engagement allows the learners to be engaged in various tasks and opportunities in building their knowledge and skills in learning Chemistry. Lastly, Assimilation part engage learners in a process where they exhibit concepts, interpretations, mindsets, or attitudes and produce pieces of knowledge that will be integrated into their knowledge for successful reflection and application.

The instruments underwent content and language validation. The recommendation of the external expert validators was used to revise the instruments. To further test discrimination index of the pre- post assessment, the assessment was subjected to pilot test. The researcher used 30 students from different schools. The computed standard deviation reveals index of discrimination that items are accepted. The items that were rated low were revised. Internal validation by statistician, subject specialist and technical editor finds the instrument highly valid. Based on this reliability test results, all indicators are retained.

The researcher designed self-paced directed module in Chemistry and a semi-detailed lesson plan for the independent learners of Grade 8 students validated by Science Head Teacher and Master Teachers and English Master Teachers. After the preparation of the research instruments, the researcher consulted her adviser, statistician, subject specialist and technical editor for suggestions and comments to review the given instrument to be used.

After the validation of the instrument used, the researcher asked permission to conduct the research. Finally, the instrument was subjected to the approval of the Dean of Graduate Studies and Applied Research of the Laguna State Polytechnic University -San Pablo City Campus for administration to the respondents.

With Bignay National High School as the target school, a letter addressed to the school head was sent as a form of formal request to formally start the said research.

After the grant of requested permission, the researcher then proceeds to the conduct of the study. Before trying out the designed module, the researcher disseminated the pre-test to the students in coordination with the distribution of Week 4 Third Quarter module on April 7, 2022 to measure the four levels of their cognitive understanding as to: knowledge retrieval, comprehension, analysis and knowledge utilization, given to the students at least one week after the deployment, then the pretest instruments were retrieved afterwards. Ninety Grade 8 student respondents were heterogeneously chosen using the sampling technique used in the study. The first designed self-paced directed module was distributed on April 14, 2022 to the modular learning modality group of Grade 8 students. After a week, the module was retrieved together with the posttest. After the distribution of Week 5 lesson, the second designed self-paced directed module was distributed on April 28, 2022 to the modular learning modality group of Grade 8 students. After a week, the module was retrieved together with the post-test. The researcher administered the questionnaires on instructional engagement and evaluation of the designed module on May 7, 2022 during face-to-face classes and distribution of Week 7 module. While the execution of tools is undergoing, the checking of pretest and posttest was executed. After all the data had been collected, a dummy table was prepared to show the results and were subjected to statistical analysis.

The statistical tools used to analyze the numerical data are as follows:

Percent count frequency distribution was used to determine the proportion of responses in each item in the research instrument.

Mean and Standard Deviation were used to determine the responses in each item in the questionnaire with respect to the respondents' perception on the instructional engagement and level of cognitive understanding.

Pearson Product Moment Correlation Coefficient was applied to determine the significant relationship between the cognitive performance of the students and the instructional engagement and assessment of the module at 0.01 and 0.05 level of significance as the case maybe.

To determine the significant difference in the cognitive understanding of the respondents, paired sample t-test was applied at 0.01 and 0.05 level of significance as the case maybe.

4. Results and Discussion

I. Extent of Instructional Engagement Manifested by Respondents as to Behavioral, Emotional and Cognitive Engagement

Table 1: Extent of Behavioral Engagement Manifested by Respondents

Statements As a student, I…	Mean	Standard Deviation	Verbal Interpretation
1.Commit to master the learning competencies in chemistry	3.96	0.92	Manifested
2.Determined in accomplishing learning tasks in Chemistry	4.01	0.87	Manifested
3.Show willingness using digital sources	4.00	0.92	Manifested
4.Exert effort in learning Science knowledge and skills	3.98	0.92	Manifested
5.Show focus on learning and complete science tasks on time	4.11	0.90	Manifested
6.Demonstrate perseverance when confrontedwith challenging and difficult tasks	3.84	0.96	Manifested
Overall	3.98	0.65	Manifested

Legend: *4.50-5.00- Highly Manifested; 3.50-4.49- Manifested; 2.50-3.49- Moderately manifested 1.50-2.49-Slightly Manifested; 1.00-1.49- Rarely Manifested*

Table 1 presents the extent of behavioral engagement manifested by respondents in self-paced directed module. It shows that students manifest behavioral engagement in science class. Among the statements, focus on learning and complete Science tasks on time as the highest, suggests that the students are highly engaged and exert effort in accomplishing their learning tasks and assignment on time. They easily understand and can follow directions in the module so that they can systematically finish the tasks on time. Demonstrate perseverance is least manifested when confronted with challenging and difficult tasks. They are least persistent in doing experiments that they found difficult without the guidance of the teacher that causes them delay their success in achieving the result.

Generally, students' manifest persistence, effort, attention, participation and involvement in accomplishing their learning tasks and mastering competencies expected in learning Chemistry.

Table 2: Extent of Emotional Engagement Manifested by Respondents in Self-Paced Directed Modules

Statements As a student, I…	Mean	Standard Deviation	Verbal Interpretation
1. Motivated to practice high level thinking	3.84	0.99	Manifested
2. Value what is being learned	4.18	0.82	Manifested
3. Feel confident that great effort gives best results	4.04	0.81	Manifested
4. Demonstrate enthusiasm in accomplishing learning tasks and constructing projects	4.01	0.91	Manifested
5.Manage oneself to keep self-motivated throughout the learning process	4.03	0.81	Manifested
6.Enjoy studying without the support of others	4.27	0.86	Manifested
7.Believe that can carry on with independent study	3.99	1.00	Manifested
Overall	4.05	0.63	Manifested

Legend: *4.50-5.00- Highly Manifested; 3.50-4.49- Manifested; 2.50-3.49- Moderately manifested 1.50-2.49-Slightly Manifested; 1.00-1.49- Rarely Manifested*

Table 2 presents the extent of emotional engagement manifested by respondents in self-paced directed module. It shows that the students manifest emotional engagement. Among the statements enjoy studying without the support of others as the highest suggests that the students give importance to what they have learned independently and that they feel that learning on their own is worth and self-fulfilling. Likewise, they manifest interest in practicing high level thinking but can further be improved because based on observation they are just good in analysis and solving problems in Chemistry. This is important forenhancing one's academic achievement, general psychological health, and ability to maintain motivationthroughout the learning process.

In general, emotional engagement examines the students' attitudes about the Chemistry lessons they are learning, their teacher, their peers, their entire academic experience, and whether or not they believe the lectures truly have worth.

Research shows that positive result for student accomplishment, including academic achievement, is linked to emotional engagement. Increased emotional engagement makes the content and learning experience more remembered. Students who perform better on emotional engagement assessments will probably perform better on accomplishment examinations. According to research by Gallup (2020), reading and math test scores increased by 6% and 8%, respectively, in schools with engagement levels that were just 1% above the national average. Achievement scores increase along with increasing engagement scores.

The study of Wara&Aloka (2018) found out that the Kenyan secondary school students felt that they were adequately emotionally engaged in the learning process. The finding

also revealed that emotional engagement is significantly related to the academic achievement leading to conclusion that emotional engagement had positive influence in academic achievement.

Table 3: Extent of Cognitive Engagement Manifested by Respondents in Self-Paced Directed Modules

Statements As a student, I…	Mean	SD	VI
1. Practice self-monitoring of performance to check own learning progress	4.03	0.88	Manifested
2.Use study tools and digital media for self-instruction	4.09	0.79	Manifested
3.Apply strategies to reinforce learning abilities on different task-related activities	3.94	0.81	Manifested
4.Analyze solutions to arrive at a conclusion	3.99	0.85	Manifested
5.Search information to address self- learning goals	3.99	0.94	Manifested
6.Use strategy to attain the learning competency	3.92	0.85	Manifested
7.Reflect on weaknesses to attain success on the expected learning outcome	4.01	1.01	Manifested
Overall	4.00	0.61	Manifested

Legend: *4.50-5.00- Highly Manifested; 3.50-4.49- Manifested; 2.50-3.49- Moderately manifested 1.50-2.49-Slightly Manifested; 1.00-1.49- Rarely Manifested*

Table 3 presents the extent of cognitive engagement manifested by respondents in self-paced directed module. It shows that the students manifest cognitive engagement. Among the statements, use study tools and digital media for self-instruction as the highest, suggest that the students use to search in Google explanations, illustrations and examples to better understand some difficult concepts in Chemistry. The students manifest reflecting on their weaknesses to attain success on the expected learning outcomes. The students may have spent more time thinking deeply and carefully about the areas they are weak and find difficulty so they will be able to determine the technique, strategy or the intervention that will help them to successfully attain what they are expected to learn.

In this study, the students employed digital media and study aids to foster independent thought and advance their self-directed learning abilities. While watching YouTube concepts and procedures, they took visual notes. Their memory and comprehension are improved by this technique. They carry out their educational tasks using the pictures and illustrations. The students reported the outcomes of their performance on written work and performance tasks to monitor their learning development. Through this, they were able to pinpoint their areas of weakness that required the most attention and effort.
Galindo (2020) suggests four cognitive strategies for student engagement. These are input, process,
output and feedback cognitive strategy.

In cognitive engagement, the students are mentally connected to what they are studying when they are cognitively engaged. This is the time the student reflects on their learning and link it to prior knowledge. It refers to how much mental effort pupils are willing and able to put into a given learning assignment and how long they persevere in the activity. By exerting effort, using strategies, investing cognitive energy in learning, engaging in metacognition, and practicing self-regulated learning, students demonstrate cognitive engagement (IGI Clobal, 2022).

II. Respondents Level of Cognitive Understanding in the Pre- and Post- Performance

Table 4: Pre- and Post-Performance of the Respondents as tor Knowledge Retrieval

Cognitive Understanding	Pretest Performance		Posttest Performance		Post test Performance
	F	%	F	%	
90-100	-		15	16.7	Very High
85-89	-		16	17.8	High
80-84	-		21	23.3	Average
75-79	3	3.3	21	23.3	Below Average
Below 75	87	96.7	17	18.9	Low
TOTAL	**90**	**100.0**	**90**	**100.0**	

Table 4 presents the respondents' level of cognitive understanding in the pre- and post-performance as to knowledge retrieval. In knowledge retrieval, results show that majority of the respondents obtained low performance which means that they still manifest knowledge retrieval but may be considered to be improved. Only 3.3% did not reach the average performance standard. In the post-performance, 23.3% or 21 obtained average. Likewise, the same number of students did not meet the average standard. The least number of respondents 16.7% or 15 obtained very high rating. Some respondents remained low and needed more focus to improve their understanding. It can be observed a remarkable change in the level of performance of the respondents based on the results in pre- and post-performance.

Almost all respondents got low score in the pretest performance because they have not studied yet the module. After studying the module, majority of the students improved their performance in the post-test because the module is catered to the students' needs, interest in reading to acquire knowledge about the lessons. Also, the module offers easier means of facilitating independent learning or self-direct learning. Even without the support of the teacher, the module provides opportunities to students to practice process skills. In performing the test, they are merely recalling facts, sequences and processes. Also, the assessment guides the students with clear and concise instruction that enable them to follow.

This is supported by the results of their posttests, which showed that despite having poor pretest scores, the students' posttest performance had improved, increasing their scores.

Table 5: Pre- and Post-Performance of the Respondents as to Comprehension

Cognitive Understanding	Pre test Performance		Post test Performance		Post test Performance
	F	%	F	%	
90-100	-	-	7	7.8	Very High
85-89	-	-	15	16.7	High
80-84	-	-	15	16.7	Average
75-79	2	2.2	28	31.1	Below Average
Below 75	88	97.8	25	27.8	Low
TOTAL	**90**	**100.0**	**90**	**100.0**	

Table 5 presents the pre- and post-performance of the respondents as to comprehension. In comprehension level, results show 97.8% or 88 out of 90 obtained low rating in the pre- performance and 2.2% obtained below average performance. The result implies that they need to improve their ability to explain and interpret concepts and processes contained in their lessons in chemistry. In the post-performance, it can be observed that a majority of 31.1% or 28 obtained did not attain the standard performance. The least number 7.8% obtained very high rating. The rest of the respondents obtained high, average and low performance rating.

From the results, it can be said that a great number of students had leveled up in their comprehension level. Butthere are still who did not improve their comprehension who needed intervention. More than 3/4 of the students had improved their comprehension level after studying the module because it develops their ability to follow directions and competence in responding to instructions. Majority of students' comprehension is in the literate level where they can only understand and explain the facts and information asked in the question. Only few students can answer questions that require implied meaning and they find difficulty understanding the meaning of concept that is not explicitly stated. There are still students who cannot answer questions that require explanation and interpretation. Studying the self-directed module requires the student to read and understand the lessons and extract the meaning of what they have read. The students must employ reading strategies so that they will improve their comprehension skill.

Table 6: Pre- and Post-Performance of the Respondents as to Analysis

Cognitive Understanding	Pre test Performance		Post test Performance		Post test Performance
	F	%	F	%	
90-100	-	-	6	6.7	Very High
85-89	-	-	21	23.3	High
80-84	-	-	13	14.4	Average
75-79	-	-	26	28.9	Below Average
Below 75	90	100.0	24	26.7	Low
TOTAL	**90**	**100.0**	**90**	**100.0**	

Table 6 presents the pre- and post-performance of the respondents as to analysis. In analysis level, 100% of the respondents obtained low rating before the self-paced directed module was applied. It shows that they are not yet capable in checking details in the concepts and processes in the lesson's modules.In their post-performance, most of the respondents 28.9% still did not attain average standard of performance while 6.7% obtained very high rating, 14.4% obtained average rating and 23.3% got high rating.

The results evidently show that the respondents' analysis level of understanding had changed in their post-performance because more students had leveled up in analysis than those who needed improvement.The learning activities in the module contain stimulating activities and self-directed experiments that help the students examine methodically concepts and processes and analyze results in learning tasks such as experiments.

The t-value result between pretest and post score of the experimental group using self-learning module, in the study of Sareen (2019), indicated significant difference inferring that self-learning module enhances student process skills in Science.

Table 7: Pre- and Post-Performance of the Respondents as to Knowledge Utilization

Cognitive Understanding	Pre test Performance		Post test Performance		Post test Performance
	F	*%*	*F*	*%*	
90-100	-	-	7	7.8	Very High
85-89	-	-	20	22.2	High
80-84	1	1.1	15	16.7	Average
75-79	4	4.4	23	25.6	Below Average
Below 75	85	94.4	25	27.8	Low
TOTAL	**90**	**100.0**	**90**	**100.0**	

Table 7 presents pre- and post-performance of the respondents as to knowledge utilization. In knowledge utilization, the students are expected to use the accumulated knowledge to tackle problems, develop new products, and deal with unfamiliar situations. A great number of respondents 94.4% or 85 out of 90 showed lack of ability in knowledge utilization, while the least number1.1% obtained average performance. After studying the self- directed module, the post-performance result showed that the highest number of respondents 27.8% remained low in performance level which means that they did not improve while the least number 7.8% obtained very high rating who showed great improvement. After studying the module, more students have developed their ability to use the knowledge they learned in practice than those who remained stagnant. The students were given opportunities to apply science processes in real life and were also provided actual learning engagement in their independent study. However, not everybody was not able to accommodate and use these opportunities due to lack of basic skills.

In the pre- performance most respondents obtained low rating in all four levels of understanding: knowledge retrieval, comprehension, analysis and knowledge utilization. This result could be expected because no instruction had not yet been applied and they had no prior understanding of the lessons. In the post-performance, most respondents have not yet attained standard level in knowledge retrieval, comprehension, and analysis. Most number of respondents remained weak in knowledge utilization because the learning activities provided in the module did not suit their ability to use in practice the

knowledge they have learned. Since they learned independently, they had no support from the teacher especially in understanding and interpreting the given processes in the module. Since their comprehension of the concepts and processes is essential in putting them into practice, the teacher should have supported them.

The study by Moradi (2022) investigated the efficiency of online learning modules for supplementing education in fundamental physics and mathematics concepts. According to a paradigm of cognitive apprenticeship, the modules were created. The findings demonstrate that the online instructional modules used by the intervention group considerably improved their performance on post-tests, whereas there was no significant change in the performance of the control group. According on survey results, pupils expressed their interest in the teaching resources. Additionally, they described a self-paced learning process in their feedback, stating that they had control over the course materials thanks to the created online instructional modules.

The results of the study by Torrefranca (2022) showed that there was a significant difference between the pretest and posttest scores of the student participants before and after they were exposed to the modules, indicating that the modules had improved their understanding of rational expressions and variations.

Typically, a pretest is given to students at the beginning of a lesson to determine their initial understanding of the measures of the learning objectives. Usually, the results show that most students do not have yet an understanding of the lesson. Post-test is given after the lesson is taught and learned to determine what the students have learned.

III. Evaluation of the Designed Self-Paced Directed Module

Table 8: Effectiveness of the Content of Designed Self-Paced Directed Module in Chemistry as to Learning Resources

Statements The learning resources …	Mean	Standard Deviation	Verbal Interpretation
1.Cater to the students' needs and Interest in reading to acquire know-ledge about the subject	4.08	0.86	Effective
2.Help develop the cognitive under-standing of the students along with their generic skills	3.87	0.91	Effective
3.Provide opportunities to students to practice process skills with less or no support from the teacher	4.00	0.95	Effective
4.Offer easier means of facilitating independent learning or self- direct learning	4.03	0.91	Effective
5.Include problem situations for the students to solve and generate a conclusion	3.96	0.86	Effective
Overall	3.99	0.73	Effective

Legend: *4.50-5.00-Highly Effective; 3.50-4.49-Effective; 2.50-3.49-Moderately Effective; 1.50-2.49-Less Effective; 1.00-1.49- Not Effective*

Table 8 presents the effectiveness of the learning resources in the designed self-paced directed module in chemistry. It shows that learning resources in the content of the designed self-paced directed module is effective in students' learning. Among the statements, cater to the student needs and in interest in reading to acquire knowledge about the subject as the highest suggests that the module provides them with quality learning opportunities to explore areas where they are interested in and what they need for them to be more likely to engage with the learning process. The learning process is likewise effective in helping them develop cognitive understanding along with their generic skills. The learning resources help provide opportunities for the student to understand and learn to broad aspects of life lifelong skills that they need to apply.

In this study, the teacher also included video supplementary lessons to facilitate thinking and problem-solving skills of the students (Aubry, 2021). The YouTube lessons also aid in communicating facts and demonstrating procedures that assist in mastery learning. Lessons about physical changes in matter are interestingly presented in videos that can be repeatedly viewed by the students. Examples of physical changes in matter are vividly portrayed in videos that are easy to assimilate and understand. Sub atomic particles are also presented by different skillful YouTube bloggers.

Video lessons can help the students effectively enhance their learning because according to eleammingindustry.com (2022) a learner is likely to remember 95% of audio-visual content compared to 10% textual content and 65% of visual content. Also, videos are learning resources provides a simpler and practical learning experiences. Learning resources help students to understand and enjoy the lessons in the designed self-paced directed module. They help students understand the objective of the lesson the module is conveying. The role of the learning resources is to provide a source of learning for the learners, assisting the process of interaction between the student and the module. Learning resources aid students in understanding and appreciating the courses in the self-paced directed module. The purpose of a learning resource is to offer students a source of learning while facilitating the interaction between the student and the module. This helps students comprehend the lesson's goal.

Learning resources enhance students' knowledge, capacities, and capacity to monitor their assimilation of new information and to contribute to their overall development and upbringing. Additionally, it gives every student in a class the opportunity to share experiences necessary for new learning, clarifies important ideas to capture and hold students' interest, and helps to make learning more lasting (Marbas, 2022). In the study of Rahmawati, et al. (2019), modules are created as learning resources that learning participants can study on their own. They are interested in how using modules influences the learning outcomes of students. by contrasting the typical results of math learning between those who used modules and those who did not. According to the results, students who used modules as learning resources had better overall math learning outcomes than those who did not.

Table 9: Effectiveness of the Content of Designed Self-Paced Directed Module as to Learning Activities

Statements The learning activities…	Mean	Standard Deviation	Verbal Interpretation
1. Provide actual learning engagement were students can utilize learned knowledge	3.96	0.90	Effective
2.Include self-directed experiments motivate students learning engagement	4.02	0.90	Effective
3.Provide opportunities to apply science processes in real life situation	4.03	0.84	Effective
4.Utilize students' learned knowledge practice	4.07	0.90	Effective
5.Contain stimulating activities that motivate students' learning engagement	4.08	0.88	Effective
Overall	4.03	0.67	Effective

Legend: *4.50-5.00-Highly Effective; 3.50-4.49-Effective; 2.50-3.49-Moderately Effective; 1.50-2.49-Less Effective; 1.00-1.49- Not Effective*

Table 9 presents the effectiveness of learning activities in the self-paced directed module. It shows that the learning activities in the module is effective in students' independent learning. Among the indicative statements, contain stimulating activities that motivate students' learning engagement as the highest suggests that the activities provided in the module are exciting that the students enjoy while engaging with their independent leaning. Activities also offer opportunities for higher order/critical thinking. The module is likewise effective with the actual engagement it provided where students can utilize learned knowledge. Learning activities therefore must include experiential learning where they can practically use the knowledge they have learned.

Students need both opportunities to use their information in real-world settings and support in integrating or sharing it in order to really grasp science concepts. Students can see what they have learnt in action and gain a greater knowledge of the subject by engaging in hands-on science activities and experiments.

Learning activities are created with the intention of fostering knowledge that supports learning objectives. The presenting of information to students' interaction will assist all learning outcomes, whether they involve declarative or functional knowledge, in some way (with others). Students can engage with and enhance their skills, information, and understandings through learning activities in a variety of ways. Students are actively involved in meaningful activities in constructive, intentional, genuine, and cooperative ways.

Several studies reviewed by Ates&Erilmaz (2011) in their investigation shows that students who participate in hands-on activities do better than those who follow a traditional, text-based curriculum, have better comprehension and change their false beliefs with accurate ones, and have more positive attitudes about science.

Similar learning activities may be seen in AlMamun, et al. (2020) study, which used scaffolded online learning modules for instructional design and provided activities for students to anticipate, observe, explain, and assess. We looked at how students interacted with these inquiry modules in a self-directed online environment to pinpoint essential scaffolding components. A multimedia scaffolding technique for self-directed inquiry can be conceptualized using the study's findings, which are based on the interactions and engagement of the students with the learning modules.

Table 10: Effectiveness of the Content of Designed Self-Paced Directed Module as to Assessment

Statements The learning activities…	Mean	Standard Deviation	Verbal Interpretation
1.Assesses students' achievement essential minimum learning competencies	3.81	0.72	Effective
2.Determines students' ability to follow directions and competence to instructions	4.17	0.81	Effective
3.Provides feedback essential in monitoring self- learning progress	4.11	0.77	Effective
4.Provides teacher basis for adjustment to cater students' learning needs	3.96	0.90	Effective
5.Makes judgment of students achievement of grade and standards in learning the subject	4.04	0.83	Effective
Overall	4.02	0.64	Effective

Legend: *4.50-5.00-Highly Effective; 3.50-4.49-Effective; 2.50-3.49-Moderately Effective; 1.50-2.49-Less Effective; 1.00-1.49- Not Effective*

Table 10 presents the effectiveness of assessment in the self-paced directed module. It shows that the assessment in the self-paced directed module is effective to students' independent learning. Among the indicative statements determine students' ability to follow directions and competence to instructions as the highest, suggests that the students are guided with clear, concise and effective instruction. They engaged in accomplishing performance tasks that assess not only their knowledge but also the utilization of their knowledge.

In this study, the researcher administered formative assessment, to assess the learners' current knowledge base or current views on a topic to be studied in the module. After learning the module, a formative assessment was administered to evaluate their learning and to gain feedback about their progress. While objective state the expected learning outcomes, assessment provides tools to determine whether the learning outcomes have been reached.

The method of assessing distance learning involves gathering data on the learning that a student has completed and analyzing that data. It will be used to judge the student's degree of achievement and the caliber of the teaching and to reach the best conclusions feasible.

Miller (2020) stated that assessment is undoubtedly a component of efforts to integrate teaching in a distance learning setting. The tests created for students in this era of online learning must insist that they apply their knowledge to fresh and unexpected scenarios.

Yazon (2016) carried out his research to support the Assessment of Student Learning module. The pre-test and post-test result that the student responders received were used to gauge the module's success. The respondents stated that the module includes pre-test, self-assessment, and post-test options in each session when it comes to evaluation activities. the test/evaluation activities are simple to score and the evaluation questions are consistent with the stated objectives. Based on the results of the pre- and post-tests, it was determined that the module on student learning assessment is successful.

Table 11: Effectiveness of the Objectives of Designed Self-Paced Directed Module

Statements The objectives…	Mean	SD	VI
1. State the essential minimum learning competencies expected to be developed by the students	4.11	0.85	Effective
2. State the goals and standards set in the k - 12 curriculum	4.08	0.80	Effective
3. State briefly, clearly and concisely what the student is able to do after lesson	4.08	0.95	Effective
4. Can be attained through independent at a specific time	3.91	0.92	Effective
5.Guide the teacher and the students to assess the learning progress	4.09	0.86	Effective
6. Develop students' level of cognitive understanding	4.12	0.87	Effective
7. Explain the knowledge, skills and attitudes needed to be attained	4.16	0.86	Effective
8. State specific outcomes that relate to specific module	4.01	0.85	Effective
9. Align properly with the assessment	3.91	0.93	Effective
10.Help to clarify, organize and prioritize learning	4.01	0.92	Effective
Overall	4.05	0.62	Effective

Legend: *4.50-5.00-Highly Effective; 3.50-4.49-Effective; 2.50-3.49-Moderately Effective;*
1.50-2.49-Less Effective; 1.00-1.49- Not Effective

Table 11 presents the effectiveness of the objectives of the self-paced directed module. It shows that the objectives in the designed self-paced directed module was effective on students' independent learning. The objective stimulates the student's active engagement and enhance their cognitive understanding. Among the indicative statements, explain the knowledge, skills and attitudes needed to be attained as the highest, suggests that the designed module establish and articulate the expectation from the lesson for the students to know precisely what is expected of them. because when the learning objectives are clearly communicated to them the students will more likely to achieve the minimum learning competencies set by DepEd.

The learning objectives in the self-paced directed modules are within the standard of K to 12 curriculum and based on the minimum essential learning competencies in the Physical Changes of Solid, Liquid and Gas, and in the Subatomic Particles. The learning objectives guided the teacher in selecting the learning resources and learning activities and in formulating the aligned assessment.

A learning objective is an outcome statement that identifies the specific knowledge, abilities, and attitudes that students should be able to demonstrate after receiving instruction. With a focus on teaching, learning objectives establish learning outcomes. They aid in organizing, categorizing, and prioritizing learning. They support educators and students in assessing their progress and motivate them to take ownership of their learning (Acuram, 2015). It stated what a student learns by the end of the module.

Students must understand the objectives. They must all be aware of what they are studying and the purpose behind it. Additionally, they must understand how the objectives relate to what they learned in the previous session, the course they are taking, and the main objective in general. Because of this, they can't just put down the objectives and trust that the children will duplicate them. It suggests that goals are adequately described in context, that students are involved, and that they can explain objectives.

Along with the mastery of the minimum essential learning competencies, development and enhancement of the domains in cognitive understanding of the students must be considered in framing the learning objectives in Chemistry and in any subject. Their cognition in knowledge retrieval, comprehension, analysis and knowledge utilization must be improved as they master the learning competencies.

It is implied that each student's particular objectives and results must be different. Each student should be able to identify their current position and the steps required to advance to the next level. Where possible, this should connect to subject standards and growth. It is essential to have high expectations for what can be accomplished and to instill that belief in the kids. In order to maximize engagement, success criteria for attaining the result must be agreed upon with the students. This will allow them to clearly understand what it will look, feel, and sound like once they have made that progress.

Validity of assessment should be assured so that it really measures what it intends to measure. It is not just about the attributes of the test nut it is also about what is intended to do with the result. It means that the result of the test or assessment will be the basis of the teacher's decision in teaching. whether intervention, remediation or enhancement is needed

Table 12: Effectiveness of the Directions of Designed Self-Paced Directed Module

Statements The directions…	Mean	SD	VI
1. Guide students with clear, concise and effective self-directed learning	4.30	0.80	Effective
2. Guide and motivate students to accomplish; learning tasks	4.22	0.75	Effective
3.Help the students to stay in focus	4.30	0.74	Effective
4.Guide the students to appropriate behavior necessary in independent study	4.17	0.77	Effective

5.Help students map out their learning goals	4.18	0.80	Effective
6.Provide timeline for completion of activities	4.17	0.85	Effective
7.Give details about grading process	4.16	0.81	Effective
8.Guide students to engage in learning	4.13	0.77	Effective
9.Facilitate students' initiatives in learning	4.02	0.81	Effective
10.Guide the students throughout the learning process	4.26	0.88	Effective
Overall	4.19	0.60	Effective

Legend:Legend: *4.50-5.00-Highly Effective; 3.50-4.49-Effective; 2.50-3.49-Moderately Effective; 1.50-2.49-Less Effective; 1.00-1.49- Not Effective*

Table 12 presents the effectiveness of the directions of self-paced directed module. It shows that the directions of the designed self-paced directed module is effective in developing the independent learning of students. Among the statements guide the students with clear, concise and effective self-directed learning and help the students stay in focus suggest that the students find it easy and systematic in performing their tasks so that they know exactly what and how they will do even without the support and supervision of the teacher. Directions that are clear and concise, timed and observable, can help ensure student compliance (Fuhrman, 2020).

Following directions or instructions required the student to attend to details, to analyze the information in the appropriate steps and to find clarification if they have difficulty in remembering or recalling information. It is important for the student to be able to follow directions so that they can function effectively in their learning tasks and also perform well in assessment.

It will be simple for the teacher to tell which students are following directions and which are not by making them visible. Additionally, observable instructions give students explicit action steps so they understand exactly what is required of them and how to do the assignment.

When given a time frame for the instruction, students can plan their starting and stopping points. This may serve to provide a clear time limit for the activity or may only serve to explain to the students how they should start and finish an activity.

Providing students with clear directions is certainly worthwhile. By taking the time out in advance exactly what to direct the students, it can be ensured that directions will be clear as possible. For conciseness, provide directions that outline each step. Break down the tasks into small steps so that students know what to do in pieces. The nature of the work of the students will help to determine directions and how many directions. The students can handle at once.

When student's complete tasks, the next direction may be for them to work with the group, work independently and how to engage in learning the module.

Part IV: Correlation Between Students' Cognitive Performance and Instructional Engagement and Assessment of Module

Table 13: Test of Significant Relationship between the Cognitive Performance and Instructional Engagement and Assessment of the Module

	Knowledge Retrieval	Comprehension	Analysis	Knowledge Utilization
Instructional Management				
Behavioral	.111	-.019	-.050	.064
Emotional	.052	-.187	-.100	-.052
Cognitive	.157	.006	-.075	.127
Assessment of the Module				
Content	.273**	.051	.070	.194
Objectives	.220*	-.005	-.035	.054
Directions	.262*	-.005	-.008	.109

***. Correlation is significant at the 0.01 level (2-tailed).*
**. Correlation is significant at the 0.05 level (2-tailed).*

Table 13 presents the significant relationship between the cognitive performance and instructional engagement and assessment of module.

The table shows that there is no significant relationship between instructional engagement and cognitive performance of the students. This means that the students' active involvement, interest, and enjoyment in the learning tasks are not attributes in their performance in cognitive understanding. Moreover, no significant relationship exists between assessment of the module and cognitive performance except for knowledge retrieval in which correlation is significant in content at 0.01 level of confidence, and in objectives and directions at 0.05 level of confidence. However, the knowledge retrieval in the cognitive performance is related to the content objectives and assessment aspects of the self-paced directed module because these components of the module contribute to the student's ability to identify and recall facts and information in chemistry. The alignment of the objectives and assessment in the module facilitate students' ability to recall facts and information and identify concepts and process in their lessons.

This finding is consistent with the finding of Delfino (2019). The study revealed that student engagement along behavioral, emotional and cognitive engagement was

positively correlated with the academic performance of the students of Partido state University.

However, this finding is not consistent with the finding in Rajabalee's (2020). study. It was found out that there was a weak but substantial positive link between the students' participation in the online module and how well they performed in the assessment. Additionally, it was shown that there was a very slight positive association between the students' final evaluation result and their level of engagement. Contrarily, their findings were not consistent with other researches that showed strong positive relationship between student engagement and academic performance.

It implies that when the lesson is presented with motivating learning resources and learning activities and when the students find the lesson meaningful. When they have high level of interest in the tasks, they tend to engage with interest, face the challenge in learning, exert effort, and will persevere to attain success in learning. They will also value their self-regulated learning and enhance student engagement especially in modular learning. The students must be provided with self-paced directed module that include stimulating learning resources, challenging learning activities that will eventually improve their cognitive understanding.

Part V: Significant Difference on the Students' Pre- and Post-Performance in their Cognitive Understanding

Table 14: Test of Significant Difference Between the Pre- and Post-Performance in Cognitive Understanding

Cognitive Understanding Pre- Post	*Pretest*		*Posttest*		*Sig. (2tailed)*	*T*	*Df*
	Mean	*SD*	*Mean*	*SD*			
Knowledge Retrieval	66.67	3.66	82.17	8.69	-18.38	89	0
Comprehension	66.78	3.49	79.6	6.95	-15.67	89	0
Analysis	66.46	3.11	79.41	6.95	-18.97	89	0
Knowledge Utilization	67.01	4.35	79.99	7.04	-18.12	89	0

Table 14 presents the significant difference on the students' pre- and post-performance in their cognitive understanding. It shows that there is a significant difference between the pre- and post-performance of the respondents in: knowledge retrieval (p=0.00) comprehension (p=0.00); analysis (p= 0.00); and knowledge utilization (p=0.00).

Generally, there is a significant difference between the pretest and post-test performance in the cognitive understanding of the groups of respondents. From this result, it can be observed that there is an increment in the cognitive understanding of the respondents after the application of the designed self-paced directed module. However, it had been observed in the result that there were still some students who failed to answer correctly the same questions in pretest and posttest which means that they did not improve their understanding even after studying the module.

In knowledge retrieval the students improve their ability in recalling facts and concepts, and incomprehension, they only were able to explain these but were not able to explain and interpret processes. However, they were not able to put into practice the concepts and processes they learned.

This result is in line with the findings of a study conducted by Kashie'ie, et al. (2017), which compared the performance of Engineering Technology students on a pre and post Mathematics competence Test. The outcomes demonstrated that post-test performance was superior to pretest performance. However, a statistical study of the performance of the students on each question revealed that the majority of them did not comprehend the fundamental ideas in algebra, trigonometry, and functions.

It implies that self-learning modules must be customized and self-paced in such a way that the independent learning method helps the student to manage learning within their level in a duration of time. The module must be directed by which learning is facilitated with appropriate learning resources and learning activities where student can learn with less or no support from the teacher. During the implementation of the self-paced directed module, the teacher needs to monitor the learning progress of the students in order to determine whether intervention, remediation or enhancement is needed. Assessment of student's performance is important because it determines whether or not the expected minimum learning competencies have been mastered.

5. Conclusion

Based on the findings of the study the following are concluded:

1) Since there is no significant relationship between instructional management and cognitive performance of the students except for the relationship between knowledge retrieval and content, objectives and directions, there is partial significant relationship between assessment of module and cognitive performance, thus, the null hypothesis is partially sustained.
2) The statistical results reveal that there is a significant difference on the pretest and post-test performance of the respondents exposed on the use of the designed self-paced directed module, therefore, the null hypothesis is not supported.

6. Recommendation

Based on the results and conclusions of the study, the following recommendations are suggested:

1) To Science teachers, since the study revealed that students are engaged on lessons but find difficulty when learning new lessons, the designed self-paced directed module may be improved and enriched by including the four levels of cognitive understanding in formative assessment and evaluating the result after each lesson in

Science to assess learning in order to determine the appropriate remediation or intervention needed for students' improvement.

2) Summative assessment on cognitive understanding of all lessons covered in a quarter may be administered and be evaluated by the Science Teachers and the Head of the Science Department to determine learners' achievement so that appropriate remediation, intervention or enhancement may be applied.
3) Providing more appropriate learning resources and experiential learning activities to enhance students' engagement in the learning process may be encouraged by the teachers.
4) Future researchers may use this as reference for their study. They are encouraged to conduct similar study and integrate instructional engagement and cognitive understanding in different instructions not only in the area of Science, but also in other subjects.

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