Process-Oriented Guided Inquiry Lessons in Grade 10 Biology

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Abstract
This descriptive developmental study determined the effect of Process-Oriented Guided Inquiry Lessons in Biology to the Grade 10 students' performance. It focused on the developed Process-Oriented Guided Inquiry Lessons, jurors' evaluation of the Process-Oriented Guided Inquiry Lessons in terms of competency-based, process skills involved, inquiry-based and cooperative learning strategy, and its effect on students' conceptual understanding, process skills and metacognitive awareness. The respondents were Grade 10 students of Taysan Resettlement Integrated School, Legazpi City, SY 2018-2019. The researcher employed a pre-experimental research design particularly a pretest-posttest design. Both qualitative and quantitative methods were utilized in analyzing the results in the lesson implementation. The qualitative data were obtained from the students' journals and remarks of the teacher-observers in the affective process skills observation sheets. In the quantitative method, data were obtained from the jurors' evaluation on the developed Process-Oriented Guided Inquiry Lessons for Grade 10 Biology, pretest and posttest scores and the students' response in the metacognitive awareness inventory. Mean gain and t-test were used for statistical rigors. Results show that the six Process-Oriented Guided Inquiry Lessons were deemed excellent by the jurors. This means that the jurors were convinced that developed Process-Oriented Guided Inquiry Lessons were of high quality and the four features were evident and commendable in the developed lessons. There were improvements in the conceptual understanding, process skills and metacognitive awareness of students supported by positive mean gain scores and the positive remarks given by the teacher-observers on student's affective process skills during the conduct of the study.

Keywords: Competency-based, inquiry-based, cooperative learning strategy, conceptual understanding, process skills and metacognitive awareness.

Introduction

Nowadays, educators have developed a wide variety of approaches to promote student engagement, enhance learning, and emphasize scientific attitudes and process skills. These approaches can be referred to as active learning. Teaching approaches where students are given opportunities to work as groups are also referred to as cooperative learning. Process-oriented guided inquiry learning (POGIL) is an approach to cooperative learning which combines a set of effective practices such as integrating guided-inquiry activities in teaching. Process-oriented guided inquiry learning is a learner-centered instructional strategy that aims to actively engage students in developing process skills during the learning process. It was developed based on the positive effects that constructivism, cooperative learning, and inquiry learning have in enhancing student's performance (Simonson, 2013). In a classroom where process-oriented guided inquiry learning is integrated, students are given the chance to work in learning groups on specially designed guided-inquiry activities that promote mastery of discipline content and the development of skills in the processes of critical thinking, information processing, problem-solving, communication and teamwork (Hanson, 2006). A lot of research conducted have proven the effectiveness of process-oriented guided inquiry learning in improving students' academic performance. Since then this student-centered teaching philosophy that was first developed in chemistry education was later adapted in a wider range of subjects.

In process-oriented guided inquiry learning, teachers only act as the facilitator of learning. The learning process will focus more on student's activities rather than the teacher's discussion. Process-oriented guided inquiry learning allows students to work on a small group consisting of 4 to 5 members where each member is assigned specific roles. Process-oriented guided inquiry learning employs learning groups as it provides a positive impact on students learning. Research has documented that learners working in teams feel better about themselves and their classmates. They also have more positive attitudes regarding the subject area, course, and instructors. Aside from that they also acquire better understanding and retention (Hanson, 2006).

The guided-inquiry activities utilized in process-oriented guided inquiry learning are designed based on the learning cycle approach. The learning cycle has different versions, but they all have similar features. According to Lawson (2002), the cycle is comprised of three steps: exploration, term introduction, and concept application. During the exploration phase, students are asked to explore or collect data from the model provided. Guide questions that promote information processing, problem-solving and critical thinking help students investigate the model given to them. After the students have figured out the pattern, they will proceed to the second phase called the term introduction where the instructor introduces the concept. Both the exploration phase and the term introduction phase guide the students to develop an understanding of the concept. The final phase called application, students will apply the concept to other situations or contexts to help generalize its meaning and applicability. The guided-inquiry activity provides information and asks questions to guide students through the learning cycle and help them develop process and learning skills (Abraham & Renner, 1896).

One principle that characterizes process-oriented guided inquiry learning as a teaching strategy is an explicit emphasis on the development of process skills as a component of the student learning process. The “process-oriented” part of Process-oriented guided inquiry learning refers to the five key process skills that would be the focus of development. These are Information Processing, Problem-solving, Critical thinking, Oral and Written Communication and Teamwork.

Aside from process skills, the student's metacognitive awareness can also be enhanced in process-oriented guided inquiry learning approach. Metacognition is utilized in this approach to help students realize that they are the one responsible for monitoring their own learning. It allows students to reflect or to assess their own learning and the strategies they need to improve their learning. During activities students can be asked to assess their own work and that of each other; instructors also monitor the groups and provide feedback to individuals, groups, and to the whole class in order to improve skills and help students identify the things that still need improvement. At the end of guided-inquiry activities, the product that each group developed gives them the opportunity to reflect on what they have learned, the strategies they have employed and the improvement they have gained from the activity (Hanson, 2006). Considering that process-oriented guided inquiry learning approach utilizes metacognition, this feature can be an instrument to help students achieve better performance in class.

This study was conducted in a barangay high school which had performed poorly in the National Achievement Test over the past years. This barangay high school has a population of more than 596 students in the school year 2017-2018. The results of the School’s Science National Achievement Test in the school year 2013-2015 had a 49.33% overall mean percentage score and this poor performance has not improved in the succeeding years. The school’s mean percentage scores were considered below the accepted standard of the Department of Education which is an MPS of 75%. This alarming poor performance of the students provided a very good reason using the process-oriented guided inquiry learning approach may be implemented as an intervention in order to give the students the chance to become active participants in the learning process by providing them with the avenues to become responsible learners. The process-oriented guided inquiry lessons will give the students more opportunities to enhance their conceptual understanding, process skills, and metacognitive awareness. Adopting the process-oriented guided inquiry learning approach to develop lessons in Grade 10 Biology it can create a positive effect on a student's conceptual understanding, metacognitive awareness, and process skills.

Research Methods

This study employed a descriptive developmental research method to describe the development of process-oriented guided inquiry lessons and determine its effect on students’ learning. The study utilized a pre-experimental research design particularly the single group pretest-posttest design. The design was used in order to evaluate the effect of process-oriented guided inquiry lessons on students’ conceptual understanding, process skills and metacognitive awareness in biology. The respondents in this study were given a test prior to the process-oriented guided inquiry lesson intervention and a test after the implementation of process-oriented guided inquiry lessons. The change between the scores of the students in the two tests was attributed to the effect of the developed process-oriented guided inquiry lessons in Grade 10 Biology.

The study combined both quantitative and qualitative techniques in the analysis of data. The researcher gathered the quantitative data using results on the Pretest-Posttest, Cognitive Process Skills test, and Metacognitive Awareness Inventory. The qualitative data were gathered from the jurors' evaluation of the process-oriented guided inquiry lessons in Grade 10 Biology, teacher-observer's evaluation on students' affective process skills and the insights in their journal.

Results and Discussions

Six (6) lesson plans were sifted from the learning competencies stipulated in the K to 12 Curriculum Guide. The topics in the book were considered in the construction of the lessons. The lesson plans have five (5) parts: the learning objectives, subject matter, teaching procedure, lesson proper, and assignment. The researcher followed the 5E Instructional Model in the lesson proper which consists of Engagement, Exploration, Explanation, Elaboration and, Evaluation.

The six (6) process-oriented guided inquiry lessons focused on how the students would learn the content and at the same time develop process skills by working as a group on guided-inquiry activities. Each lesson developed was incorporated with a cooperative learning strategy and guided-inquiry to give the students the opportunity to work effectively as part of a cooperative group and share each other's idea. All the lessons were developed to give the students the chance to conduct small group discussions and brainstorming as the students accomplished the guided-inquiry activities.

Table 1 presents the topics of the developed lessons. The learning competencies are also given together with what guided-inquiry activities will be done and the process of how the students will learn the content.

Table 1. Process-Oriented Guided Inquiry Lessons

Lesson Plan	Learning Competency	Guided Inquiry Activity	Process-Oriented
Lesson 1: DNA and RNA Structure and DNA Replication	Explain how protein is made using information from DNA. Code: S10LT-IIId-37	-Interpreting DNA and RNA model. -Evaluating and interpreting the table using Chargaff's rule. -Interpreting the DNA replication video.	Students were expected to work cooperatively, generally in groups of 4 to 5. Each group interpreted the DNA and RNA Structure to answer the guide questions. They also evaluated and interpreted a table that showed Percentages of Bases in Four Groups in order to identify which sample supports the Chargaff's rule of base-pairing. Lastly, the students also watched and interpreted a video to identify the correct sequence of DNA replication.
Lesson 2: Protein Synthesis		-Solving a protein synthesis problem by determining the correct mRNA, tRNA and Amino acid sequence. -Calculating the total value of the amino acid sequences.	The students worked together in small groups to understand the concept and to solve the protein synthesis problem. Each group identified a specific strategy that would help them determine the correct mRNA, tRNA and amino acid sequence using the information from the DNA. Lastly, the students calculated the mystery gene expression equation using the corresponding values of the amino acid sequence.
Lesson 3: Mutations	Explain how mutations may cause changes in the structure and function of a protein. Code: S10LT-IIIe-38	-Analyzing the mutation that occurred in each sample. -Drawing conclusion based on the findings.	Each group analyzed the different samples and determined the mutation that occurred. The students also determined the major causes of each mutation. At the end of the activity, each group drew a conclusion based on the answers they formulated in the guided-inquiry activity.
Lesson 4: Fossils and Geologic Time Scale	Explain how fossil records, comparative anatomy, and genetic information provide evidence for evolution. Code: S10LT-IIIf-39	-Interpreting the fossil and sedimentary rock layer. -Creating a pie chart that shows the range of time of each era based on the data provided. -Interpreting the geologic time scale.	In the first part of the activity, each group is expected to interpret the fossil model and sedimentary rock layer diagram to answer the guide questions. To understand the length of time of each ear in the geologic time scale, the students created a pie chart that correctly shows the range of time of each era. The students also interpreted the geologic time scale to complete the guide questions in the activity.
Lesson 5: Evidences of Evolution		-Interpreting the models whether homologous or analogous structures. -Interpreting the embryological development model. -Interpreting and evaluating the amino acid sequence to determine which organism is closely related to humans.	The students participated in small group work. In the first part of the activity, the students interpreted two models and determined whether these are homologous or analogous structure. The students justified their answer afterward. The second part of the activity gave the students an opportunity to interpret the embryonic development model and explain how this evidence supports evolution. The last part of the activity allowed the students to interpret the amino acid sequences of different organisms and use these amino acid sequences to determine which organism is closely related to humans.
Lesson 6: Theories of Evolution	Explain the occurrence of evolution. Code: S10LT-IIIg-40	-Comparing Darwin and Lamarck's ideas about evolution. -Analyzing and arranging the cards using Lamarck's theory of evolution and Darwin's theory of evolution. -Drawing conclusion based on their findings.	In a small group, the students read an article about the two theories of evolution. They used their understanding in completing the first part of the activity. The students determined whether each statement was from Darwin or Lamarck. In the last part of the activity, the students also applied the information they have gathered in the reading material in analyzing the cards and arranging them in the correct order based on Darwin's theory and Lamarck's theory. Each group was given enough time to discuss their ideas with the whole group before arranging the cards. After arranging the cards, the students drew a conclusion based on how they arranged the cards and how they understood the theories of evolution.

These lessons were evaluated by jurors from the Division of Albay. The jurors evaluated and gave their numerical and adjectival ratings based on the given content criteria. Each lesson was evaluated in terms of the following criteria: competency-based, process skills involved, inquiry-based and cooperative learning strategy.

Table 2 summarizes the evaluation of the jurors by generalizing the criteria. The overall mean under each criterion (i.e., competency-based, process-skills involved, inquiry-based and cooperative learning strategy) for a lesson was multiplied then added to those of the other lessons. The total was then divided into the total number in the evaluation tool for the process-oriented guided inquiry lessons.

Table 2. Summary of the Jurors' Evaluation of the Developed Lessons

Lessons	Competency -Based		Process Skill Involved		Inquiry-Based		Cooperative Learning Strategy		Overall Mean	Adj. Rating
	W.M	Adj. Rating	W.M	Adj. Rating	W.M	Adj. Rating	W.M	Adj. Rating	W.M	Adj. Rating
1	4.94	E	4.74	E	5.00	E	4.63	E	4.83	E
2	4.97	E	4.74	E	4.42	VS	4.58	E	4.68	E
3	4.94	E	4.67	E	4.58	E	4.71	E	4.73	E
4	5.00	E	4.48	VS	4.58	E	4.50	E	4.64	E
5	4.91	E	4.41	VS	4.79	E	4.54	E	4.66	E
6	4.85	E	4.70	E	4.67	VS	4.58	E	4.70	E
Mean	**4.94**	**E**	**4.62**	**E**	**4.67**	**E**	**4.59**	**E**	**4.71**	**E**

Legend: 5 (4.50-5.00) means Excellent; 4 (3.50-4.49) means Very Satisfactory; 3 (2.50-3.49) means Satisfactory; 2 (1.50-2.49) means Moderately Satisfactory; and 1 (1.00-1.49) means Poor.

The overall ratings of the jurors in the different criteria revealed an overall mean of 4.71 which is interpreted as "Excellent." This means that the process-oriented guided inquiry lessons were of high quality and that the different criteria for the lessons are evident.

Although the lessons were generally rated "Excellent", it is noted that the jurors rated Lesson 5 with the lowest score of 4.41 for the process skills involved because the guided inquiry activity in Lesson 5 needed to have more models and data that would help the students practice their information processing skills. The jurors recommended adding more models and information suited to the level of understanding of the students that would help enhance student's information processing skills. One of the ideas that they recommended is adding a model that shows the amino acid sequences of organisms. According to one juror, the model that should be included in that guided-inquiry activity must challenge students to use their information processing skills in interpreting which of the following organisms are closely related.

The result is consistent with the comments and suggestions of the jurors. One juror stated that "*The activities are organized and have included guide questions that promote a deeper understanding of the concepts in biology. The provided models and information will challenge the students to have critical analysis and interpretation as they accomplish the given tasks.*" One juror more said, "*Allowing the students to work together in doing the activity motivates the students, encourages active learning, and develops key critical-thinking and communication.*"

Whenever there is an instructional intervention done in a learning setting, it hopes to generate a positive outcome in improving the quality of education. The present study aimed to do the same by enhancing the students' conceptual understanding, process skills and metacognitive awareness in studying heredity and biodiversity and evolution.

Table 3 presents the statistical data gathered from the pretest and posttest results of the group. The individual learning competency was also presented to show the areas in which the conceptual understanding of the students was advanced or diminished. The performance level was also given for comparison purposes.

Table 3. Conceptual Understanding Results Summary Statistics

Learning Competencies	**Pretest Mean Scores**	**Performance Level**		**Posttest Mean Scores**	**Performance level**	
		%	Descriptive Equivalent		%	Descriptive Equivalent
LC 1	7.35	38.68	LM	9.93	52.24	NM
LC 2	4.95	45.00	LM	6.08	55.23	NM
LC 3	7.43	39.08	LM	9.90	52.11	NM
LC 4	4.90	44.55	LM	6.28	57.05	NM
Mean	24.63	41.83	LM	32.18	54.15	NM
Standard Deviation	5.65			6.18		
Mean Gain	+7.55					
p-value	0.00					
Significance	Significant **(α=0.05)**					

Legend: 92% and above means Full Mastery (FM); 83% to 91% means Near Full Mastery (NFM); 75% to 82% means Mastery (M); 51% to 74% means Near Mastery (NM); 25% to 50% means Low Mastery (LM); 24% and below means No mastery (NoM).

The table shows that there was a significant improvement in the scores of the group ($p < 0.05$). This means that the students' performance in the posttest was better than the performance in the pretest. In addition, the scores of the group became more varied after the implementation period. Similarly, this means that some students in this group made significant progress while others did not; thus, extending the range of the test scores. The mean scores of the group have increased from 24.63 to 32.18 (+7.55). It was evident that the mean scores of the students in the posttest were higher than the mean scores in the pretest. The result implies that the students' conceptual understanding in biology has improved after the implementation of the process-oriented guided inquiry lessons.

The performance level of the group has also increased from 41.83% (low mastery) to 54.15% (near mastery). The students gained the highest performance level in Learning competency 4. The pretest is only 44.55% which was interpreted as "Low Mastery" and the posttest is 57.05% which was interpreted as "Near Mastery". This only shows that during the implementation of the process-oriented guided inquiry lessons the students developed a greater understanding of the theories of evolution and the process of how evolution takes place within species.

Overall, the results suggest that the students' conceptual understanding was enhanced. The students could grasp the different concepts in Heredity, Biodiversity and Evolution in the process-oriented guided inquiry lessons. The result implies that the developed process-oriented guided inquiry lessons helped the students gain knowledge in the six lessons. It can be drawn in the discussions above from the students' journal entries and the supporting previous researches that it helped the students improve their understanding of the topics.

The process-oriented guided inquiry learning project identified five process skills as those that would be the focus of development in a process-oriented guided inquiry classroom. The process skills are identified as cognitive process skills and affective process skills. The cognitive process skills are information processing, problem-solving and critical thinking skills. The students use these cognitive process skills when learning new concepts and procedures, practicing skills and solving problems. The affective process skills are also developed in process-oriented guided inquiry learning. These are teamwork and oral and written communication which can be developed when students work together as a group on guided-inquiry activities. The process skills of the students play a crucial role in their success in the subject.

Table 4 presents the statistical data gathered from the tests results of the group. The mean scores under the different processes emphasized in this study were also shown for tracking the areas which may have improved or diminished after the implementation of the Process-Oriented Guided Inquiry lessons for the group.

Table 4. Cognitive Process Skills Results in Summary Statistics

Parameters	**Pretest Mean Scores**	**Performance Level**		**Posttest Mean Scores**	**Performance level**	
		%	Descriptive Equivalent		%	Descriptive Equivalent
Information Processing	17.50	43.75	LM	22.16	55.39	NM
Problem Solving	8.66	43.29	LM	11.79	58.95	NM
Critical Thinking	15.61	39.01	LM	20.74	51.84	NM
Mean	41.76	42.02	LM	54.68	55.39	NM
Standard Deviation	7.47			8.43		
Mean Gain	+12.92					
p-value	0.00					
Significance	Significant **(α=0.05)**					

Legend: 92% and above means Full Mastery (FM); 83% to 91% means Near Full Mastery (NFM); 75% to 82% means Mastery (M); 51% to 74% means Near Mastery (NM); 25% to 50% means Low Mastery (LM); 24% and below means No mastery (NoM).

The data table shows that there was a significant improvement on the pretest and posttest scores of the group ($p < 0.05$). This means that the students' performance in the cognitive process skills posttest was better than the performance in the cognitive process skills pretest. Talking about the dispersion of the test scores, the posttest scores became more varied after the implementation period. This connotes that some students in this group made significant progress while the others did not; thus, extending the range of the test scores. The mean scores of the group have been increased from 41.76 to 54.68 (+12.92). It is evident that there was an increase in the mean scores of the students in the posttest. This is supported by the higher increment on the test scores of the students under the different cognitive processes. The result implies that the students' cognitive process skills were enhanced after the implementation of the process-oriented guided inquiry lessons.

In this study, the affective process skills developed by the students were observed during the process-oriented guided inquiry lessons. There were three teacher-observers invited to observe the students as they worked on the guided-inquiry activities as a group. In each lesson, the teacher-observers gave remarks on how the groups worked together and how they effectively presented their output.

Overall, the remarks given by the teacher-observers were positive. This highly suggests that the process-oriented guided inquiry lessons had successfully developed the students' affective process skills. The students were able to show effective teamwork and oral and written communication as they accomplished the guided inquiry activities.

Metacognition is considered a critical component of successful learning. It involves self-regulation and self-reflection of strengths, weaknesses, and the types of strategies you create. This is used in process-oriented guided inquiry learning by creating an environment where continuous improvement is encouraged, and students realize that they are in charge of their own thinking.

Table 5 presents the comparison between mean scores and the corresponding level of metacognitive awareness of Grade 10 students before and after the process-oriented guided inquiry lessons intervention. The weighted mean in each indicator was computed then interpreted according to its corresponding qualitative remarks. The average weighted mean was computed using the means of the indicators.

Table 5. Metacognitive Awareness Results Summary Statistics

Metacognitive Awareness Indicators	Mean Score and Level of Awareness				Mean Gain
	Pretest Weighted Mean	Interpretation	Posttest Weighted Mean	Interpretation	
1. I understand my intellectual strengths and weaknesses in biology.	3.79	Mostly aware	3.97	Mostly aware	0.18
2. I know what kind of information is most important to learn in biology.	3.39	Aware	3.66	Mostly Aware	0.27
3. I am good at organizing biology information/concepts.	3.63	Mostly aware	3.95	Mostly aware	0.32
4. I know what my Biology teacher expects me to learn.	3.63	Mostly aware	4.13	Mostly aware	0.50
5. I am good at remembering information related to biology.	3.74	Mostly aware	3.87	Mostly aware	0.13
6. I have control over how well I learn biology concepts.	3.87	Mostly aware	3.97	Mostly aware	0.10
7. I am a good judge of how well I understand concepts in biology.	3.37	Aware	3.42	Aware	0.05
8. I learn more when I am interested in the topic in biology.	2.79	Aware	3.74	Mostly aware	0.95
9. I try to use strategies that have worked in the past.	3.39	Aware	3.87	Mostly aware	0.48
10. I have a specific purpose for each strategy I use.	3.82	Mostly Aware	3.84	Mostly Aware	0.02
11. I am aware of what strategies I use when I study.	2.84	Aware	3.05	Aware	0.21
12. I find myself using helpful learning strategies automatically.	3.95	Mostly aware	3.97	Mostly aware	0.02
13. I know how to use a specific strategy when studying biology concepts.	3.63	Mostly aware	3.71	Mostly aware	0.08
14. I know several strategies to use when studying biology.	3.08	Aware	3.13	Aware	0.05
15. I learn best when I know something about the topics in biology.	3.32	Aware	3.89	Mostly aware	0.57
16. I use different learning strategies depending on the topics in biology.	3.84	Mostly Aware	4.18	Mostly aware	0.34
17. I can motivate myself to learn biology when I need to.	3.66	Mostly aware	3.92	Mostly aware	0.26
18. I use my intellectual strengths to compensate for my weaknesses in biology.	3.34	Aware	4.00	Mostly Aware	0.66
19. I know what strategy will be most effective in learning biology.	3.63	Mostly aware	3.76	Mostly aware	0.13
20. I know why a specific strategy works better than the other when studying topics in biology.	3.95	Mostly Aware	3.97	Mostly Aware	0.02
Average Weighted Mean	**3.51**	**Aware**	**3.79**	**Mostly Aware**	
Mean Difference	0.28				
Standard deviation	0.32		0.29		
***p* value**	0.00				
Significance	Significant **(α=0.05)**				

Legend: 1.0-1.5 (never aware); 1.6-2.5 (sometimes aware); 2.6-3.5 (aware); 3.6-4.5 (mostly aware); and 4.6-5.0 (always aware).

Results show that there is a significant increase in the students' overall metacognitive awareness in biology. At the end of the implementation, the students had increased response in mostly aware. The pretest for Metacognitive awareness had an overall mean of 3.51 which was interpreted as "aware". The pretest overall mean denotes that the students were already aware of their own learning but not most of the time. The posttest for metacognitive awareness had an overall mean of 3.79 which was interpreted as "mostly aware". This means that the developed process-oriented guided inquiry lessons in Grade 10 Biology had a positive effect on enhancing students' metacognitive awareness. The mean difference of the pretest overall mean and the posttest overall mean is 0.28.

The overall evaluation suggests that the posttest result is statistically significant but with a minimal mean difference since the lesson implementation only happened for a short period of time. As with any skill, enhancing metacognitive abilities requires time, patience and practice, but helping students to develop metacognitive skills at each stage of a task will help. Prior to the task, this involved setting goals, preparing thoroughly and thinking about similar previous situations. During the task, this included monitoring their performance and after the task seeking feedback, taking action on it and keeping a diary.

The overall findings of this study on the effects of the developed process-oriented guided inquiry lessons in the students' conceptual understanding, process skills, and metacognitive awareness suggest that the intervention enhanced their academic performance under each criterion. The impact of the process-oriented guided inquiry lessons has been proven as a force to reckon with in the context of teaching biology.

Conclusion

Six (6) Lessons under Module 2 (Heredity: Inheritance and Variation) and Module 3 (Biodiversity and Evolution) of the K to 12 Curriculum Guide for Grade 10 biology were developed. The jurors' overall evaluation of the process-oriented guided inquiry lessons for Grade 10 Biology was excellent. This implies that the jurors were convinced that developed process-oriented guided inquiry lessons were of high quality and the four features namely: competency-based, process skills involved, inquiry-based and cooperative learning strategy were evident and commendable in the developed lessons. The integration of the process-oriented guided inquiry lessons in Grade 10 Biology was effective in enhancing the students' conceptual understanding, process skills, and metacognitive awareness.

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