

# STUDENTS' LEARNING OUTCOMES IN A DIFFERENTIATED INSTRUCTIONAL APPROACH IN GRADE 8 SCIENCE

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**Abstract:** The study investigated the students' learning outcomes through differentiated instructional approach in grade 8 science. Specifically, the study aimed to: determine the level of students' academic performance; ascertain the attitudes of students; find out the significant difference between students' academic performance; and find out the significant difference between students' attitudes as exposed to non-differentiated instructional approach and differentiated instructional approach. Quasi-experimental research design was used to determine the students' learning outcomes in the two sections of Grade 8 science. The instruments made use of academic and non-academic assessment. Analysis of Covariance (ANCOVA) was used to determine any significant difference on students' academic performance. The use of differentiated instructions namely: content, process and product had exhibited an increase on students' academic performance in science. These results had provided a gratifying experience among students such that they performed better and gained high scores on their tests. With differentiated instruction, the students fostered positive attitude toward science. The students' academic performance between two groups indicated high significant difference; thus, students' engagements for learning through differentiated instruction were found to perform better than in non-differentiated instruction. Analysis on students' attitudes toward science showed no significant difference between groups.

**Keywords:** academic performance, content, differentiated instruction, process, product and student's attitude

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## Introduction

Teachers should teach with quality performance so as learners' attainment toward content, process and product can be viewed as success in learning outcomes. In teaching, students in class require a variety of pedagogical approaches to address different abilities, styles and motivations in order to support meaningful learning. The current reform in secondary education program of the Department of Education adheres to the implementation of the K to 12 Basic Education Curriculum. This educational program was designed to develop the learner in attaining the essential knowledge and skills for lifelong learning and self-actualization hence, it engages the students' critical thinking and creative problem-solving skills.

As noted, teachers are confronted with large class size, the lack of resource science materials and lack of professional development to facilitate various instructional strategies for effective teaching.

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Although classroom teachers have been expected to assess students' needs and a change of teaching styles yet preparation have remain relatively stagnant. Thus, it posits a challenge in attaining the goals in science teaching.

The recent framework for K-12 science education calls for education to address weaknesses for teachers on how to deliver new approaches to enhance quality teaching and learning. Teachers have a great role in determining students' learning such as how they learn best, their interests and enthusiasm. For learning to be successful, teachers must view each learner as an individual, examining their strengths, knowledge-based and skills (Piermarini & Zazza, 2010). Even novice teachers must understand that each student requires special attention and adaptations on their learning experiences to fit their unique abilities and attitudes. Thus, an effective method in addressing students' differences is greatly needed.

Differentiated instruction (DI) is described as classroom practice with a balanced emphasis on individual students' course content. More importantly, it is a way of addressing the needs and a way of assessing performance of all the learners. Further, teachers have to differentiate their instructions such as allowing more class time to finish an assignment, giving choices of which book to read and mixing up the different types of assignments given throughout the week (Levy, 2008; Rodriquez, 2012).

The philosophy of differentiated instruction as a model instructional strategy for science teaching rests on the premise that it allows critical learning when implemented to classroom setting (Ibeneme, 2010).

Recent attempts have been made to introduce differentiated instruction at all levels but very few documentation as to the challenges to effect the process of student's learning. Thus, the present study endeavored to look into how differentiated science instructions environment and its features will be introduced in the context of teaching and learning. The activities are tailored to students' needs and abilities (Joseph et al, 2013; Gregory & Champman, 2007).

The theoretical approach emphasizes that teacher can differentiate the content, process and product of teaching according to different teaching strategies.

In education, the philosophy behind differentiated instruction integrates the constructivists learning theory, styles of learning and cognitive development of Jean Piaget's theory. The overall impact toward the curriculum rests on the idea of creating knowledge construction through accommodation and assimilation, thus teachers teaching philosophy is to adapt instruction to students' learning differences (Tomlinson, 2003).

The study examined the level of students' academic performance in Grade 8 Science through differentiated instructional approach. Specifically, the study aimed to:

1. Determine the level of students' academic performance as exposed to non-differentiated instructional approach and to differentiated instructional approach in terms of:
  - a. content;

- b. process; and
  - c. product.
2. Ascertain the attitude of students as exposed to non-differentiated instructional approach and to differentiated instructional approach;
  3. Find out the significant difference between students' academic performance as exposed to non-differentiated instructional approach and to differentiated instructional approach; and
  4. Compare students' attitude as exposed to non-differentiated instructional approach and to differentiated instructional approach.

### **Materials and Methods**

The study utilized the quasi-experimental research design using pretest-posttest to determine the level of learning outcomes in Grade 8 Science of two intact sections of students of Valencia National High School, Valencia City, Bukidnon, Philippines who are exposed to a non-differentiated and differentiated learning environment.

The implementation was adapted and modified from the study of Joseph et al. (2013) and Preszler (2006). This instructional approach was made explicit to students and was presented as a sequence of goals to be pursued.

The study utilized academic and non-academic assessment. They were content validated by a panel of experts in biology and were subjected to a reliability test measure.

The students' academic performance in science when exposed to non-differentiated and differentiated instruction followed the prescribed K to 12 Basic Education Program Learning Progress and Achievement as shown below:

Grading Scale	Descriptive Rating
90-100	Outstanding
85-89	Very Satisfactory
80-84	Satisfactory
75-79	Fairly Satisfactory
Below 75	Did Not Meet Expectations

The attitudinal survey questionnaire consisted of thirty seven (37) items was administered to all respondents in the study to determine their learning behavior in science. The items was adapted with modification from Zain et al. (2010). Five (5) point Likert rating scale was used to analyze and compare the affective attitudes of the students toward Science (Biology) when exposed to non-differentiated and differentiated instruction.

The following was embedded in the scale during the interpretation of data.

Scale	Range	Descriptive Rating	Qualitative Interpretation
5	4.51-5.0	Strongly Agree	Highly Positive
4	3.51-4.5	Agree	Positive
3	2.51-3.5	Undecided	Moderately Positive
2	1.51-2.5	Disagree	Negative
1	1.00-1.5	Strongly Disagree	Highly Negative

The negative statements were given reverse weights. Thus a high score indicates positive attitude towards science and a low score indicates negative attitude.

To determine the effectiveness of differentiated instructional approach over non-differentiated instruction, an achievement test about living things and their environment which consisted of 46 items was administered as pre-test and post-test to students both in the experimental and control groups.

For the statistical analysis of the data, the following techniques were used: descriptive statistics such as the means, frequency values, percentages and standard deviation were used to analyze the data obtained from learning outcomes in Science (Biology). Analysis of Covariance (ANCOVA) was used to determine any significant difference among academic performance of students under a non-differentiated and differentiated instructional approach.

## **Results and Discussion**

Table 1 presents the students' academic performance as to content. The students exposed to a non-differentiated instruction obtained pretest mean percentage score (MPS) of 41.14 indicating "did not meet expectations", which means their scores were found below the cut-off scores. Although students were exposed to non-differentiated instruction, "fairly satisfactory" results were attained by the students in their posttest. This could be that the learners' knowledge based on the concept related towards "Living Things and Their Environment" allowed them to exhibit a slightly increased academic performance. The students' posttest MPS score was 78.12 indicating "fairly satisfactory" results. This means that students had shown an increase in academic performance on the specified content; thus, they perform better.

In a differentiated instruction, the students' pretest MPS was 51.25 indicating "did not meet expectations". The results might be due to unclear concepts as reflected on the test items while the students' posttest MPS score was 87.50 indicating "very satisfactory"

Table 1. The students' academic performance as to content

Grading Scale	Non-differentiated Instruction				Differentiated Instruction			
	PRETEST		POSTTEST		PRETEST		POSTTEST	
	N	%	N	%	N	%	N	%
90-100 (Outstanding)	0	0	5	13.9	0	0	16	45.7
85-89 Very Satisfactory	0	0	10	27.8	0	0	8	22.9
80-84 (Satisfactory)	0	0	6	16.7	0	0	4	11.4
75-79 (Fairly Satisfactory)	0	0	4	11.1	1	2.9	4	11.4
74-Below (Did Not Meet Expectations)	36	100	11	30.6	34	97.1	3	8.6
Total	36	100	36	100	35	100	35	100
MPS	41.14	(DNME)	78.12	(FS)	51.25	(DNME)	87.50	(VS)

This findings were notably exhibited by the students while they were exposed in a varied instructional methods. These data results conform similar findings on the study of Abdi (2014) that when students were instructed through inquiry-based learning, they achieved higher score than the ones which were instructed through the traditional method.

Pabualan (2011) conducted a study on “Content Mastery in Ecology Through Guided Inquiry-Based Learning Among High School Students” and found out that with inquiry-based learning, students’ content mastery were found in their order of inquiry skills namely: Evaluating, Questioning, Analyzing, Hypothesizing, and Investigating. Of these inquiry skills, questioning and analyzing were found significant at 0.05 level. Similarly, Pilandra (2006) reported a significant difference between student’s academic achievement as exposed to discovery and non-discovery approach.

Gernale (2014) studied on “Academic Performance and Attitudes of Grade 7 Students in Science Cooperative Learning Environment” and revealed an increase of student’s academic performance when exposed to cooperative laboratory approach. More so, students in a cooperative learning value the success of the groups to achieve significantly high scores in the posttest for the knowledge level and the total achievement in science through cooperative learning (Pandy & Kishore n.d.). According to Tomlinson (2003), through differentiated instruction it presents an effective means to offer the individual opportunities to perform their best and fostered group learning in class.

The students' academic performance as to process is presented in table 2. As shown in the table, the students exposed under a non-differentiated instruction obtained a pretest MPS of 47.22 indicating "did not meet expectations", which means that their scores were found below the passing scores. These results might be attributed to the students' knowledge-based and were noted passive in their learning thus students' score did not meet the expected results.

*Table 2. The students' academic performance as to process*

Score	Non-differentiated Instruction				Differentiated Instruction			
	PRETEST		POSTTEST		PRETEST		POSTTEST	
	N	%	N	%	N	%	N	%
90-100 (Outstanding)	0	0	4	11.1	0	0	11	31.4
85-89 (Very Satisfactory)	0	0	5	13.9	1	2.9	13	37.1
80-84 (Satisfactory)	0	0	9	25.0	3	8.6	5	14.3
75-79 (Fairly Satisfactory)	0	0	0	0	0	0	0	0
74-Below (Did Not Meet Expectations)	36	36	18	50.1	31	88.5	6	17.2
Total	36	100	36	100	35	100	35	100
MPS	47.22	(DNME)	74.81	(DNME)	61.90	(DNME)	86.09	(VS)

However, the students' posttest MPS was 74.81 indicating "did not meet expectations" results. This indicates that the emphasis was more on teacher-activity leaving little room for student-initiated questions, and less interaction between students and does not require an exploration tasks to give meaning on concepts. Hence more or less students' results were found quite low in the posttest. According to Abdi (2014) that in a teacher centered method all students are assumed to have the same level of background knowledge in the subject matter and are able to absorb the learning material at the same pace.

In a differentiated instruction, the students' pretest MPS as to process was 61.90 indicating "did not meet expectations" results. This indicates that students' interests are not yet engage in the activities, they lack opportunities to use appropriate laboratory techniques to collect evidences while the posttest MPS of the students was 86.09 indicating "very satisfactory" results. These results allow the learners in an ideal inquiry approach to engage appropriate laboratory activities like taking actions as scientists

did and experiencing the process of knowing and making justification in the laboratory activities performed (Sandoval and Reiser, 2004).

The significant improvement in the test scores of the students involved in the study were noted. Mc Adams (2001) claimed that in a differentiated instruction, there was a tangible impact on the students' learning and the learners were more motivated and enthusiastic about their process of learning. These findings suggest therefore, that through process, it is how the strategy was introduced in the class and somehow students gained knowledge for there was a "very satisfactory" results.

Table 3. The students' academic performance as to product

Score	Non-differentiated Instruction				Differentiated Instruction			
	PRETEST		POSTTEST		PRETEST		POSTTEST	
	N	%	N	%	N	%	N	%
90-100 (Outstanding)	0	0	4	11.1	0	0	12	34.28
85-89 (Very Satisfactory)	0	0	7	19.4	1	2.9	6	17.14
80-84 (Satisfactory)	0	0	8	22.2	3	8.6	10	28.60
75-79 (Fairly Satisfactory)	0	0	0	0	0	0	0	0
74-Below (Did Not Meet Expectations)	36	36	17	19.4	31	88.57	7	20
Total	36	100	36	100	35	100	35	100
MPS	39.25	(DNME)	77.03	(FS)	49.33	(DNME)	83.23	(S)

As shown in the table, the students who were exposed to non-differentiated instruction obtained a pretest MPS of 39.25 indicating "did not meet expectations" which means that the students failed to meet the conceptual understanding on the lessons on "Living Things and their Environment". Perhaps the elaboration of concepts, processes and skills were not facilitated and misconceptions were still experienced by the learners themselves. However, after thorough interventions by the teacher through teacher directed as a form of strategy such as quick laboratory demonstrations, the students obtained a posttest MPS of 77.03 indicating "fairly satisfactory" results. This indicates that the students had shown a slight increase in their academic performance as to product for the students in group processed their information on a specific task and exhibited incomplete laboratory worksheets. The results adhere with the findings of Abdi (2014) that whenever teacher instruction presented lessons it engages in a discussion stemming from the teacher's explanation and questions with the guidance of

the teacher leading toward coherence and consistent generalizations which help the learners explain the results of their exploration in their activities.

On the other hand, the pretest MPS of students as exposed to differentiated instructional approach as to product was 49.33 indicating “did not meet expectations results which means that students don’t have the prior knowledge on the topics beforehand as such, their scores were found low in the pretest. After exposure to differentiated instruction coupled with different activities in the class, the students obtained a posttest MPS of 83.23 indicating “satisfactory” results thus they performed better and were motivated to express their opinion, discussed the lessons on what they have learned were more stimulated to find answers on their own questions.

The summary of students’ academic performance as shown in table 4 reflects a very satisfactory result.

*Table 4. Summary of students’ academic performance*

	Non-differentiated Instruction		Differentiated Instruction	
	PRETEST	POSTTEST	PRETEST	POSTTEST
Components	MPS	MPS	MPS	MPS
Content	41.14 (DNME)	78.12 (FS)	51.25 (DNME)	87.50 (VS)
Process	47.22 (DNME)	74.81 (DNME)	61.90 (DNME)	86.09 (VS)
Product	39.53 (DNME)	77.03 (FS)	49.33 (DNME)	83.23 (S)
Grand MPS	42.51 (DNME)	76.65 (FS)	54.16 (DNME)	85.60 (VS)

The study obtained similar findings with the research of Seyhan & Morgil (2007) that when an instructional model is introduced there was a greater understanding of the instruction covered especially on questions that require interpretation.

Results of the current study stipulated the same findings by Balm (2009), that student who scored high in the post achievement test have high perceptions of inquiry learning skills scores. With differentiated product, students have the choice to apply their knowledge and skills as well as mastery on the learning goals (Taylor, 2015).

### ***Students’ Attitudes toward Science Learning***

As gleaned on table 5, the summary of students’ mean scores on six indicators on students’ attitudes in non-differentiated instruction and differentiated instruction is 4.14 (positive) and 4.05 (positive) in differentiated instruction respectively. This means that both groups under study were found favorable that they agree on how important science in school and their learning toward the subject.



Table 5. Summary of students' mean scores of attitudes of non-differentiated and differentiated instruction

INDICATOR	Non-Differentiated Instruction		Differentiated Instruction	
	MEAN	DESCRIPTIVE RATING	MEAN	QUALITATIVE INTERPRETATION
Learning science in school	4.23	Positive	4.30	Positive
Self-concept in science	3.62	Positive	3.58	Positive
Practical work in science	4.23	Positive	4.05	Positive
Science outside of school	4.32	Positive	4.26	Positive
Future participation in science	3.89	Positive	3.67	Positive
Importance of science	4.60	Highly Positive	4.57	Highly Positive
Overall Mean	4.14	Positive	4.05	Positive

(-) Negative statement

### ***Analysis of Covariance (ANCOVA) on Students' Academic Performance.***

Table 6 presents the analysis of Covariance on the students' academic performance as exposed to non-differentiated instruction obtained an MPS of 76.69 and 85.65 overall MPS for the differentiated instructional approach. The computed F- value

of the covariate which is the pretest is equal to 1.613 with p-value is equal 0.208 indicating a non-significant difference at 0.05 level. This means that the two groups did not differ in their content knowledge prior to the lessons presented. Hence students have the same level of background knowledge in the subject matter. However, in terms of the performance of the two groups, the F-value is 46.171 ( $p < 0.01$ ) which indicates highly significant difference at 0.01 level. This implies that there is a significant difference on the MPS of the students instructed via differentiated than the non-differentiated instruction. Thus, students performed better in differentiated instruction than the non-differentiated instruction. The overall findings of the current study reject the null hypothesis "There is no significant difference on the students' academic performance as exposed to non-differentiated and differentiated instructional approach".

Table 6. Analysis of Covariance (ANCOVA) on students' academic performance between two groups

Group	N	MPS	Std. Deviation
Non-differentiated instruction	36	76.69	10.23
Differentiated instruction	35	85.65	9.10
Total	71	81.11	10.63

  

Source	SS	df	MS	F	Sig
Model	468653.850a	3	156217.950	1677.648	0.000**
Pretest (Covariate)	150.175	1	150.175	1.613	0.208

Group	8598.684	2	4299.342	46.171	0.000**
Error	6331.972	68	93.177		
Total	474985.822	71			

Legend: \*\* Significant at  $p < 0.05$

–not significant at  $p < 0.05$

The three instructional methods employed which uses the cooperative learning, discovery learning and inquiry-based learning approach are supported on the idea that students in the their science investigation become engaged in the activities which provided them on their participation as they interact on the variety of teaching materials in allowing them to differentiate content in the class. More so, that the students assimilate the concepts though cooperative work and the nature of discovery learning by themselves.

These data findings conform with the investigations of Abdi (2014) that a significant difference between the achievement levels of the students who have been exposed to inquiry-based instruction. There was a similar data results by Murillo (2014) that when students are exposed to a new instructional model such as the learning cycle it leads to better performance and were more successful than those that were not supported by instructional model (Seyhan & Morgil, 2007). Further results indicated on the same findings investigated by Tsay & Brady (2010) that a significant positive relationship between the importance of grades and involving in cooperative learning as a form of differentiated instruction.

The analysis on the students' attitudes toward science between two groups is shown in table 8. The data shows the t-value of -1.1319 with a probability value of 0.191 indicated no significant difference at 0.05 level. This means that student seemed to have lack of understanding towards science and contributes to the negative attitudes to science. The current results of the study failed to reject the second null hypothesis that "there is no significant difference on the students' attitudes as exposed to non-differentiated and differentiated instructional approach".

Table 8. Comparison of students' attitudes toward science between two groups

Attitude	Mean Score	Std. Deviation	t-value	p-value
Non-Differentiated Instruction	4.13	0.32	-1.1319	0.191
Differentiated Instruction	4.03	0.32		

Legend: \* $p < 0.05$ -signifinant

ns –not significant

These findings were notably consistent with the research investigated by Foley and McPhee (2008) on the students attitudes toward science in Class Lessons Hands-on or Textbook based Curriculum and found out that the difference in attitudes do not correlate significantly with test scores.

Similarly, Maddock (2007) reported that there was no relationship between the attitudes and science achievement on cognitive test. Turgut & Gurbuz (2011) and Magday (2011) pointed out in their

research that no significant relationships existed on students' attitudes toward the implemented teaching strategy in science class.

## **Conclusions**

Based on the findings of the study, the following conclusions were drawn:

The use of differentiated instructions in content, process and product had exhibited an increase on content knowledge or academic performance in science. These results had provided a gratifying experience among students such that students performed better and gained high scores on their tests. Science teachers may continually use and model out differentiated instructions and incorporate the different instructional strategies to address students' needs and improve student's academic performance

With differentiated instruction, the students fostered positive attitudes toward the importance of science, the learning of science outside of school, the learning of science in school, practical work in science, future participation in science and self-concept in science as indicators on which students showed more intensively and demonstrated favorable attitudes toward the subject. To maintain the positive attitude of students towards the subject, teachers may consider strategies that will develop and enhance students' interest by teaching the subject meaningfully using different enjoyable learning activities.

The students' academic performance between two groups indicated high significant difference between each other thus students' engagements for learning through differentiated instruction were found to show greater impact on their test scores in science. The relevance of differentiated instruction among students in Grade 8 Science has been observed. Teachers therefore, should provide approaches to students' learning commensurate with their capacity to learn, so as to meet the desired levels of comprehension.

The students' attitudes toward science between two groups showed no significant difference at 0.05 level thus failed to reject the stated null hypothesis. In the light of this finding, the pedagogical approach through differentiated instruction requires teachers, educators, administrators to look into the process of teaching and learning and some forms of instructional strategies is needed to ensure how the learners behave to achieve meaningful learning.

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