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Differentiating Instruction in a Mathematics Classroom: Its Effects on Senior High School Learners' Academic Performance and Engagement in Basic Calculus

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Abstract:

A quasi-experimental study was conducted to investigate the effects of differentiated instruction, a strategy that may cater to learners' diversity, towards their academic performance and engagement in Basic Calculus. It was participated by sixty Grade 11 learners in the Science, Technology, Engineering and Mathematics (STEM) strand of Bukidnon State University Secondary School, Malaybalay City during the second semester of the school year 2017-2018. Lessons on differentiation and its applications were developed. Researcher-made academic performance test and engagement scale were evaluated by a panel of experts and underwent validity and reliability analysis. The gathered data were analyzed and interpreted using appropriate statistical techniques: mean, standard deviation, frequency, percentage, one-way analysis of covariance (ANCOVA) and paired t-test. The results revealed that the learners' academic performance when taught using differentiated instruction was *Very Satisfactory*; while learners taught with the conventional instruction was *Fairly Satisfactory*. There was a statistically significant difference in the academic performance between the two groups of learners, in favor of those taught with differentiated instruction. Moreover, the engagement level of the learners in the experimental group was *Moderate* before and after the intervention, and there was a statistically significant difference between them attributed to differentiated instruction.

Key Words: Senior High School, Diversity of Learners, Mathematics Education, Intervention

Introduction

A fundamental component of academic advancement is the upgrading of the teaching and learning process. There has been a great deal of discussion in education about how learners learn and what teaching strategies the teacher could use (Burton, 2000). With the diversity of learners inside the classroom, teachers need to be aware of their learners' academic history and couple it with their observations and pre-assessments. Each learner is valued for the unique strengths they possess while being offered opportunities to demonstrate skills through various assessment techniques (Mulroy, 2003). With this background knowledge about the learners, teachers may design lessons and activities that incorporate learners' learning styles, readiness, and interest to further improve their performance in the different subject areas.

In 2012, the Philippines embraced the K to 12 Basic Education Curriculum to further enhance the educational system of the country. The latest curriculum has aimed to strengthen the

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teaching of Mathematics through spiral progression, where learners are allowed to learn topics and skills appropriate to their developmental stages with high retention and mastery in constant review and revisit of prior knowledge. The products of this advancement are expected to exhibit skills as critical problem solvers, innovative, creative citizens, and informed decision makers.

With the implementation of K to 12 in Philippine Basic Education, Senior High School has been added in the curriculum to be at par with the international graduates. As a result, some subjects in the tertiary level were dragged down in the senior high school specifically Basic Calculus for Science, Technology, Engineering and Mathematics (STEM) strand. The learners are having difficulty adjusting with the content of the subject making them fall below their expected level of mathematics achievement.

In Bukidnon State University's Secondary Laboratory School, the improvement of learners' low performance in Basic Calculus remains a challenge to teachers. Teachers need to have a variety of teaching strategies and approaches to enhance students' learning outcomes in order to solve the low achievement of learners in Mathematics (Gaylo & Dales, 2017). With the recent trends in assessing student learning, teachers may use placement assessment to determine students' readiness, determine students' interest using interest inventories and identify learners' learning styles and environmental inclinations. A formative assessment may be conducted and results may be used to be the springboard of instruction. Hence, the lessons may be differentiated to reach all learners and accommodate each learner's preference.

Differentiating the instruction provides opportunities for learners to have numerous options for absorbing in information, creating a sense of concepts and articulating what they gain (Tomlinson, 2001). It includes responding positively to what learners know and can do. The said approach entails providing multiple pathways in learning for learners to access to the most suited learning opportunities appropriate their learning capacity. One way of doing it is through matching learners' preferences, needs, intelligence and interest with the most appropriate teaching pedagogy, curriculum goals and learning activities (Algozzine & Anderson, 2007).

Efforts exerted by teachers to increase learners' achievement may be useless with their disengagement, hence, there is a need to investigate how instructional strategies affect learners' engagement in the classroom (Gaylo & Dales, 2017). On a personal note, it was observed that learners are more likely to engage in class if the teachers employ varied ways of presenting the lesson considering their learning preferences. They were given options to do and apply what they have understood. Students' engagement is the quality and quantity of their cognitive, behavioral and affective responses to the learning process, as well as in-class and out-class activities (Gunuc, 2014).

Differentiated instruction in Mathematics was studied by various researchers. Many studies investigated the effects of differentiated instruction on academic performance, engagement and other variables. Results revealed that significant differences in the results surfaced (Aranda & Zamora, 2016; Muthomi & Mbugua, 2014; Konstantinou-Katzi et al., 2013; Lewis, 2013; Stager, 2007). In the review of literature conducted, a majority of the studies found that differentiating instruction through learning needs, scaffolding and flexible grouping resulted to learners better performance (Williams, 2012; Thorton, 2012; McAdamis, 2001). Some studies

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pointed out the barriers and constraints to be hurdled to provided opportunities for learners to have differentiated lessons (King, 2010; Lange, 2009; Gray, 2008; Huss-Keeler & Brown, 2007). It was found that
insufficient training, support, and resources in the differentiation of instruction resulted in no significant difference between learners whose instruction was differentiated as compared to those not differentiated.

With these, the researcher conducted a study to investigate further the effects of differentiated instruction on senior high school learners' performance and engagement in Basic Calculus, on limits and derivatives. Previous studies conducted were not aligned to the recent Philippine K to 12 Basic Education Curriculum and the additional two years of secondary education, senior high school, have not been studied much because it just started in 2016.

Specifically, the study sought to answer the following questions:

1. What is the academic performance in Basic Calculus of Grade 11 learners when taught using differentiated instruction and of those taught using conventional instruction?
2. Is there a significant difference in the academic performance in Basic Calculus of Grade 11 learners when taught using differentiated and conventional instruction?
3. What is the engagement in Basic Calculus of Grade 11 learners before and after they were taught using differentiated instruction?
4. Is there a significant difference in the engagement in Basic Calculus of Grade 11 learners before and after they were taught using differentiated instruction?

Review of Literature

The study is anchored on Tomlinson's (2005) concept of differentiated instruction. The proponent asserted that differentiated instruction is rooted in the belief that there is variability among any group of learners and that teachers need to adjust instruction accordingly (Tomlinson, 2005). In differentiating instruction, it is posited that learners learn best when their teachers accommodate the differences in their readiness levels, interests and learning styles to engage the students into meaningful learning. Tomlinson (2001) mentioned that lessons may be differentiated in terms of content, process, and products. It encompasses the preparation and delivery of instruction, techniques in managing classrooms, and prospects of learners' performance that considers the diversity and varied levels of readiness, interests, and learning profiles of the learners.

Dewey (1938) and Piaget (1952) were the early proponents of differentiated instruction. The theorists believed in a learner-centered approach, where it is important to consider the uniqueness of every learner taking account of their personality, strengths, abilities and past experiences as part of the learning process. In their constructivist perspective, learning is a dynamic process informing teachers that each learner needs time, space, and suitable experiences to support the learning processes (Taber, 2011). Learners construct reality regarding their prior experiences, conceptual knowledge, values attitudes, and preferred ways of knowing.

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Vygotsky's (1978) theory of zone of proximal development (ZPD) asserted that students learn best when faced with tasks or engaging learning experiences guided by a more skilled peer and teachers. The teacher's role in a constructivist classroom is not limited to give a lecture to learners but to act as an expert who can guide students into implementing cognitive strategies such as self-testing, articulating understanding, asking probing questions, and reflecting (Bhattacharjee, 2015).

The teaching strategies used in the classroom affect learners' academic performance (Gaylo & Dales, 2017). The academic performance of learner's matter because it is the gauge of how well the learners' learned the learning competencies and how successful are the teachers in facilitating the learning process. Aside from teaching strategies, learners' engagement in the lessons needs to be taken into consideration for it may be associated with learners' academic performance. With learners' disengagement, maximum learning experience may not be met.

Differentiated instruction is a mixture of the use of strategies based on the learning styles, cognitive theory, and the constructivism theory (Anderson, 2007). Since students learn differently, acknowledgment of learning styles is important. Further, differentiating instruction is not altering the learning objectives of a lesson. Instead, it is adjusting the content, the process, and the output, which allows students to develop own understanding through strategies that suit their needs. In addition, learners who were motivated and engaged in learning tend to perform considerably higher academically and are better behaved than unmotivated and disengaged peers (Fredricks et al., 2004).

Engagement has been revealed to be one of the many determinants that affect the academic performance of students (Holgado, 2013). The said construct is considered a key contributor to academic success (Skinner et al., 2008). In most researches conducted in engagement, three commonly identified dimensions were named: affective engagement, behavioral engagement, and cognitive engagement. Attard (2002) elaborated the three engagement dimensions: (a) cognitive dimension involves the idea of investment, recognition of the value of learning and a willingness to go beyond the minimum requirements; (b) affective dimension includes learners' responses to school, peers and teachers, influencing their inclination to be involved in school work; and (c) behavioral dimension encompasses the idea of active participation and involvement in academic and social activities.

Differentiated instruction was investigated for its effectiveness in Mathematics classrooms. In Kenya, Muthoni and Mbugua (2014) examined the effects of differentiating the instruction on students' achievement in mathematics in secondary schools in Meru County. Using quasi-experimental design, in particular, Solomon four-group design, results revealed that differentiated instruction significantly improved the students' achievement in mathematics when compared with the traditional instruction. Further, Stager (2007) examined tiered activities in increasing student knowledge in fractions. The students were clustered according to their capability and asked to complete activities appropriate to their level. The study revealed that significant gain in students mean test scores were achieved.

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Lewis (2013) studied various strategies in an attempt to increase student engagement and academic achievement in the classroom. The researcher assessed each student's learning styles (visual, auditory, kinesthetic, and tactile) and implemented differentiated learning plans for each learning style group, while documenting their engagement and academic progress. It was revealed that learning style-based instruction was very effective for some learners but not for others. A parallel study conducted by Konstantinou-Katzi et al. (2013) proved that differentiated instruction was effective in improving students' performance and in enhancing their motivation and engagement. There was a positive influence on student learning and attitude towards Mathematics when differentiated instruction was used for learners in Mathematics. Findings of Chamberlin and Powers (2010) cited that students receiving differentiated instruction experienced greater gains in their mathematical performance.

Methodology

A quasi-experimental pretest-posttest design was used in the study. The design utilized two intact classes in Bukidnon State University-Secondary School Laboratory, during the second semester of the school year 2017-2018. One intact class was assigned randomly as the experimental group taught with differentiated instruction. The other intact class was the control group taught using conventional instruction. All groups were given a pretest before the conduct of the study and a posttest after the implementation of the developed differentiated Basic Calculus lessons. In addition, the experimental group answered an engagement scale before and after the intervention. All of the learners in the two classes were present in the conduct of the experiment. However, only 30 students from each of the two classes were considered in the analysis of data.

Lessons were developed on topics of the definition of derivatives using limit and its geometric interpretation, curve sketching, and application of derivatives. The cited topics were least mastered by learners based on the need assessment conducted. A researcher-made task analysis matrix (TAM) guided the development of differentiated lessons. TAM contained topics, concepts, instructional objectives, procedural activities for differentiated instruction, skills, assessment and references that were based on the K-12 curriculum guide. Further, the learning style inventory results of the learners were considered in the development of the lessons. The developed lessons were validated by a panel of experts prior to the conduct of the study. They were experts on content, pedagogy, and technicalities and have evaluated the content and content accuracy, clarity and appropriateness of the lessons.

The research instruments utilized in the study were validated researcher-made performance test and an engagement scale. The academic performance test was crafted to assess the academic performance of learners in Basic Calculus and was tried out for validity and reliability purposes. The test was composed of 30 multiple choice items based on the learning competencies in the K to 12 Curriculum. The same test was administered to the experimental group and the control group. The engagement variable of learners in Basic Calculus, an engagement scale was used which was adopted from the study of Gaylo and Dales (2017) and was based on Attard's (2002) engagement construct. There were three dimensions of engagement that were taken into consideration: cognitive, affective, and behavioral. The

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researcher modified the engagement scale instrument to suit the present study. Each engagement dimension consisting of 10 items were answered by the learners in the experimental group.

Before the conduct of the study, the approval from concerned authorities was secured. The necessary protocols were followed. The ethics in conducting research were considered. Prior consent from the participants and their parents were sought. On the start of the implementation, the teacher-researcher oriented the student-participants about the study which includes the confidentiality of results and voluntary participation. After the orientation, learners took a pretest for the performance test on both groups. The experimental group also answered an engagement scale together with the pretest. The presentation of the lessons took place employing the differentiated instruction for the experimental group and conventional instruction for the control group. The teacher-researcher personally facilitated the lessons in the two intact classes. The classes had the same learning objectives, motivation, and assessment. They only differ in the procedure due to the different strategies utilized.

On the derivation of derivative lessons, the experimental group used their multiple intelligences in making infographics, storyboard and video clips. However, the control group had the usual knowing, processing, and transferring activities. The lessons on curve sketching were based on the students' readiness in the experimental group, while the control group had the usual processes. While on the third lesson, news reports and role play on the real-world applications of derivatives was actualized including its application in business. During each activity, the teacher-researcher provided supervision and assessment on the work of the learners in both the experimental and control group. Rubrics were being utilized in the activities conducted in the experimental group. At the end of the intervention, the posttest which is similar to the pretest was conducted to both groups. The experimental group also answered an engagement scale after the conduct of lessons.

The scoring procedure followed the DepEd Order No. 8, s. 2015, also known as "Policy Guidelines on Classroom Assessment for the K to 12 Basic Education Program". In the 30-item multiple choice researcher-made performance test, every correct answer was given one (1) point. The test was given as pretest and posttest. A pretest was administered before all the lessons started, while the posttest was given after all the lessons were presented to the students. Using the new guidelines in rating students' achievement effective school year 2015-2016, the raw scores were converted to percentage scores in order to ensure that the values are parallel to each other. To get the percentage score, divide the raw score with the highest possible score and multiply to 100%. The percentage scores were transmuted using the transmutation table prescribed by the Department of Education to get the academic performance grade of the students. The scoring description follows:

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Score Range	Grading Scale	Description	Qualifying Statement
26-30	90-100	Outstanding	Exceeds the core requirements in terms of knowledge, skills and understanding in Basic Calculus and can transfer them automatically and flexibly through an authentic task.
23-25	85-89	Very Satisfactory	Develop the fundamental knowledge, skills and understanding in Basic Calculus and can transfer them automatically and flexibly through an authentic task.
21-22	80-84	Satisfactory	Develop the fundamental knowledge, skills and understanding in Basic Calculus with little guidance from the teacher and can transfer these understandings through an authentic task.
18-20	75-79	Fairly Satisfactory	Possess the minimum knowledge, skills and core understanding in Basic Calculus but needs help throughout the authentic task.
0-17	Below 75	Did Not Meet Expectations	Struggles with understanding the prerequisite and fundamental knowledge and skills in Basic Calculus.

Furthermore, an Engagement Scale in Basic Calculus was used in the study. The students answered the engagement scale based on the given statements. The scale ranges from 1 to 4; where 1 is Never, 2 is Sometimes, 3 is Usually and 4 is Always. The scoring rubrics follow:

Scale	Range	Response	Qualifying Statement
4	3.25 – 4.00	Always	Students have a high engagement in Basic Calculus
3	2.50 – 3.24	Usually	Students have a moderate engagement in Basic Calculus
2	1.75 – 2.49	Sometimes	Students have a low engagement in Basic Calculus
1	1.00 – 1.74	Never	Students have no engagement in Basic Calculus

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The data gathered were treated using appropriate statistical techniques. They were tabulated and organized into tables. Research questions number one and three were answered using descriptive statistics namely frequency, percentage, mean and standard deviation to determine the academic performance and engagement of the learners. The second research question was answered using analysis of covariance (ANCOVA) due to the existence of intervening variables and was utilized to test the significant difference in the academic performance between the two groups. The last question, which is to compare the engagement of learners before and after the use of differentiated instruction, paired sample t-test was applied.

Findings

Academic Performance of Learners

The academic performance of learners was based on the scores they obtained from the pre-test and post-test administered to them covering lessons in the definition of derivatives using limit and its geometric interpretation, curve sketching, and applications of the derivative. The mean scores and standard deviations, as well as the frequency and percentages, before and after the conduct of the study obtained from the experimental group and the control groups are presented and described in Table 1. The data indicated that both groups were initially at par in their pretest results. It revealed that learners in both groups did not meet established expectations with the lessons in the mathematical concepts covered in the study. The pretest results show that the learners had poor academic performance scores.

Table 1
Pretest-Posttest Scores of the Experimental and the Control Groups

Performance Level (PL)	Score Range	Control Group				Experimental Group			
		Pretest		Posttest		Pretest		Posttest	
		f	%	*f*	%	*f*	%	*f*	%
Outstanding (O)	26-30	0	0%	0	0%	0	0%	4	13%
Very Satisfactory (VS)	23-25	0	0%	2	7%	0	0%	13	44%
Satisfactory (S)	21-22	0	0%	8	27%	1	3%	10	33%
Fairly Satisfactory (FS)	18-20	1	3%	16	53%	1	3%	3	10%
Did not Meet Expectations (DN)	0-17	29	97%	4	13%	28	94%	0	0%
	Total	30	100%	30	100%	30	100%	30	100%
	$\bar{x}$	12.80		19.57		13.70		23.27	
	SD	3.24		2.39		3.13		2.53	
	PL	DN		FS		DN		VS	

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Furthermore, the results reveal that the experimental and control group were comparable in terms of performance before the intervention. However, the pretest mean scores of the participants in the control group were slightly widespread as compared with that of the experimental group in the pretest results. It is suggested that good teaching strategies could be used to enhance learners' academic performance. This implies that if teachers fail to incorporate effective strategies, the learners' academic performance would remain on a low level.

Nevertheless, the posttest results of both groups showed an increase in their mean scores. However, comparing the posttest mean scores of the two groups, the experimental group had greater improvement than the control group. Based on the performance level descriptions set in the scoring procedure, the experimental group had a Very Satisfactory rating; while, the control group had a Fairly Satisfactory rating.

The results also showed that a greater percentage on the number of students in both groups had improved their academic performance level. There are learners in the experimental group who reached the *Outstanding* level and none of them remained did not meet prescribed expectations while on the control group two learners reached the *Very Satisfactory* level. However, none of the learners in the control group had reached the *Outstanding* level. There were still learners who did not meet the prescribed expectations.

The obtained results affirm that the use of differentiated instruction had increased learners' performance significantly higher than the conventional method of teaching. The finding conforms to the study by Aranda and Zamora (2016) and Konstantinou-Katzi et al. (2013) who disclosed that differentiated instruction had made improvements and positive impact on the academic performance of students. It was observed in the experimental groups' higher posttest mean compared with that of the control group. The results of the present study were also in consonance with the findings of Muthomi and Mbugua (2014) who investigated the effects of differentiated Instruction on students' achievement in mathematics in secondary schools in Meru County in Kenya wherein a significant increase in the student's achievement was noted. Likewise, the research of Koeze (2007) on the effects of differentiated instruction considering students' learning style showed that students performed better.

To determine whether there is a significant difference in the academic performance between the Grade 11 Learners taught with differentiated instruction and those learners taught with the conventional, one-way ANCOVA was used at 0.05 level of significance. Table 2 shows a summary of the results. The result of this statistical procedure showed that there was a significant difference in the academic performance in Basic Calculus between the experimental group and the control group, controlling the effect of the pretest. The difference may be attributed to the use of differentiated instruction. The data show that the teaching method obtained a p-value which was lower than the significance level of 0.05. Since the p-value was lower than the significance level, the null hypothesis which states, that there is no significant difference in the performance of learners taught using differentiated instruction and of those taught with the conventional instruction is rejected. The results further revealed that the use of differentiated instruction in the lessons on the definition of derivatives using limit and its geometric interpretation, curve sketching, and applications of derivatives had an effect on the academic performance of the experimental group.

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Table 2
Comparison of the Academic Performance between the Experimental and the Control Group

Source	Type III Sum of Squares	Df	Mean Square	F	p-value
Corrected Model	353.878[a]	2	176.939	49.754	0.000
Intercept	692.637	1	692.637	194.767	0.000
Pretest	148.528	1	148.528	41.765	0.000
Teaching Method	155.053	1	155.053	43.600	0.000
Error	202.706	57	3.556		
Total	28077.00	60			
Corrected Total	556.583	59			

*R squared=0.636

The findings are similar to the former results of the research conducted by Muthomi and Mbugua (2014) in Kenya. The researchers also sought to investigate whether there was a significant difference in the performance between the experimental group taught with differentiated instruction and the control group with the conventional method. The statistical analysis and findings suggest that there was a difference between the experimental group and the control group. Similarly, the result was in favor of the experimental group. Moreover, the results support the previous research conducted by Chamberlin and Powers (2010). Differentiated instruction had an impact in addressing the diverse needs of students. It was found out that there is a significant difference in the group of students receiving differentiated instruction compared to the students having the conventional method of teaching. The group taught using differentiated instruction which is the experimental group has experienced greater gains in their mathematical performance and understandings. The results also concur with Tieso (2005) who posits that those students who were taught using a differentiated instruction demonstrated significantly higher achievement on the post-test scores than did the students who were taught using traditional methods.

The differentiated activities used that catered the learning styles of learners includes the business proposal presentation for visual, headline news for auditory and role-playing for tactile/kinesthetic have helped the learners in the experimental group to better understand the different real-world problems presented related to the applications of derivatives. The learners in the experimental group obtained higher posttest scores because they did not purely rely on what the teacher had input during the lesson. They searched and read other resource materials they can use to enhance the output expected from them. Aside from the output to be presented, a member of the group was to be randomly tasked to explain their work, because of these all of the group members helped one another to be able to recognize the concepts and be prepared for the presentation. The teacher's role was not limited to giving a lecture but act as an expert who guided the learners to articulate their understanding (Bhattacharjee, 2015).

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Engagement of Learners in Basic Calculus

The study examined the engagement of learners in Basic Calculus taught using Differentiated instruction. To determine the engagement in Basic Calculus of the learners in the experimental group, pretest and posttest mean and standard deviations of the engagement scale were gathered, analyzed and compared. Table 3 presents the overall engagement in Basic Calculus of the experimental group before and after the conduct of the study. Results indicated that before the conduct of the study, the participants had a *Moderate* engagement in Basic Calculus based on the mean pretest scale. The small standard deviation obtained implies that the participants are in more agreement with one another and their rating cluster closer to the average rating.

Table 3
Engagement level of Grade 11 Learners in the Experimental Group

Engagement	Pretest			Posttest		
	$\bar{x}$	SD	QD	$\bar{x}$	SD	QD
Cognitive Engagement	2.87	0.27	Moderate	2.99	0.34	Moderate
Affective Engagement	3.15	0.21	Moderate	3.39	0.32	High
Behavioral Engagement	2.92	0.33	Moderate	3.10	0.44	Moderate
Overall Engagement	2.98	0.20	Moderate	3.16	0.29	Moderate

The pretest results suggested that an improvement in the engagement of learners in Basic Calculus must be considered. This implied that intervention and strategies must be given in order to improve students' engagement level. The researcher made an emphasis on the need for studies to investigate appropriate strategies to increase student engagement because it is associated with performance. The result is similar to the findings of Gaylo and Dales (2017) that engagement is usually an average level, which implies that teachers need to initiate strategies to boost learners engagement in the subject matter. Gunuc (2014) emphasized the need for more studies to investigate appropriate strategies that may increase a student's engagement.

On the other hand, posttest results disclose that after the intervention the engagement of the experimental group was still on the *Moderate* level. Nevertheless, the posttest mean of learner's responses was higher compared to the results in the pretest. The engagement level of learners' may not improve to a high level but there was an increase in the mean. It could be inferred that employing differentiated instruction in Basic Calculus lessons can heighten learners' engagement in the subject. Further, it can be inferred from the table that the affective

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engagement of students before and after the intervention really was heightened that it went up to the next level.

To find out whether the engagement increase is statistically significant, paired t-test was used. Table 4 shows the result. It can be gleaned from the table that the engagement level before and after the intervention has a significant difference based on the p-value. The t-value had a p-value less than 0.05, thus the decision is to reject the null hypothesis, stating there is no difference in the engagement levels. There is sufficient evidence to support the claim that the increase in the engagement before and after the intervention was brought by the use of differentiated instruction.

Table 4
Comparison of the Engagement of Learners in the Experimental Group

Pair	t-value	df	p-value	Remarks
Before - After	-8.424	29	0.000	Significant

The result of the study conforms to the findings of Konstantinou-Katzi et al. (2013) that students who are engaged obtain higher scores because they participate in the learning process with a connection to the teacher and the lesson. In the previous results on learners' academic performance between the control group and the experimental group, it was found out that the students who experienced differentiated instruction performed better than those learners taught using the conventional method. The results in the engagement corroborate the findings that more engaged the students in the lessons, they perform better. McAdamis (2001) had parallel results that aside from the significant improvement in the test scores of low scoring students with differentiating instruction, the students are more motivated and enthusiastic about learning. Moreover, the engagement results imply that the learners taught with differentiated instruction got higher mean posttest performance scores because they are engaged.

Conclusion

Generally, the use of differentiated instruction had significantly increased the academic performance and engagement in Basic Calculus of Grade 11 learners. It aids the improvement of the academic performance of learners and heighten their engagement. Differentiated activities in the classroom initiated by teachers, when incorporated into the lessons, give opportunities for learners to learn better. Differentiated instruction assists learners to develop the fundamental knowledge, skills, and understanding in Basic Calculus and aid them in the transfer of learning. It serves as an effective teaching strategy to influence learners to be engaged in class cognitively, affectively and behaviorally. The more engaged the learners in the classroom, the more suited the activities in their needs, readiness and intelligences, the more they are learners successful in the learning process.

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Suggestions and Recommendations

Mathematics teachers are encouraged to use differentiated instruction in facilitating the teaching and learning process to help enhance learners' academic performance and boost their engagement. Activities initiated in the classroom has to be tailored to the learning styles, interest and readiness of the learners for the optimum learning experience. One way to do it, is to develop differentiated lessons in Mathematics. Seminars, workshops and trainings related to differentiated instruction may be introduced and may capacitate teachers to develop more effective lessons, not only in Mathematics, but also with other subject areas. Similar studies may be conducted, or may consider other research designs, research questions, instruments, locale and participants.

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