Razalas' Grouping Method and Mathematics Achievement

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Abstract
This study aimed to raise the achievement level of students in Integral Calculus using Direct Instruction with Razalas' Method of Grouping. The study employed qualitative and quantitative analysis relative to data generated by the Achievement Test and Math journal with follow-up interview. Within the framework of the limitations of the study, the Razalas' Method of Grouping revealed a significant increase on the gain scores between the two groups and a significant difference was obtained within and between groups (control and experimental). However, qualitative assessments further showed that the Razalas' Method of grouping creates and develops self-confidence, encourages effective communication and facilitates exchange of ideas towards a common goal. The students from both groups were in favor with the sequence of the presentation of the lesson, especially with the incentives given.
Keywords: Razalas' Method of Grouping; Direct Instruction; and Cooperative Learning

1. Introduction
Integral Calculus is a required subject for computer science and engineering students. Zhang (2003) emphasized that the objectives of the course is to impart to the students the concepts and theories of calculus that will make them comprehend the mathematical ideas and develop their abilities to think logically, deeply and creatively. But few students learn computational skills, and obtain useful tools for future needs. Most of the student commented that calculus is abstract, boring and hard for them. Calculus is very important but very hard to be learned by the students. The problem on hand is how to teach calculus so that the students will be motivated to learn.

The researcher in his 29 years in teaching mathematics courses at the university level, found Integral Calculus as the most difficult subject for science and engineering students. He agrees with Ainsworth (1994 as cited by Miller 2005 and re-cited by Salazar, 2012) that students who come to college without an adequate background in math will likely withdraw from or quit performing when a math class becomes difficult. One of the problems that the researcher observed over the years of teaching Integral Calculus is that many students have a weak algebra and differential calculus background. That is the main reason that most students in Math 04 (Integral Calculus) failed (69% failure) and most of them were repeaters for the school year 2011-2012.

A great deal is being written and said about new ways of improving mathematics teaching and learning. Most of the suggestions in improving students' performance in mathematics invariably become concerned with the development of some forms of initialized instructions, making a wider and more effective use of applications and devising new ways of increasing appeals to student intuition in the development of concepts (Salazar, 2003 as cited by Salazar, 2012).

Recently, Salazar's (2012) study revealed an increase of gain scores in the Achievement Test of the students in Integral Calculus using Direct Instruction with Salazar's Method of Grouping. Although, the Achievement Level of the students revealed a failure mark, a significant increase of the gain scores was achieved. Further, insights drawn from the student's journal showed that Ramadan Timing contributed to this low increase.

Furthermore, Salazar (2012) recommended replicating his study using regular timing and different types of grouping. Also, Salazar (2007) recommended an inverse method of grouping of the Salazar's Method of grouping.

Thus, the researcher in this study replicated Salazar's study but used the reverse method of the Salazar's Method of Grouping , named as RAZALAS Method of Grouping and was conducted in a regular timing, second term of SY 2012-2013.

1.1 Statement of the Problem
This study used the Direct Instruction with Razalas Method of Grouping versus Individual Learning that determines the effects on students' achievement level in Integral Calculus.
Specifically, this study answered the following questions:
1. What is the students' achievement level in Integral Calculus?
2. Is there a difference in the scores in the achievement test of the students' after exposing them to the Razalas Method of Grouping and Individual Learning?
3. What are the gain scores of the students' achievement level in Integral Calculus?

4. Is there a difference in the gain scores in the achievement test of students' after exposing them to Razalas Method of Grouping and Individual Learning?
5. What insights are drawn from students' journal?

1.2 Research Hypothesis
The study put forward the following hypothesis:
1. There is a significant difference in the scores in the achievement test of students exposed to Razalas Method of Grouping and Individual Learning.
2. There is a significant difference in the gain scores in the achievement test of students exposed to Razalas Method of Grouping and Individual Learning.

1.3 Significance of the Study
The main purpose of the study was to raise the achievement level of students in Integral Calculus.
Results of this study will encourage Integral Calculus teachers to use Razalas' Method of Grouping, if found effective.

This study is beneficial to students who valued sharing and helping others, exchange of ideas and effective communication among their classmates and in turn become fruitful citizens in this country.

Insights drawn from this study will guide mathematics teachers in teaching Integral Calculus and inspire them to conduct researches on strategies in teaching mathematics.

This study will also encourage administrators to recommend to his teachers the possibility of using Razalas Method of Grouping.

1.4 Scope and Limitations of the Study
This study used Direct Instruction to both groups but different method of grouping (Razalas' Method of Grouping versus Individual Learning) on the seatwork stage to raise the students' achievement level in Integral Calculus. A validated Achievement Test (teacher-made test) lifted from The Calculus 7 (Liethold, 1997) and Math Journal used by Salazar's (2012) was used in this study.

This study was conducted at an International University in Bahrain during the final term, second trimester, school year 2012-2013. The subjects of the study were the two (2) existing classes composed of combined second year Bachelor of Science in Mechatronics Engineering (BSME), Bachelor of Science in Computer Science (BSCS) and Bachelor of Science in Engineering Informatics (BSEI) students who were officially enrolled in Math 04 (Integral Calculus). The researcher himself handled the experiment.

The topics covered were: areas under the curve, area between curves, volume of solid revolution- disk and ring method.

1.5 Definition of Terms
The following important terms were operationally and/or conceptually defined as to be used in this study.
Achievement in Integral Calculus – This refers to the performance of the student respondents in the Achievement Test (teacher- made test) in Integral Calculus.
Achievement Level- This is the interpretations of the student scores and gain scores based on the University grading system (Student Handbook)
Achievement Test – It is a four question (5 points each) problem solving test in Integral Calculus lifted from The Calculus 7 (Liethold, 1997).
Control group –This is the group of students that were exposed to Direct Instruction with Individual Learning on the seatwork stage.
Direct Instruction- It is the method of teaching used by the researcher to both groups (experimental and control groups)
Individual Learning – In this study, it is in the seatwork stage that the students work/solve the problems given and defend their solutions individually
Experimental group –It is the group that was exposed to Razalas Method of Grouping.
Gain Scores – It refers to the increase in score of the control and experimental groups from pretest to post test.
Math Journals – It refers to the written impressions, comments and suggestions of the students with regard to the method of teaching, grouping method and incentives given as used in this study. The same also serves as the guide questions for the interview.
Mechatronics/Informatics/Computer Science students – This refers to the students officially enrolled in Math 04, second semester, SY 2012-2013.
Razalas' Method of Grouping- This an inverse method of grouping used by Salazar (2007, 2012) in the seatwork stage. That is, the first stage is an individual competition and the next stages, a group member is added based on the student choice until the group has three members, then it starts again individually but with different group

members in the next round(s). Additional 5 points were given to students or group who successfully defended their solutions. The accumulated points were added and ranked and added to students score in the final examination. Thus, the Salazar's Method has 1-2-3 group members, while the Razalas' Method had 3-2-1 group members. But, the group member who discussed their groups' solution completely was the eliminated member from the group.

2.0 Methodology
This chapter describes the research design, the subjects of the study, instrument that was used, data collection procedures and data analysis of the study

2.1Research Method
The research design employed the quasi-experimental method. In particular, nonequivalent control groups design.
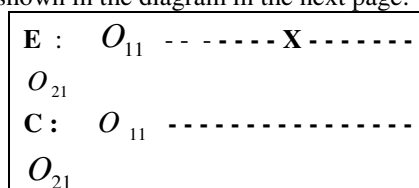The research design of this study is shown in the diagram in the next page:

$$E : \quad O_{11} \text{ -- - - - - - X - - - - - - -}$$
$$O_{21}$$
$$C : \quad O_{11} \text{ - - - - - - - - - - - - - - -}$$
$$O_{21}$$

Figure 2. The Research Design

In figure 2, E and C are the experimental and control groups, respectively. The two groups were given   pretest and posttest. The symbol X represents the experimental treatment that was given to group E.
The symbol O_{11} represents the pretest (Achievement Test in Integral Calculus) which was administered to the two groups prior to the intervention, while the symbols, O_{21} represents the posttest that was given after the intervention.

2.2Subjects of the Study
This study utilized two (2) existing classes (section CC –Sunday and Tuesday and CD-Monday and Wednesday, 8:00-10:00 am and 6:00-8:00 pm in Math 04 (Integral Calculus), respectively, which was the researchers' teaching load for the second trimester SY 2012-2013. Nine (9) students were enrolled in section CC and 34 students- section CD was the subjects in the study. The female students in section CD (13) were not included in the study due to cultural orientation.
    The overall groups mean was computed to ensure the comparability of the control and experimental groups at the start of the experiment.

Table 1 Distribution of Students by Group and Mathematical Ability

Group	Grade		n	Overall Group Mean	Interpretation
	Average Prelim Grade	**Average Midterm Grade**			
Control	40.06	38.69	9	39.38	Failed
Experimental	43.88	41.25	21	42.56	Failed

    Table 1 show the average grade for the prelims and midterms for the 2nd Term, SY 2012-2013 which the students were currently enrolled. Further, the table shows that the overall group means ratings of both the experimental and control groups are 42.56 and 39.38 respectively, which implies that the groups are not different in terms of mathematical ability. This observation is supported by the students' scores in the pretest with a mean score of 0.33 (control group) and 0.29 (experimental group). Actually, only one (1) student in each group got a score of 3 and 6 respectively. And those students were repeaters of Math 04 (Integral Calculus).This simply shows that most students in this study have no background in finding the areas and volume of solid revolutions using Integral Calculus.

2.3 Instruments Used
Qualitative and quantitative data were gathered using the following instruments:
Achievement Test in Integral Calculus. A validated Achievement Test (teacher-made test) lifted from The Calculus 7 (Liethold, 1996) and was used by Salazar (2012) in this study. Each item in the test is represented by a topic covered in this study. The test was problem solving where the students were required to solve the area under a curve, area between curves and volume of solid of revolution- disk and ring method. The test consisted of four (4) problems with five (5) marks each and with twenty (20) as the highest possible score. (Appendix A).
The researcher made a scoring rubric written on the Achievement Test and answer key with corresponding

marks which were prepared by the researcher before marking. The test was checked and was graded by the researcher using the University Grading System.

Table 2 Achievement Test Scores Descriptions

University Grading System*			
Score	**Grade Ratings**	**Grade Range**	**Achievement Level Interpretations**
20	96-100	1.00	Excellent
18- 19	86-95	1.25-1.50	Very Good
14- 17	69-85	1.75-2.25	Good
10- 13	50-68	2.50 -3.00	Fair
Below 10		5.0	Failed

 * Student Handbook SY 2011-2012

With respect to the working description of the gain scores on the achievement test scores, the following criteria were used.

Table 3 *Gain Scores Descriptions*

Gain Scores	**Achievement Level Increase Descriptions**
17 - 20	Very High Increase
13 - 16	High Increase
9 - 12	Average Increase
5 - 8	Low Increase
1 - 4	Very Low Increase

Math Journals – This instrument was the source of qualitative data to determine insights with regard to the method of teaching used by the researcher. Prompts focused on the method of teaching specifically on the grouping method used and the incentives given. The students were encouraged to answer the questions in paragraph or outline form in English. This was used to validate the results of the quantitative assessments. (Appendix B)

Interview. The interview was used to validate the results of the quantitative assessment of the students (Appendix B). This also served as a source of qualitative data on the students. The interview was conducted informally by groups to increase the rapport in the discussion and minimize shyness among the interviewees. The interview questions focused on the method of teaching, grouping method and incentives given and follow-up questions. The Math journal served as the guide questions to confirm their answers and some follow-up questions.

2.4 Data Collection

Two (2) existing classes in Math 04 (Integral Calculus) as regular load of the researcher was the source of data to be collected. However, matching was done to ensure comparability in terms of the mathematical ability of the students based on their prelims and midterm grades and the results of the pretest. By lottery, the Sunday - Tuesday (TD) class was for the control group while the Monday-Wednesday (MW) class was for the experimental group.

As soon as the treatments were assigned, the researcher conducted an orientation on the processes of the study. Then, the pretest was conducted after the orientation. The researcher himself handled the two classes

Prior to the conduct of the experiment, a try-out was done for one(1) meeting, to familiarize and to make the students feel at ease with the new method.

The Math journal was given after the posttest. To motivate them to answer the questions on the journal, the researcher gave an incentive of additional ten (10) points if they answered all the questions. The posttest was considered as Quiz no.2 with open notes.

To control other factors that might influence the outcomes of the study, the time limit for conducting the two classes was two hours.   Four (4) topics were covered in the experiment. Both groups were provided with course specifications and instructional materials. PowerPoint presentations were prepared. The teaching method used differs only on the seatwork stage.

2.5 The Intervention

Direct Method of Instruction was used to both groups .However, on the seatwork stage Razalas' Method of Grouping was used in the experimental group and individual learning on the control group.

The sequence of activities for both groups is outlined below:

I.   *Introduction/Review* –setting the stage for learning.

II.   *Development* – explaining/deriving the formula and giving illustrative examples

III.   *Guided* Practice- solving a problem with the student on the board, the teacher just acted as a secretary.

IV.   *Closure*- summarizing on the lesson with emphasis on the important points.

V.   *Seatwork* – setting of problems to be given to the students to be solved on the board (one problem at a time) using the following methods of grouping.

Individual Learning: Students worked on the seatwork individually. The teacher moved around to assist or gave hints and suggestions on how to solve particular problems whenever necessary. Sometimes the students approached the teacher, showed their work and asked for hints. The first student, who presented the correct solution and answer to the teacher, presented and defended his solution on the board and earned additional five (5) points,. However, a grace period of five (5) to ten (10) minutes was given to give chances to others who were still solving the problem before the solution was discussed on the board. The same earned 5 additional points. The accumulated points were ranked and the group was given additional points on their final examination based on the ranking. The highest additional point was ten (10) points and the lowest was one (1) point. Then the teacher moved on to the next problem.

       Razalas' Method of Grouping. The method of group was the reverse of Salazar's Method of Grouping used by Salazar (2012). Thus, the Razalas Method of Grouping is presented: the first stage was three (3) members for each group of their choice. As soon as the group answered the problem and successfully defended their solution in class, each member earned additional 5 points. The member who discussed the group solution was eliminated from the group and worked individually in the next stage. The remaining group members (2 members) worked for the next problem. As soon as the group answered the problem and successfully defended their solution in class, each member earned additional 5 points. The member who discussed the group solution was eliminated from the group and worked individually in the next stage. Until the time that no grouping existed, then they went back to stage 1. This cycle continued until the end of the trimester. However, membership of groups must not be the same on the next groupings.

       The posttest was administered after the experiment. The math journal was given a day before the posttest. As soon as the students submitted their Math journal, follow-up questions were asked (interview) to the subjects of the study.

2.6 Data Analysis

Both quantitative and qualitative analyses were done to determine the achievement level of the respondents who were exposed to Razalas' Method of Grouping and Individual learning. The quantitative data were derived from the math journals and follow-up interview results.

       The mean of the prelim and midterm grades of the two groups were used to determine the comparability of the subjects Wicoxon-Mann-Whitney, a non-parametric test was used to test the significance of the difference between groups pretest, posttest, gain scores and within groups' pretest and posttest results.

       The Vassar Stats: Website for Statistical Computations (http://faculty.vassar.edu) was used in the statistical computations. Hypothesis was tested at 0.05 level of significance.

3.0 Presentation, Analysis of Qualitative and Quantitative Data

The following discussion presents the results of the analysis of the student scores in the achievement test in Integral Calculus. It describes the effects of the Razalas' Method of Grouping on the student's achievement level. This result is supported by the qualitative data gathered from the math journal and follow-up interview.

3.1 Achievement Level

It can be gleaned from the table in the next page, that both groups (control and experimental) have a mean score in the pretest is 0.33 and 0.29 respectively with a grade equivalent of 5.0, a failure grade. 100% of the students in the control group failed. However, only one student got a score of three (3) out of twenty (20), the rest got zero. In the experimental group, only one (1) student got a score of six (6) and the rest got zero, a 100% failure. Therefore, the two groups are comparable at the very start of the study.

       Further, the posttest in the control group obtained a failure grade (5.0) with a mean score of 9.33 which is almost passing (passing score is 10) and the experimental group obtained a passing grade (1.75 – interpreted as Good) with a mean score of 14.33. A gain score of 9 (interpreted as average increase) was obtained by the control group while the experimental group achieved a high increase of 13.71marks.

       Student's math journal revealed some reasons on their performance on the achievement test followed by their answers during the interview.

Table 4 presents the results of the pretest and posttest of the two groups.

Table 4 Comparison of Raw Scores in the Achievement Test

Raw Scores	PRETEST						POSTTEST					
	Control Group			Experimental Group			Control Group			Experimental Group		
	f	%	ITP	f	%	ITP	f	%	ITP	f	%	ITP
20										2	10	E
18-19							1	11	VG	3	14	VG
14-17							1	11	G	7	33	G
10-13							4	45	F	2	10	F
Below 10	9	100	FL	21	100	FL	3	33	FL	7	33	FL
Total (Mean)	9	100	FL (0.33)	21	100	FL (9.33)	9	100	FL (0.29)	21	100	FL (14.33)
Grade Equivalent			5.0			5.0			5.0			1.75

Legend: **ITP** – Interpretation: **E**- Excellent: **VG**- Very Good ; **G** – Good ; **F**-Fair; : **FL**- Failed

A student in the control group commented:*"During the finals, the teaching method which used was more effective because it triggered the minds of the students and left the basic information in our minds".*

When this student was ask to explain about this remark: *He said: Dr. giving us the chance to solve a problem and in turn explain our answer individually in class with that incentives to be given, pushed us to think.*

On the other hand, a student in the experimental group remarked:*" It's a good idea in which the students can learn the subject when the student sharing the idea and i think, sometime, some student need the explanation in Arabic, so when there is a group, the explanation is in Arabic".*

This was also observed by another student, that there exist language barriers which hinder them to understand the lesson. He said:*"Many students lack English language skills".*

That's why, in class, they have a choice to explain their solutions in Arabic or English. But most of them preferred to explain their solutions in Arabic.

Furthermore, a repeater of this subject commented upon submitting his posttest. "*Sir. I'm sure I will bass (pass) this term, not only me, most of us. Remember, last year, I enrolled this subject, Ramadan Timing. Honestly, I can't concentrate that time. Am working, fasting, tired, and hungry. No time to study. Sure, Doctor I will bass (pass) now".*

One student even suggested, *"I think it's better to start the grouping from the beginning not only in the final period".*

3.2 Difference in Scores in the Achievement Test

Table 5 below presents the results on the test of significant difference of the scores in the achievement test of the students before and after exposing them to Razalas' Method of Grouping and Individual learning.

Table 5 Difference of the Scores in the Achievement Test

Group and Test Compared		n	Sum of Ranks	Test Used	Z–critical value	z-observed value	Decision
Within Groups	Pretest vs Posttest (control group)	9(ns/r=7)	W=-28	Wilcoxon Sign Rank Test	24	-----	significant
	Pretest vs Posttest (experimental)	21	W=-231		1.645	4.01	Significant
Between Groups	Posttest(control) vs Posttest(experimental)	9 vs 21	U^A =62	Mann-Whitney Test	Upper limit=127 Lower Limit=62	1.45	Significant

* Significant at 0.05 level of significance

Table 5 revealed that there is a significant difference on the student scores in the achievement test before and after exposing them to Razalas' Method of Grouping and Individual Learning. Razalas' Method of grouping is effective in raising the achievement level of the subjects of this study. This results is opposite of the findings of Salazar's Study (Salazar, 2012). Results revealed that the Salazar's Method was not effective in raising students score in the Achievement Test.

3.3 Gain Scores within Groups

Table 6 in the next page exhibited an increase of scores in the Achievement test in both group after exposing them to Razalas' Method of grouping and Individual Learning.

As seen in table 6 , the control group obtained an average mean increase (9) while the experimental

group performed a high mean increase (14.33) in the Achievement test after exposing the groups (control and experimental) to Individual learning and Razalas' Method of Grouping , respectively.

Only 44 % (4 out of 9) obtained an increase within the range of 9-12 in the control group, while in the experimental 29% (6 out of 21) got a very high increase (score range 17-20),and none obtained a very low increase (score range of 1-4) in which is worth to be considered. This result indicates that involvement in cooperative learning is a strong predictor of student's academic performance (Tsay & Brady, 2010).

Table 6

Gain Scores within Groups

Gain Scores Range	Control Group			Experimental Group		
	f	**%**	**ITP**	**f**	**%**	**ITP**
17-20	1	11	VH	6	29	VH
13-16	1	11	H	5	23	H
9-12	4	44	A	4	19	A
5-8	1	11	L	6	29	L
1-4	2	23	VL	0	0	VL
Total **(Mean)**	**9**	**100**	**A** **(9)**	**21**	**100**	**H** **(14.33)**

Legend: ITP – Interpretation ; VH – very high increase ; H – high increaseA - average increase ; L – low increase ;

As seen in table 6 above, the control group obtained an average mean increase (9) while the experimental group performed a high mean increase (14.33) in the Achievement test after exposing the groups (control and experimental) to Individual learning and Razalas' Method of Grouping , respectively.

Only 44 % (4 out of 9) obtained an increase within the range of 9-12 in the control group, while in the experimental 29% (6 out of 21) got a very high increase (score range 17-20),and none obtained a very low increase (score range of 1-4) in which is worth to be considered. This result indicates that involvement in cooperative learning is a strong predictor of student's academic performance (Tsay & Brady, 2010).

3.4 Comparison of Gain Scores

Table 7 below revealed a significant difference of the gain scores of the students between the control group and the experimental group.

Table 7

Group and Test Compared	n	Sum of Ranks	Test Used	z-critical value	z-observed value	Decision
Control Group Gain Scores Vs Experimental Group Gain Score	9 21	U_A =242	Mann-Whitney Test	Lower Limit=62 Upper Limit=127	z=-1.79	Significant

 * *significant at 0.05 level of significance.*

Results of the Mann-Whitney Test revealed that the Razalas Method of Grouping raised the students' scores in the achievement test in terms of their gain scores as evidenced by accepting the alternative hypothesis, that there is a significant difference in the gain scores in the achievement test of students exposed to Individual learning and Razalas Method of Grouping. This findings was also disclosed by Salazar (2007) on using Enhanced-Group Moore Method of Instruction in raising student's van Hiele Levels of Geometric \understanding and Proof-construction Performance.

3.5 Insights Drawn from Students Math Journal and Interview

The following are insights drawn from students Math Journal and interview in terms of the researcher method of teaching, method of grouping and incentives given.

4.0 Method of Teaching Used

The students from the two groups (control and experimental) had written the following impressions and comment.

A student from the control group had written on his journal:

"Practical approach, individual seat work on the white board. Creates the sake of ownership".

When asked what does he mean from this statement. *"Doctor, Individual seatwork and explaining our answers on the board boast our morale, because we done it by our own and I am proud that I have done it by myself. And*

I learned from it".

While from the experimental group, a student said in his math journal*:*

My opinion regarding the grouping learning is good because the student encouraged,discussion, share their knowledge as long as they are active".

This was supported by another student: *"its grouping method is a good way in teaching. beerfor, then individual so shiring the ides is wery good way".*

But, two students wrote some disadvantages in the grouping method used*:" Some students is not sharing the group in solving the questions".*

 Also, *"Too much conversation off topic chaos in class".*

This chaos however was controlled by the professor.

Some students commented on the incentives given*:" It's a good idea because the subject is hard, and by giving Bonus, the student will have anther chance to increase his grade".*

and was supported by two more students. *"Weve given a chance to score more on our critical low mark quizzes by getting bonus points".”The Bonus points are very helpful If I have low score in any of the assignments or quiz these point helps me to get % in the assignment or quiz".*

The incentives given served as a motivating factor to students to participate in class.

Most of the students considered the subject difficult, and one student said:*" Student's basic knowledge is poor which affects the course objectives making it difficult to achieve".*

This was also found out in Salazar's study (2012) that students had poor background in algebra. According to him, it is not that the student does not learn, it's because the students are not ready to learn.

Lastly, here are some of the general comments*:" I belief that the problem lies on the students, because Dr. Salazar has a nice way of explaining and deliver information. He share his experience with us and advised all his students. Regardless other student circumstances. Because the are responsible".*

And lastly, " *I think we just need a longer period of time in this subject so we can absorb the lesson's more".*

The students responses to the Math Journal and Interview disclosed that they have tried their best to at least earn the bonus points. They have developed the value of sharing and helping others. It promoted effective communication and exchange of ideas towards a common goal. The incentives made the seatwork enjoyable.

5.0 Summary, Findings, Conclusions and Recommendations

This chapter presents the summary, findings, conclusions derived from the findings and the recommendations based on the findings of this study.

5.1 Summary

The main objective of this study was to raise the achievement level of the students in Integral Calculus (Section CC and CD) in an International University-Bahrain, second trimester, SY 2012-2013. They were assessed using an Achievement Test.

The study assessed the students' achievement level in Integral Calculus before and after exposing them to the two grouping methods, the Razalas' Method of Grouping and Individual learning. Insights were drawn from the Math Journal and follow-up interview from the groups.

The existing two Math 04 class teaching loads of the researcher consisting of nine (9) and twenty one (21) students officially enrolled in Math 04 (Integral Calculus) were involved in the study. By lottery technique, the two sections were assigned to control and experimental group. The researcher handled both classes. Instructional materials were provided to the students.

Prior to the conduct of the study, a try out was done for one (1) meeting, to familiarize and, as much as possible, put the students at ease with the new method and make necessary adjustments.

Direct Method of Instruction was used to both groups but different only at the seatwork stage.

In the control group, students did the seatwork individually (Individual learning). The teacher moved around to assist/give hints and suggestions on how to solve the problem. Sometimes the students approached the teacher, showed their work and requested for hints. The first student to present to the teacher a correct solution defended his solution before class in Arabic. If successfully defended, he earned bonus (5) points.In the experimental group, the first stage composed of students with three (3) members of their choice. As soon as the group successfully defended their solution before the class and earned additional 5 points, the group member who discussed the solution was eliminated and works individually in the next stage. The group (with two members) continues in the next stage, and if able to defend their solutions before the class successfully, each group member earned additional 5 points and work individually in the next stage. Then they go back to stage 1. This cycle continued until the end of the trimester. However, group membership was never the same in the next rounds.

Quantitative data were gathered from the achievement test. The VassarStats: Website for Statistical Computations (http://faculty.vassar.edu) was used in the statistical computations. Qualitative data obtained from

the math journal and follow-up interview of the students from the two groups.

A validated Achievement Test in Integral Calculus (Salazar, 2012) was used in this study.

The study was carried out from May 26 to April 9, 2013 (five meetings, 2 hours. each) , the final term which concentrates on the applications of Integral Calculus (Area and Volume)

5.2 Findings

The findings of this study are presented below following the sequence of the research questions in the statement of the problem.

1. The pretest results of the two groups in the Achievement test showed mean scores of 0.33 and 0.29 for the control group and experimental groups, respectively). Both mean scores fall in the category of FAILURE. That is, the students do not have any idea of what to do, even on graphing a line and a parabola which are topics in their pre-requisite subject- Analytic Geometry.

However, the Achievement Test mean score in the control group improved from 0.33 to 9.33. A nearly passing mean score (passing 10). However, in the experimental group, the achievement test mean score improved from 0.29 to 14.33 which is a passing mean score with a grade equivalent of 1.75.

2. Comparing the test scores within groups (experimental and control groups) revealed that there is a significant difference between pretest scores and posttest scores in both groups. Also, the same findings were obtained in comparing the posttest scores between the control and experimental groups.

3. In the gain scores obtained within groups, the control group obtained a mean gain score of 9 interpreted as average increase while the experimental group revealed a 14 mean gain score which is interpreted as a high increase.

4. A significant difference of the gain scores between the two groups was revealed by the Mann-Whitney Test.

5. The following insights were drawn from the students' math journal and follow-up interview:

They felt that Integral Calculus is difficult even before the prelims and midterm periods .They had poor background in the prerequisite subjects (algebra, trigonometry, analytic geometry and differential calculus) which are needed in integration. Both groups were in favor of the sequence of presentation of the lesson used in this study especially on the incentives given.

The Razalas" Method grouping encouraged them to solve problems by themselves, shared and helped others in the next stages. The incentive (plus five points) served as a driving force to solve the problems on the seatwork stage. .

While in the control group, competitive atmosphere was felt. They have to solve the problem by themselves as fast as they can to earn more additional points.

5.3 Conclusions

It is therefore possible to increase the gain scores of the students using the Razalas' Method of grouping .The students are interested to learn but are not ready to learn.

Although, the result revealed a failure mark on the pretest but a significant increase of the gain scores was achieved in the posttest. Specifically, an average increase was gained by the control group and a high increase was gained in the experimental group, credited to the Razalas' Method of Grouping. Insights drawn from the students journal that can contribute more in raising students achievement in Integral Calculus deserves an attention , which is implementing the grouping method from the start of the classes not only on the final period..

5.4 Recommendations

On Poor Preparation in Integral Calculus. It is recommended that there must be a strong foundations on students pre-requisite skills, specifically on algebra, analytic geometry and differential calculus. College Algebra must be a five (5) units subject same as Analytic Geometry and Differential Calculus, and Integral Calculus must. There should be an strict implementation on the policy of accepting new students.

On Future Researches. For future researches, the following could be considered;

Use of homogeneous or heterogeneous small grouping according to ability levels, gender type, reverse order of grouping used in this study, or other types of grouping.

Use of large samples (two sections with 40 students for each group).

Implementation of the Razalas' Method of grouping in other basic mathematics courses in the tertiary level like College Algebra, Trigonometry, Analytic Geometry and Calculus.

Replication of the experiment comparing Salazar's and Razalas' Method of Grouping.

Research in using Mathematical Software i.e MATLAB

Calculus is viewed by the students as the most difficult mathematics subjects by AMAIUB students. Unless a strong foundation on its pre-requisite skills is achieved, the students' performance in Integral Calculus will still be low. Students are interested to learn, but they are NOT ready to learn.

6.0 References

Abu , Ronni & John Flowers (1997) . The effects of cooperative learning methods on the achievement, retention and attitudes of home economics students in North Carolina. Journal of Vocational and Technical Education. Vol. 13. No.2. scholar.lib.vt.edu/ejournal/JVTE

Ali, Hatim(2011) A comparison of cooperative learning and traditional lecture methods in the project management department of a tertiary level institution in Trinidad and Tobago. Caribbean Teaching Scholar. Vol 1, No.1. pp.49-64

Dancis , Jerome S. & Davidson, Neil (1970). *The Texas Method and Small Group Discovery Method.* Retrieved (2007) from http:// www.discovery.utexas.edu./rim.reference/dancisdavidson.html.

Dean, David & Deanna Kuhn (2006).Direct Instruction versus Discovery; The Long View. *www.interscience.wiley.com*

Dela Cruz, Luzviminda A. (2001). *Cooperative Learning: Its Effects on Students'Achievement in Math II.* Unpublished master's thesis. Leyte Institute of Technology, Tacloban City.

Leithold, Louis (1996). The calculus 7. Harper Collins Publisher Inc .New York

Maden, Sedat .(2011) Effect of Jigsaw 1 Technique on Achievement in Written Expression Skill. Educational Sciences: Theory & Practice. 11(2)pp. 911-917. Egitim Danismanligi ve Arastirmalan lletisim Hizmetieri Tic. Td. Sti.

Miller, David (2005). Helping students understand technical calculus via online learning supplement and group learning .http//math.unipa.it/grim/21project/21charlotte MillerDavidPaperEdit.pdf

Peterson, Penelope(1979).Direct Instruction: effective for what and whom? Leadership Association of Supervision and Curriculum Development.

Salazar, Douglas A. (2007). *Enhanced-Group Moore Method: Effects on van Hiele levels of Geometric Understanding, Proof-construction Performance and Beliefs.* Unpublished dissertation. University of the Philippines Open University.

Salazar, Douglas A. (2003). *Modular Approach in Teaching College Algebra.*Mathematics and Statistics Journal. College of Arts and Sciences. Leyte Institute of Technology. Vol.1 no.1

Salazar, Douglas (2012). Salazar's Grouping Method: Effects on student's achievement in integral calculus. AMA International University –Bahrain.

Zhang, Biao. (2003). Using student-centered teaching strategies in calculus. The China Papers. Retrieved from science.uniserve.edu.au/pubs/china/vol2/biaozhang.pdfChina 12/09/2012

http:// psychology.about.com/od/psychologynews/qt/groupsize

http:www.co-operation. Org

www.aft.org/tools4teachers

http://www.ldonline.org/article/5932/

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