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Effects of a Self-Made Workbook in College Algebra on the Students' Academic Performance

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Abstract. This study aimed to determine the effects of a self-made workbook in College Algebra on students' academic performance. The findings showed that the experimental group, which used the workbook, scored higher than the control group in all evaluations. Both groups were at the "proficiency" level, but the experimental group exceeded the control group in all 12 evaluations, with an average difference of 3.62% in favor of the experimental group. Additionally, 82.22% of students in the experimental group reached the "Advanced" level (90% and above in final grading performance), compared to only 20% in the control group (85% to 89%). The data revealed a "very high" relationship between the experimental group's performance in the 12 evaluations and their final grading performance, significant at the 5% level. This indicates that the student's performance in the evaluations strongly predicts their final grading performance. The mean performance of the experimental group in the evaluations was 3.62% higher than that of the control group, and the t-test indicated a significant difference between the two groups' performances. Similarly, the final grade of the experimental group's mean performance was 4.05% higher than that of the control group, with a significant difference confirmed by the t-test. This study implies that using a self-made workbook in College Algebra can significantly enhance students' academic performance, suggesting that tailored educational materials can improve learning outcomes. Implementing such resources could lead to higher proficiency and advanced student performance levels.

Keywords: Academic performance; College algebra; Experimental group; Workbook evaluation.

1.0 Introduction

As an institution of higher education, the university plays a crucial role in students' academic development. Kadri et al. (2021) argue that this can start a virtuous cycle of increasing the quality of education for every citizen, focusing on enabling each child to reach their full potential. Consequently, educators must continually seek ways to enhance the learning experience, making it more effective and valuable for learners.

O'Keefe et al. (2013) emphasizes the importance of recognizing its practical applications and intrinsic beauty. He notes that Mathematics is filled with mysteries to explore, games to play, patterns to discover, and symmetries to admire. As one of humanity's great achievements, engaging with Mathematics requires only an open mind. Students' perceptions of Mathematics vary widely. While some students' academic achievements align with their intelligence, others struggle significantly with Mathematics despite having average or above-average intelligence. This discrepancy, often unnoticed because these students appear normal, poses a challenge in traditional educational settings.

Aligned with the university's vision to be a dynamic institution developing competitive, productive, and world-class human capital, the researcher aimed to contribute to this vision by addressing issues in Mathematics education. Mathematics is a critical subject in the curriculum, essential for decision-making during academic and daily life. College Algebra, in particular, is an engaging and versatile area of Mathematics, rich with practical applications and historical significance. However, negative perceptions and dissatisfaction with Mathematics programs are common. Critics argue that the selection and treatment of subject matter are often inadequate or inappropriate (Baig, 2015).

Uayan (2020) highlights that an effective Mathematics teacher uses varied instructional materials to promote quality education. However, the Philippine Educational System faces challenges such as the lack of instructional materials, especially in secondary public schools, affecting learners' preparedness for college. The Department of Education has been developing programs to update instructional materials and upgrade equipment. In response to these challenges, the researcher developed a self-made College Algebra workbook to enhance students' learning experiences and improve their performance. This study aimed to determine the effect of the said on students' academic performance.

2.0 Methodology

2.1 Research Design

The research design used in this study was the Static Group Comparison. This design involves two groups: one group receives the treatment while the other does not, serving as the control group. The treatment in this study was a self-made and validated workbook used by the experimental. It employed a complete enumeration method since its main goal was to track and monitor the BSED-Math graduates regarding their employability status. group. The control group did not receive the workbook. The results from both groups were compared and analyzed to determine the effects of the treatment.

2.2 Research Environment

The study took place at Negros Oriental State University – Guihulngan Campus in Guihulngan City, Negros Oriental. This university is one of the satellite campuses of NORSU. It consists of six colleges: College of Arts and Sciences (CAS), College of Business Administration (CBA), College of Criminal Justice Education (CCJE), College of Education (CED), College of Agriculture, Forestry and Fisheries (CAFF), and College of Industrial Technology (CIT). Various programs include Bachelor of Science in Computer Science, Mass Communication, Business Administration, Hospitality Management, Elementary Education, Secondary Education, Criminology, and Industrial Technology. The university is centrally located, near the Guihulngan City Hall and across from the Guihulngan City District Hospital.

2.3 Research Respondents and Sample

The respondents were two sections of College Algebra students from different colleges within NORSU-Guihulngan Campus. Each section consisted of 45 students. The names of the two sections were drawn from a lot to determine which section would be the experimental group and which would be the control group. The selected section became the experimental group, and the other served as the control group. The researcher employed a complete enumeration method since its main goal was to get the effects of a self-made workbook of the two sections of the course.

2.4 Research Instruments

The researcher used a self-made and validated workbook as additional instructional material for the experimental group. The workbook covered Sets and Number Systems, Polynomials, Special Products, Factoring, Simplification of Algebraic Fractions, Rational Exponents and Radicals, Linear Equations, Complex Numbers, and Word Problems. Three experts in Mathematics reviewed the workbook to ensure its validity. These experts included a Ph.D. in Mathematics from Silliman University, a Ph. D. in Mathematics Education from Foundation University, and a Ph.D. in Mathematics from NORSU Main Campus. Their feedback was incorporated to finalize the workbook.

2.5 Experimental Procedures

After the workbook was validated, permission was obtained from the Campus Administrator and the Dean of the College of Arts and Sciences. Both the experimental and control groups were evaluated after each topic was discussed. The experimental group received the workbook, while the control group did not. The experimental group could read and discuss the workbook's contents in advance, whereas the control group relied on classroom discussions and other resources. Both groups engaged in group discussions and completed exercises, but the experimental group had the advantage of the workbook.

2.6 Data Analysis

The following instruments were employed to analyze and interpret the data: (First) percentage, which was used to show the evaluation results for each workbook topic and the student's academic performance. (Second) The students' extent of perceptions of the various topics in the workbook they created and validated were obtained using the Arithmetic Mean. (Third) The degree of correlation between the two variables was determined using the Pearson Product Moment Coefficient of Correlation.

3.0 Results and Discussion

3.1 Performance of the Experimental and Control Group

Table 1 shows that the experimental group scored higher than the control group in all 12 evaluations. The experimental group reached an advanced level, indicating that students at this level exceed core requirements regarding knowledge, skills, and understanding and can apply them automatically and flexibly in authentic performance tasks. In contrast, the control group reached a proficiency level, meaning that students at this level had developed fundamental knowledge, skills, and core understandings. The average difference between the experimental and control groups was 3.62% in favor of the experimental group.

Table 1. Descriptive Comparison of the performance of the experimental and control group

Evaluation Number	Experimental Group		Control Group	
	Rating	Interpretation	Rating	Interpretation
1. Sets and Number System	95.02	Advanced	90.18	Advanced
2. Polynomials	94.11	Advanced	91.02	Advanced
3. Special Products	95.04	Advanced	92.02	Advanced
4. Factoring	90.42	Advanced	88.64	Proficient
5. Simplification of Algebraic Fractions	95.78	Advanced	92.02	Advanced
6. Multiplication and Division of Fractions	93.60	Advanced	91.40	Advanced
7. Addition and Subtraction of Fractions	94.16	Advanced	92.09	Advanced
8. Complex Fractions	88.64	Proficient	82.29	Approaching Proficiency
9. Rational Exponents and Radicals	85.02	Proficient	83.16	Approaching Proficiency
10. Linear Equations and Its Application	88.60	Proficient	84.02	Approaching Proficiency
11. Complex Numbers	89.11	Proficient	85.87	Proficient
12. Word Problems	86.16	Proficient	79.11	Developing
Average	**91.27**	**Advanced**	**87.65**	**Proficient**
Standard Deviation	**2.41**		**2.00**	

A study by Erdoğan and Baran (2009) revealed that their experimental research showed an increase in the test scores of Early Mathematics Ability at the end of the education process. The scores of students in the experimental group were higher than those in the control group. Futalan et al.'s (2020) findings also align with those of Erdogan and Baran. Students with access to the solutions manual scored higher than those without it.

However, Brahm et al. (2017) contradict these findings. Their study shows that learners exhibit the same degree of improvement in Mathematics, whether they use a conventional textbook or a customized workbook designed to address specific problems South African learners face. From a policy perspective, no evidence supports the relative effectiveness of the specific workbooks considered in the study.

Table 2. T-test result comparing the performance of the experimental and the control groups in the 12 evaluations

Students	$\bar{x}$	n	S	Computed t	Tabular t	Decision/ Remark
Experimental Group	89.40	37	4.47	2.219	1.99	Reject H_0 (significant)
Control Group	87.20	37	4.04			

5% level of significance and 72 degrees of freedom

The data in Table 2 reveal that the mean performance of the experimental group in the 12 evaluations is 2.2% higher than that of the control group. A t-test was employed to test this difference statistically. The computed value of t (2.219) is greater than the tabular value of t (1.99). These findings provide sufficient evidence to reject the null hypothesis. This means that, at the 5% level, the difference in performance between the experimental and control groups is significant. This implies that the teaching methodology using the workbook positively impacts the experimental group's performance, resulting in higher scores than the control group. The workbook or instructional material serves as a channel between the teacher and the students in delivering instruction. It motivates the teaching-learning process, capturing students' attention and encouraging them to learn.

Table 3. T-test result comparing the performance of the experimental and the control groups in the first grading period

Students	$\bar{x}$	n	S	Computed t	Tabular t	Decision/ Remark
Experimental Group	90.97	37	3.13	2.889	1.99	Reject H_0 (significant)
Control Group	88.86	37	3.16			

5% level of significance and 72 degrees of freedom

The data in Table 3 illustrate that the mean performance of the experimental group in the final grade is 2.11% higher than that of the control group. The data also reveal that the computed value of t (2.889) is greater than the tabular value of t (1.99). These findings provide sufficient evidence to reject the null hypothesis, indicating that, at the 5% level, the difference in mean performance between the experimental and control groups is significant. This suggests that students in the experimental group learn better than those in the control group, likely due to the teacher's new instructional method using workbooks.

A study by Ali et al. (2010) notes a significant difference between the academic achievement of students taught through traditional methods and those taught through problem-solving methods. It also reveals that students taught using problem-solving methods achieve better academic results than those taught using traditional methods. Similarly, Oladejo et al. (2011) conclude that a teacher's ability to create "local" materials instead of "standard" ready-made materials makes lessons more effective and improves student achievement. Mbah's (2013) findings also reveal a statistically significant difference in the educational performance of students taught with instructional materials compared to those who did not.

3.2 Final Grade of the Students in College Algebra

Table 4. Final grading performance of the students in college algebra

Rating	Experimental Group		Control Group	
	Frequency	Percentage	Frequency	Percentage
90% and above (Advanced)	37	82.22	9	20.00
85%-89% (Proficient)	5	11.11	25	55.56
80%-84% (Approaching Proficiency)	3	06.67	11	24.44
Average Performance	**92.07**		**88.02**	
Standard Deviation	**1.69**		**1.99**	

Table 4 establishes that 82.22% of the 45 students in the experimental group are at the advanced level, while only 20% of the 45 students in the control group are at the same level. This indicates that most of the students in the experimental group achieve a final grade performance of 90% or above, compared to the control group, where most students achieve final grades ranging from 85% to 89%.

Oladejo et al. (2011) support this finding. Their research shows a difference in the achievement of students taught using standard instructional materials, those taught with improvised instructional materials, and those taught using conventional methods. Students taught with improvised instructional materials obtained the highest achievement scores, followed by those using standard instructional materials, while the control group scored the lowest.

Several studies show that teaching methods affect both academic performance and attitudes. Handy et al. (2010) cited that this is expected since attitude has a strong cognitive component. Omarbek et al. (2022) cited that while

there is no direct study on the effect of teaching methods on attitude, the influence is expected to mirror that of academic achievement. This inference is based on the positive correlation between attitude and academic achievement.

3.3 Relationship between the Performance of the Students in the Twelve Evaluations and Their Final Grade Performance

Table 5. Relationship between the performance of the students in the 12 evaluations and their final grade performance

Students	Computed r	Tabular R	Degree of Relationship	Decision/Remark
Experimental Group	0.9481	0.325	Very High	Reject H_0 (Significant)
Control Group	0.9460	0.325	Very High	Reject H_0 (Significant)

5% level of significance and 45 degrees of freedom

Table 5 reveals a "very high" relationship between the experimental group's performance in the 12 evaluations and their final grading performance. To test this statistically, the computed value "r" is compared to the tabular value "r." The null hypothesis is rejected since the computed value exceeds the tabular value. This rejection indicates that the relationship is significant at the 5% level. These findings suggest that the experimental group's performance in the 12 evaluations is a very strong predictor of their final grading performance.

The control group shows similar results. Their performance in the 12 evaluations also strongly determines their final grading performance. The data in Tables 1 and 4 support this result. Table 1 shows that both student groups performed better in the 12 evaluations. Likewise, Table 4 indicates that they also have higher final grading performance. The study by Sapuan (2012) supports these results, showing that evaluation performance predicts students' performance in the first grading period. Similarly, Mehmet's (2021) findings reveal a significant relationship between students' prior achievements and their current performance.

4.0 Conclusion

The research findings indicate that the experimental and control groups demonstrated proficiency in College Algebra across 12 evaluations, with the experimental group consistently achieving higher numerical ratings. Notably, while the experimental group attained an "advanced" level performance in their final grade, the control group remained at the "proficiency" level. This study found a significant correlation between the experimental group's performance in the 12 evaluations and their final grading performance, suggesting a strong and consistent improvement. Similarly, the control group also exhibited a very high correlation between their performance in the 12 evaluations and final grading, indicating consistent results within their group. Furthermore, there is a significant difference between the performance of the experimental and control groups in both the 12 evaluations and final grades, with the experimental group outperforming the control group. Overall, these results demonstrate that the self-made workbook used by the experimental group had a positive effect, contributing to their higher ratings than the control group, where it enhances students' understanding and performance in college algebra. Therefore, it is suggested that (1) teachers use, improvise, or develop instructional material that enhances the progress of learning of the learner so that time in facilitating is maximized (2) the school administrators motivate and support teachers in the preparation of more instructional materials like the workbook (3) the school administrators help the current researcher in reproducing the workbook so that all the students will benefit from it (4) the teachers make a parallel study in other mathematics subjects with other groups of students in different settings.

5.0 Contributions of Authors

There is only one author for this study.

6.0 Funding

The researchers personally shoulder the funding of the study.

7.0 Conflict of Interests

There is no conflict of interest in this study.

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9.0 References

Ali, R., Hukamdad, Dr., Akhter, A., & Khan, A. (2010). Effect of using problem solving method in teaching mathematics on the achievement of mathematics students. Asian Social Science, 6(2), 67-72. https://doi.org/10.5539/ass.v6n2p67

Baig, F. (2015). Application of Teaching Methods in Mathematics at Secondary Level in Pakistan. Pakistan Journal of Social Sciences, 35(2), 935-946. https://bit.ly/3ZJ3zjs

Brahm et al. (2017). Failing to catch up in reading in the middle years: The findings of the impact evaluation of the Reading Catch-Up Programme in South Africa. International Journal of Educational Development, 53(1), 36-47. https://doi.org/10.1016/j.ijedudev.2016.11.008

Erdoğan, S., & Baran, G. (2009). A study on the effect of mathematics teaching provided through drama on the mathematics ability of six-year-old children. EURASIA Journal of Mathematics, Science and Technology Education, 5(1), 79-85. https://doi.org/10.12973/ejmste/75259

Futalan, M. C., Canete, R., Calisang, C., Comighud, S., & Cordevilla, R. (2020). Effects of Social Interactions - Constructionist Approach in Teaching Mathematics. Journal of Mathematics, 6(5), 1-40. https://doi.org/10.13140/RG.2.2.19608.21766

Handy, T. C., Smilek, D., Geiger, L., Liu, C., & Schooler, J. W. (2010). ERP evidence for rapid hedonic evaluation of logos. Journal of Cognitive Neuroscience, 22(1), 124–138. https://doi.org/10.1162/jocn.2008.21180

Mbah, M. (2013). Use of Instructional Materials and Educational Performance of Students in Integral Science. Journal of Research & Method in Education, 3(4), 7-11. https://bit.ly/4eBhmga

Kadri, K., Mansor, A. and Nor, M. (2021). Principal and Teacher Leadership Competencies and 21st Century Teacher Learning and Facilitating Practices: Instrument Development and Demographic Analysis. Creative Education, 12(9), 2196-2215. https://doi.org/10.4236/ce.2021.129168

O'Keefe, P. A., Plass, J. L., Homer, B. D., Case, J., Hayward, E. O., Stein, M., & Perlin, K. (2013). The impact of individual, competitive, and collaborative mathematics game play on learning, performance, and motivation. Journal of Educational Psychology, 105(4), 1050-1066. https://doi.org/10.1037/a00332688

Ozcan, M. (2021). Factors Affecting Students' Academic Achievement according to the Teachers' Opinion. Education Reform Journal, 6(1), 1-18. https://dx.doi.org/10.22596/erj2021.06.01.1.18

Oladejo, M., Olosunde, G., Ojebisi, A., & Isola, O. (2011). Instructional Materials and Students' Academic Achievement in Physics: Some Policy Implication. European Journal of Humanities and Social Sciences, 2(1), 112-126. https://bit.ly/3BdXykW

Omarbek, N., Kaymak, S., Sydykov, B. (2022). The Effect Of Active Learning Method On Students' Academic Success, Motivation And Attitude Towards Mathematics. Journal of Language and Linguistic Studies, 18(2), 701-713. https://bit.ly/3BdXEci

Uayan, M. (2020). The Extent of Use of the MTB-MLE in Teaching Grade 3 Mathematics and Its Effect on the Performance of the Pupils. Journal of Educational Research, 5(8), 2456-2947. https://doi.org/10.5281/zenodo.3978030