

Experiences and Effect of using a Developed Workbook on the Proficiency Level of Grade 7 Students in Word Problems Involving Linear Equations in One Unknown



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ABSTRACT: As Mathematics is a subject of practice, printed instructional materials like workbooks will help learners exercise their skills in Math and at the same time monitor their learning progress. This action research was conducted to determine the experiences and effect of using a developed workbook in teaching word problems involving Linear Equations in One Unknown among a group of Grade 7 students in JBT Caing Sr. Memorial Integrated School, Tambilil, Kiamba, Sarangani Province. This investigation employed quantitative research design, through quasi-experimental and interview. Forty (40) students were divided into the control and experimental group, in which the control group was taught using the traditional method and the experimental group experienced learning with the use of a developed workbook. T-test results revealed that there is a significant difference between the mean gain scores of the experimental and the control group, showing that the use of the workbook is more effective and elicited higher scores than those under the traditional way of learning. Through a focus group discussion, the students who used the developed workbook found the material convenient to use, and helpful in solving word problems. With this, the developed workbook can be used as a supplementary teaching-learning material in a Mathematics learning space.

INTRODUCTION

Background of the Study

The teaching process is said to be a procedure of forming a link between the world and the learner. To accomplish that, an educator must be continuous in finding ways to connect to the learners with diverse needs and different backgrounds. One way of achieving this is the utilization of appropriate educational materials in the classroom.

Instructional materials are sometimes referred to as teaching aids for the purpose it serves in the teaching-learning process. Soper (2005) stressed that not only do teachers need good educational materials to connect to the learners, but they also need to use them in a way that enables learners learn as much from them. Olawale (2013) proposed that instructional materials can also improve and be developed to match the needs of the learners.

The National Council of Teachers of Mathematics (NCTM) recommends that all learners have opportunities to solve meaningful and complex Math problems. Chances such this, help learners become "confident in their ability to tackle difficult problems, eager to figure things out on their own, flexible in exploring Mathematical ideas and trying alternative paths, and willing to persevere" (NCTM, 2000, p. 21). With this, as Math is a subject of practice, printed instructional materials like workbooks and modules will help learners exercise their skills in Math and at the same time monitor their learning progress.

Printed instructional materials, such as modules, workbooks, comic strips, are the learner-friendly medium that helps teachers and learners reinforce concepts through appealing practice and problem-solving. Also, printed learning resources may allow the educational process more meaningful and exciting. In an article written by Herbst (2011), it was mentioned that printed instructional materials are useful resources in education and facilitate experiences in Mathematics courses. Moreover, in a paper authored by Campbell (2010), it was stated that developed and evaluated printed instructional materials such as comics, workbooks, magazines, newspapers, and pamphlets can provide self-directed and self-paced learning.

Under the current curriculum, the K to 12, the spiral approach of teaching Mathematics is being implemented. Learners will certainly have difficulties dealing with Math in the higher grade levels if they were not able to master the competencies taught from the preceding level, making the freshman year of Junior High School critical. With this, mastery of content in the Grade 7 curriculum must be guaranteed to ensure learning progress.

In the view of achieving the vision of the Department of Education, highlighting learners whose values and competencies enabling them to realize their full potential, and since teachers are now dealing with visual learners, the researcher aimed to use a developed printed instructional material in the form of a workbook in teaching Word Problems Involving Linear Equations in One Unknown.

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METHODOLOGY

Research Participants

The participants of the study were forty (40) Grade 7-Flores students of JBT Caing Sr. Memorial Integrated School, Tambilil, Kiamba Sarangani Province. Two groups were formed, with 20 students each, and were treated as the control and experimental. Levene's Test for Homogeneity of Variances was employed to ensure the evenness of the control and the experimental group ($F(1, 38) = 0.28619, p = 0.59579$).

Research Instrument

The Developed Workbook

The content of the developed Workbook is arranged from the **easiest to the most difficult** of word problems. The topics in the Workbook were organized in this order: (1) Number, (2) Age, (3) Work, (4) Geometry, and (5) Distance, Rate, and Time. In each section of the Workbook, learners are given brief **descriptions** of the focused type of word problem. Then, **examples** with suggested step-by-step and very detailed solutions are discussed. Learners will then **work in pairs, in trios, or in teams**, to practice solving problems similar to the examples. A 10-item **evaluation** test follows added with **challenge problems** which are solved a little differently making it challenging. There are 30-item **enrichment** problems for the learners to practice more the skill acquired. The last part of the Workbook is the **answers to problems** revealing the correct responses for every problem posed in every section of the workbook.

Data Gathering

This study employed both quantitative and qualitative research design. Quantitative data was obtained through quasi-experimental and the qualitative data was obtained through phenomenology as learners shared their experiences and insights in using the developed workbook.

One section of Grade 7 students was divided into two groups, with 20 students each, and were treated as the control and experimental group. Both groups were given the same contents of pre-test and posttest. Control group was taught using the traditional method of instruction and the experimental group was taught with the use of a workbook in solving Word Problems Involving Linear Equations in One Unknown.

Pretest and Posttest administered in teaching Word Problems Involving Linear Equations in One Unknown were constructed with a table of specifications paralleled with the grade 7 competencies under the existing K to 12 curriculum. It consisted of 10 items, with 2 for each sub-topic: number problem; age problem; work problem; geometry problem; and rate, distance & time problem. Tests were checked, gathered, tabulated, interpreted and treated with utmost confidentiality.

To gather the experiences of the students who used the developed workbook, a focus group discussion (FGD) was conducted involving the researcher and purposively selected six (6) students.

To determine the level of proficiency of grade 7 students in Solving Word Problems Involving Linear Equations in One Unknown during pre-test and posttest, mean was used. The scale below described their proficiency level quantitatively and qualitatively.

Score	Verbal Interpretation	Description
9-10	Very High	The proficiency level of the learners in the pre-test/post-test is very high with scores of 81-100%
7-8	High	The proficiency level of the learners in the pre-test/post-test is high with scores of 61-80%
5-6	Moderate	The proficiency level of the learners in the pre-test/post-test is moderate with scores of 41-60%
3-4	Low	The proficiency level of the learners in the pre-test/post-test is low with scores of 21-40%
0-2	Very Low	The proficiency level of the learners in the pre-test/post-test is very low with scores of 0-20%

To determine if there is a significant difference between the level of proficiency in the pre-test scores and post-test scores and the mean gain scores of the control and experimental group, t – test was used with 0.05 level of significance.

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DISCUSSION OF RESULTS AND REFLECTION

Table 1. Proficiency Level in Solving Word Problems Involving Linear Equations in One Unknown of Grade 7 Students in the Control and Experimental Groups before the Intervention.

Score	Control	Experimental	Description
9-10	0 (0.0%)	0 (0.0%)	Very High
7-8	0 (0.0%)	0 (0.0%)	High
5-6	0 (0.0%)	0 (0.0%)	Moderate
3-4	0 (0.0%)	0 (0.0%)	Low
0-2	20 (100.0%)	20 (100.0%)	Very Low
Mean	0.55	0.60	
Description	Very Low	Very Low	

Table 1 presents the proficiency level in solving word problems involving Linear Equations in One Unknown of grade 7 students in the control and experimental groups before the interventions. Both the control and experimental groups have **very low** proficiency level with $\bar{x} = 0.55$ and $\bar{x} = 0.60$, respectively. It is observed that the mean score of the experimental group and the control group have a 0.05 difference (**not significant** with $t = 0.490$, $p = 0.626$). This outcome means that learners' knowledge, in both groups, are on the same level before the employment of the intervention. The results also showed that students were yet equipped to solve word problems involving linear equations in one unknown.

A strong ground in developing printed instructional materials is when there is an identified deficiency in a content area across the curriculum (Rivera, 2019). The result of this test, although expectedly, shows that there is indeed a need to apply interventions to improve learner's proficiency.

Table 2. Proficiency Level in Solving Word Problems Involving Linear Equations in One Unknown of Grade 7 Students in the Control and Experimental Groups after the Intervention.

Score	Control	Experimental	Description
9-10	0 (0.0%)	2 (10.0%)	Very High
7-8	0 (0.0%)	7 (35.0%)	High
5-6	3 (15.0%)	9 (45.0%)	Moderate
3-4	9 (45.0%)	2 (10.0%)	Low
0-2	8 (40.0%)	0 (0.0%)	Very Low
Mean	3.20	6.45	
Description	Low	High	

After learning the process of solving word problems, the control group got $\bar{x} = 3.20$ that is described as **low**. The experimental group, which as well was taught the same competencies but with the use of the developed workbook, got $\bar{x} = 6.45$ that is described as **high**.

This determines that there is still an existing difficulty for the students in the control group to successfully solve word problems involving Linear Equations in One Unknown. One the other hand, this infers that the use of developed workbook improved the proficiency of the learners in solving word problems involving Linear Equations in One Unknown. Similar to a descriptive and experimental study conducted by Ebuk and Bamijoko (2016), they have concluded that integrating Math workbooks as a teaching tool is beneficial to Mathematics learners and helpful to teachers. The researchers discussed that the use of workbook is a great help in understanding basic concepts in Mathematics and increases the performance of the learners in Math through observing their achievement test scores.

Table 3. Difference Between the Pretest and Posttest Mean Scores of Grade 7 Students in the Control Group

Control Group	Mean	t computed	p-value	Remark
Posttest	3.20	12.698	.000	Significant
Pretest	0.55			

Table 3 presents the difference between the means of the pretest and posttest mean scores of Grade 7 students of the control group. Results show that there is a significant difference between the means of the pretest scores ($\bar{x} = 0.55$) and posttest scores ($\bar{x} = 3.20$) of the control group. The outcome reveals a **significant difference** between the tests ($t = 12.698$, $p = 0.000$), which implies that there has been a substantial increase in the proficiency of the learners through the traditional method of teaching word problems.

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It is noticeable that though revealing a significant difference between the tests, the mean score of the control group after delivering the lesson does not go anywhere near the passing score. Additionally, the teacher agreed to the anecdotes of Carlson and Winquist (2011), in their own experimental research, that individual interaction between the teacher and the learners were less through the lecture method of teaching Mathematics compared to the teaching approach with a workbook as a supplement.

Table 4. Difference Between the Pretest and Posttest Mean Scores of Grade 7 Students in the Experimental Group

Experimental Group	Mean	t computed	p-value	Remark
Posttest	6.45	22.123	.000	Significant
Pretest	0.60			

It is notable in Table 4 that there is an increase between the means of the pretest scores ($\bar{x} = 0.60$) and posttest scores ($\bar{x} = 6.45$) of Grade 7 students in the experimental group. Consequently, a **significant difference** has been remarked by this outcome ($t = 22.123, p = 0.000$). This implies that using the developed workbook is effective in improving the proficiency level of students in solving word problems involving Linear Equations in One Unknown.

A workbook, as discussed by Oliver, Herrington, and Omari (2001), have served well in supporting learner-centered independent learning. This statement was also in accordance with the observation of the teacher as learners were more enthusiastic in accomplishing homework and reviewing previous lessons. This also agrees in a paper authored by Campbell (2010) stating that developed and evaluated printed instructional materials can provide self-directed and self-paced learning. Irrefutably, learning resources such as a workbook may allow the educational process more meaningful and exciting.

Table 5. Difference Between the Mean Gain Scores of the Experimental and the Control Group

Group	Mean	t computed	p-value	Remark
Experimental	5.85	9.502	.000	Significant
Control	2.65			

Table 5 presents the difference between the mean gain scores of the two groups. T-test revealed that there is a **significant difference** between the mean gain scores of the experimental ($\bar{x} = 5.85$) and control group ($\bar{x} = 2.65$) with $t = 9.502, p = 0.000$. This shown that the use of developed workbook elicited higher scores than the traditional method of teaching word problems involving Linear Equations in One Unknown. The outcome supported the notion of Herbst (2011) that printed instructional materials are useful resources in education and facilitate experiences in Mathematics lessons.

As a final point, to sustain the function of a school organization, communication, well-thought decision-making, and creative strategizing are the essentials. Even outside the classroom situation, workbooks were also used to keep an organization up and going. Workbooks give artistic strategic thinking that helps people overcome biases and shortcomings. When these materials are employed efficiently, the organization is said to have a blueprint towards their goals and objectives (Lieberman, 2011).

Experiences of Students in Using the Developed Workbook

To gather the experiences of the students who used the developed workbook, a focus group discussion (FGD), with six (6) participants from the experimental group, was conducted and the following are the excerpt of some of the learners' responses to the highlighted questions:

Was the workbook useful to you? How so?

"Yes, because I learned so much about age problems. Natulungan po ako nito dahil nandoon and mga examples na naka-step by step."

Arnold Nico G. Guinat, Grade 7

"Yes, because it helped me as a guide in solving word problems. I was also motivated to think well especially on problems which are really hard."

Trixie Marie D. Dela Peña, Grade 7

Which part of the workbook was the most helpful for you?

"The part of the workbook that was the most helpful to me is the Examples presented in every unit. It served as my guide to answer different word problems."

Princess Nicole Moreno, Grade 7

"For me, the most helpful part of the workbook is the unit about number problems. It helped me to think creatively for the problems challenged me as a problem solver because it has so many problems to exercise my skills!"

Trixie Marie D. Dela Peña, Grade 7

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Will you recommend using the workbook to other learners? Why so?

“Yes, because I learned a lot about word problems because of this book. I want to share it to many learners like me. This workbook can help many students to improve their skills in solving word problems.”

Princess Nicole Moreno, Grade 7

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the findings, the following conclusions are formulated:

The experimental and control groups have almost the same pretest mean scores before the intervention which was described as **very low**. After the intervention, the use of a developed workbook and traditional method of teaching have both increased the proficiency level of the students in solving word problems involving Linear Equations in One Unknown to **high** for the experimental group and **low** for the control group. With this, the use of developed workbook was identified to be more effective in improving the students' proficiency level in solving number, age, work, geometry, and rate, distance, & time word problems compared to the traditional method of delivering such lessons. Lastly, learners who experienced using the developed workbook found it useful as the workbook presents sufficient information about the process to successfully solve word problems, it has many practice problems, and they would not waver to endorse the material to other learners.

Recommendations

Based on the findings and conclusions, there were recommendations made; primarily, the “Workbook in Word Problems Involving Linear Equations in One Unknown” can be used in as supplementary material in teaching Mathematics for Grade 7 learners. As emphasized by Dancza, Copley, Rodger, and Moran (2016), a workbook provides learners additional learning resource and highlights the application of concepts with practice. Henceforth, topics with fundamental concepts in Grade 7 Mathematics can also be added in the workbook for learners' use. Moreover, Mathematics teachers must be heartened and able to prepare engaging materials in teaching simple and complex topics in Mathematics since many of teacher-prepared materials are tested and confirmed to aide learners master competencies. Also, school administrators should be willing to provide support to the initiative of teachers to develop instructional materials such as the workbook. Lastly, the developed workbook is commended for possible use in a Mathematics learning space as a supplemental teaching-learning material.

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