



Project BT's (Brain Teasers) and Students' Performance Through Problem-Solving

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Rene B. Molina Jr., LPT, M.Ed

Department of Education, Division of Sagay, City Negros Occidental, Philippines

ABSTRACT

The purpose of this study was to determine the performance of students in Sagay National High School through problem-solving with the integration of brain teasers. A quantitative approach was used to answer the problem presented. Two sections were chosen purposively from grade 8 regular students to be the participants of this study and were classified as control and experimental group. They were given pretest and posttest to determine if there is an improvement in the performance of students. To answer the goal of this study, the researcher utilized different statistical tools, such as mean, paired sample t-test, and ANCOVA. The mean gain of the experimental group is 3.43 which is significantly higher compared to the mean gain of the control group which is only 1.2. It also shows that the experimental group increased in post-test scores by 46.41% and only a 16.81% increase in the post-test scores of the control group. Based on the data gathered, analyzed, and presented, the researcher, therefore, concluded that the integration of brain teasers was successful since there was a significant difference in the post-test scores between the control and experimental group. It was seen that the integration of brain teasers in modular distance learning modality was effective for students during the pandemic. This study may serve as a basis for science supervisors and school heads to craft lessons with the integration of brain teasers as an enhancement to the performance of students in problem-solving in modular distance learning modality as it was seen as effective.

Keywords: brainteasers, student's performance, problem-solving

INTRODUCTION

Background of the Study

Skills in solving problems are very important in helping a person solve issues rapidly and efficiently. It's what employers desire for every job applicant since employees with these sets of skills tend to be independent.

According to Doyle (2020), problem-solving skills demand rapid identifying of the root issue and implementing a solution. That is why teachers prepare students to be equipped with knowledge and a set of skills that will get them a job in the future.

The ability to solve problems is crucial in every element of life, and engaging in problem-solving activities in the classroom can help prepare students for tackling actual difficulties in practical settings. One of the most valuable abilities a person can develop in life is the ability to thoroughly assess a situation, gather details, and then craft an implementable solution, whether in their social connections, workplaces, or educational settings (Swarnika Pallavi, 2020). On the other hand, word problems tend to be complex sometimes because of their descriptive language. Learners frequently do not understand what exactly they are being asked, particularly when a word problem includes abstract ideas. Other challenges also arise when learners have poor foundations in math and are unable to come up with a plan for solving or classifying an equation's steps (Masullo, 2017).

Teachers are already exhausting different strategies to enhance the problem-solving skills of each student. They used varying interventions they believed to be helpful for their students in handling word problems. One of the interventions that the researcher believes, is that Brain Teasers will sharpen students' cognition and help them acquire or enhance skills that would be very helpful in dealing with word problems. A brain teaser is a form of a puzzle that often requires an unconventional way of thinking to solve. It has been exposed to us since our childhood. Brain teasers are often given to us by our teachers as enjoyable activities in school to help students sharpen their minds while having a fun experience with their fellow students. (Morales, 2010).

The researcher also believes that the integration of Brain Teasers is helpful not just in problem-solving but also in learning as a whole. According to Morales (2020), "When you exercise your mind in solving different kinds of puzzles, it gives you the ability to think quickly. When you solve different kinds of puzzles habitually, your mind becomes stronger and sharper. Regular engagement with brain teasers helps improve your problem-solving skills, your memory, and your ability to learn.

Objectives of the Study



This study aimed to determine the effectiveness of brain teasers on the performance of Grade 8 students through problem-solving.

Specifically, the study sought to answer the following objectives.

1. What are the pre-test and post-test scores of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group)?
2. Is there a significant difference between the pre-test and post-test scores of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group)?
3. Is there a significant difference between the posttest scores of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group)?

Hypotheses

Below are the hypotheses of the study.

1. There is no significant difference between the pre-test and post-test scores of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group).
2. There is no significant difference between the post-test scores of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group).

Theoretical Underpinnings

As learners go through the various grade levels in school, there is always one constant: Word problems. Whether students are learning chemistry, biology, physics, etc., word problems always play a role. Teachers also have an important role in widening their perspectives in terms of using strategies that would help students in handling word problems. This study focused on using an intervention that would enhance students' ability to solve word problems.

A person builds new information based on their experiences through the processes of accommodation and assimilation, in accordance with Jean Piaget's constructivist learning theory. By integrating new knowledge into an existing structure without altering that structure, a person assimilates. This may happen when individuals' experiences are aligned with their internal representations of the world. Reframing one's mental picture of the outer world to accommodate new experiences, in accordance with Piaget. When we act based on the belief that the world operates in a certain way and our expectations are not met, we frequently fail. However, by accommodating or accepting this new experience and reorganizing our model of how the world functions, we are able to learn from our own failures as well as those of others.

The researcher believes that brain teasers as an intervention would have a great contribution to students' experiences that would be very important in constructing new knowledge that would help them in dealing with word problems.

Review of Related Literature

This part presents related concepts and studies, which gave the researcher background information relevant to the investigation.

Problem-solving Skills

Problem-solving skills are vital to all aspects of life, giving students activities that enhance their ability to solve even basic word problems will make them ready to solve real-life challenges. One of the most important life skills one can learn is how to analyze a situation critically, identify its root cause, and come up with a workable solution, whether at school or at home. By assigning them word problem exercises in class, you can introduce your pupils to word problems from an early age. Such activities stimulate social and cognitive advancement and can give pupils the tools they'll need to address and solve challenges for the rest of their life (Swarnika Pallavi, 2020).

Underlying Issues with Word Problems

Every teacher is aware that they have imparted the fundamental abilities needed to solve word problems. Additionally, these abilities are included in the school's curriculum and are also given examples in literature. Through their performance in the classroom, the students themselves have demonstrated that they have mastered these fundamental competencies. Teachers have also provided examples of how these fundamental abilities can be put to use in word problem-solving. However, many pupils still struggle to learn this approach.

Teachers and learning theorists are turning to technology tools, specifically software, to teach word problems in an effort to solve this issue. Teachers enquire as to whether some abilities, like answering word problems, can be taught. After all, professors can model countless numbers of word problems, but when it's time for students to work on them on their own, they must read and comprehend the question, determine what is being asked, establish a process, and then follow it. Students frequently encounter word problems that are different from those they encounter in class. The pupils will have to forecast utilizing their prior knowledge and experiences (Masullo, 2017).



Brain Teasers as a Tool to Enhance Cognition

A brain teaser is generally defined as a form of a puzzle that frequently requires an uncommon way of thinking to solve. Almost everyone is exposed to these from a young age. In school, teachers would usually have brain teasers to exercise the minds of the students while having a great bonding time with their classmates.

Every time you solve different kinds of brain teasers, it is like working out your brain, and it enhances your ability to think quickly. When you regularly engage in physical activity, your muscles become stronger, you can maintain physical activity, and your body as a whole gets better and stronger. The same thing occurs to your brain; when it is subjected to brainteasers, it grows stronger and more shaped. Regularly solving brain teasers enhances your memory, problem-solving abilities, and learning capacity. The majority of us mistakenly believe that reading is sufficient for mental exercise. Regularly completing brain teasers will be a huge aid because it needs to be challenged (Morales, 2020).

Synthesis

Information stated in the related literature had helped the researcher in understanding and grasping a general view of brain teasers as a tool to enhance students' ability in solving word problems. Problem-solving skills are important in every industry. Even in school where word problems are always on the way, these skills are essential in students' academic performance.

Word problems always play a role not just in our everyday lives but also in students' studying stage. Undeniably, most of the students are facing challenges when they encounter word problems most especially to those who lack basic problem-solving skills.

According to several studies, brain teasers are good exercises to sharpen the mind and enhance an individual's ability to learn. Regular brain teasers test your ability to think creatively in order to solve them. Your brain somehow develops the ability to think rapidly and from multiple perspectives, and this aids one in solving challenges encountered in daily life.

RESEARCH METHODOLOGY

This section presents the research design, research participants, research instrument, instrument validation, procedure on the gathering of data, and statistical analysis used in conducting the study.

Research Design

In this study, the researcher used quasi-experimental research. The purpose of a quasi-experimental design is to demonstrate the causal connection between an independent and dependent variable (Thomas, 2020). Likewise, the said design is appropriate for this study to determine the significant differences between the scores of the control and experimental group when taken as a whole, and in terms of pre-test and posttest. In finding the performance of the students through problem-solving, descriptive statistics was used. For significant differences, inferential analysis was used.

Respondents of the Study

The focus of this experimental research was to determine the effectiveness of brain teasers on the performance of Sagay National High School Grade 8 students in science through problem-solving.

The participants of the study were the two sections of Grade 8 of Sagay National High School officially enrolled during the School Year 2021-2022. The two groups (controlled and experimental groups) were determined through purposive sampling. The researcher administered a test taken from modules released by the Department of Education to the participants of the study

Research Instrument

The study utilized a test taken from modules released by the Department of Education. The said test only focuses on word problems during the first and second grading period. The researcher chose the word problems from the previous grading periods (first and second) to make sure that the topics from the test were already taken up by the respondents. This ensures that the setup was controlled and the only variable that could affect are the brain teasers.

Validity of the Data Gathering Instrument

To determine the validity of the research instrument, the researcher adapted the Content Validity Ratio devised by Lawshe (1975). The validity of the research instrument was established by the five validators who were considered experts in the field of science. They are Maricor C. Rochar, MEd, Sherah S. de los Santos, RN, MEd, Fergem Anne C.



Flores, MEd, RJ L. Batangas, MEd, and Rosa C. Yanoc, MEd. The evaluation instrument formulated by Lawshe was used in providing numerical ratings which resulted in a computed alpha of 1.00 which further means that the instrument is valid and appropriate for its purpose in the study. Suggestions and comments were also considered for the improvement of the instruments.

Reliability

In testing the reliability of the research instrument, pilot testing was conducted on other groups of students who have the same characteristics as the participants. The result was then analyzed using the KR-20 test of reliability. The research instrument obtained a reliability score of 0.802. According to Kim (2021), a KR-20 score above 0.70 is generally considered to represent a reasonable level of internal consistency reliability. This further means that the instrument was reliable.

Data Gathering Procedure

Pre – Implementation

The researcher obtained the necessary measure and protocols with regards to the conduct of the study. First, the researcher chose a topic of his interest. The main objectives and the specific questions were formulated so that the researcher was guided on the flow of the study. Next, the participants of the study were identified and were given a letter of consent. After the participants were identified, the researcher proceeded in the making of research questionnaire appropriate for the study.

Implementation

Upon the approval of the conduct of the study in Sagay National High School, the researcher administered the test questionnaire to the participants. Instructions were given clearly so that reliable and honest responses can be acquired from participants. Ethical considerations were given attention by the researcher. After the participants answered the test questionnaires, the researcher retrieved them and sought the assistance of the statistician to treat and analyze the gathered data.

Post Implementation

The statistician made an appropriate and accurate statistical treatment on the data obtained. Each question on the statement of the problem was answered. After analyzing and interpreting the data, findings and results were revealed to the researcher. Conclusions were made based on the results as well as recommendations were formulated from the conclusions so that possible issues and concerns with regards the study were properly addressed.

Data Analysis

The following statistical test were employed by the researcher in answering the different questions about the study.

For problem 1, the mean or the median scores of the Pre-test and Posttest of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group) was used to determine the performance through problem-solving before and after the intervention.

For problem 2, Paired Sample T-test was utilized to determine the significant difference between the pre-test and posttest scores of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group).

For problem 3, Paired Sample T-test was utilized to determine the significant difference between the posttest scores of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group).

Ethical Considerations

In order to undertake any kind of research, ethical factors must be taken into account. Ethics ensures that no one's rights are abused and that the study being done is open and has no ulterior motives (Bhasin, 2020).

For the researchers and participants, upholding ethical standards and principles provides several benefits. First, they supported the overall goals of the study, such as the pursuit of knowledge and the desire to steer clear of mistakes. Second, ethics foster virtues like respect, trust, and accountability that are essential for productive teamwork. Thirdly, they play a crucial role in ensuring that researchers are held accountable to societies and communities, which in turn fosters public confidence in and support for research (Boyland, 2020). For that case, the researcher made considerations of ethical issues in this study at each stage.

All participants in the study were given a thorough explanation of its objective by the researcher prior to data collection in the field. The researcher was explicit that the study's sole intent was academic and that it would not affect participants' daily lives or employment in any way, positive or negative. The study did not identify the participant's demographic details, and the data they supplied were treated and kept confidential. The study's



participants were advised that their participation was entirely voluntary and that they had the right to revoke their consent at any time.

The participants were also given the assurance that all written data would be destroyed as soon as the study's report was turned in. No one other than the researcher and adviser, when needed, would have access to the information during the whole report-writing process. Lastly, the researcher asked all the participants to freely sign the letter of consent which contains that they agree to be one of the participants in the study.

RESULTS AND DISCUSSION

This section presents the results or findings of the study about "PROJECT BT's (Brain Teasers) and Students' Performance through Problem Solving" after quantifying and analyzing the data gathered with the use of statistical tools. The discussions about the analyzed data and table that corresponds to are also presented to answer the objectives of the study.

Performance of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group) During Pretest and Posttest

Table 1
Performance of the Control and Experimental Group during Pretest and Posttest

VARIABLES	CONTROL (n = 44)		EXPERIMENTAL (n = 44)	
	Mean	Standard Deviation	Mean	Standard Deviation
PRETEST	7.14	2.43	7.39	2.32
POSTTEST	8.34	2.27	10.82	2.15

Table 1 shows the performance of Grade 8 – Quartz (Control Group) and Grade 8 – Granite (Experimental Group) during the pretest and posttest. Based on the data gathered from the participant's responses, the pretest scores of Grade 8 – Quartz (Control Group) got a mean value of 7.14 and the posttest scores got a mean value of 8.34. The pretest scores of Grade 8 – Granite (Experimental Group) got a mean value of 7.39 and the posttest scores got a mean value of 10.82. This was also supported in the study conducted by Fatih (2016) where the experimental group had a higher post-test mean compared to the control group. In the same study, it was also seen that the posttest mean was higher compared to the pretest mean of both groups (control group and experimental group). Furthermore, the mean value obtained from the pretest scores and posttest scores of Grade 8 – Quartz (Control Group) has a mean difference of -0.963. On the other hand, the mean value obtained from the pretest and posttest scores of Grade 8 – Granite (Experimental Group) has a mean difference of -3.020, indicating that there is a 16.81% increase in the posttest scores of Grade 8 – Quartz (Control Group) and a 46.41% increase in Grade 8 – Granite (Experimental Group). This implies that after the intervention was imposed, there was a big increase in the posttest scores of Grade 8 – Granite (Experimental Group). The integration of brain teasers as an intervention is highly effective.

The above statement concurs with the study of Altun, et al. (2016) where it was found that all experimental groups showed a significantly higher difference when compared to the control group. Thus, the experimental method applied in all experimental groups was more effective than the control group.

Table 2
Significant Difference Between the Pretest and Posttest Scores of the Control Group

VARIABLES	t-stat	p-value	Interpretation
Pretest – Posttest	-10.054	0.000	SIGNIFICANT

*Mean Difference is Significant at 0.01 level

Table 2 shows the significant difference between the pretest and posttest scores of Grade 8 – Quartz (Control Group). Based on the gathered data, Grade 8 – Quartz (Control Group) got a p-value of 0.000 which was interpreted as "Significant". This indicates that there is a significant difference between the pretest and posttest scores of the control group.

This was agreed by the study of Kuzu (2020) on Mind Games wherein it was found out that there is a significant difference in the control group.



The above statement was negated by Altun et al. (2016) where it was seen that there was no significant difference between the analysis results applied to compare the pretest and post-test scores of the control group.

Table 3
Significant Difference Between the Pretest and Posttest Scores of the Experimental Group

VARIABLES	t-stat	p-value	Interpretation
Pretest – Posttest	-16.816	0.000	SIGNIFICANT

*Mean Difference is Significant at 0.01 level

Table 3 shows the significant difference between the pretest and posttest scores of Grade 8 – Granite (Experimental Group). Based on the gathered data, the pretest and posttest scores of Grade 8 – Granite (Experimental Group) got a p-value of 0.000 which was interpreted as "Significant". This indicates that there is a significant difference between the pretest and posttest scores of the experimental group.

This was agreed by the study of Ekiz (2016) where the result of the analyses was seen that the t value obtained with regards to the difference between mean scores was significant.

The above statements were negated by Altun et al. (2019) where it was found that there was no significant difference in the result of the pretest between the experimental and control group.

Table 4
Significant Difference Between the Posttest Scores of the Control Group and Experimental Group

VARIABLES	t-stat	p-value	Interpretation
Control – Experimental	0.729	0.000	SIGNIFICANT

*Mean Difference is Significant at 0.01 level

Table 4 shows the significant difference between posttest scores of Grade 8 - Quartz (Control Group) and Grade 8 – Granite (Experimental Group). Based on the data gathered, the control and experimental group got a p-value of 0.000 which was interpreted as "Significant". This means that there is a significant difference between the post-test scores of the control and experimental group.

It was seen in the study of Kapri (2017) wherein the posttest score of the experimental group was higher compared to the control group which shows the significance of the study.

The above statement was negated by the research conducted by Bulut (2019) where he concluded that although the posttest scores of the experimental group were higher compared to the control group, the difference in the outcome of the test result was not statistically significant.

Discussion

The primary objective of this study was to examine the impact or the effect of brainteasers on students' performance through problem-solving. Specifically, the study sought to compare the performance of the control and 8 - Granite (Experimental Group) before and after the intervention was implemented. The study also sought to assess whether there was a statistically significant difference between the students' scores before and after the intervention.

In response to the research questions stated in this study, the results showed that the weekly integration of brain teasers in printed modular distance learning had a significant impact in students' performance through problem-solving. The mean score results of the experimental group (Grade 8 – Granite) with intervention (brain teasers) revealed that they performed significantly better compared to the control group (Grade 8 – Quartz). Thus, the integration of brain teasers to enhance the performance of the students through problem solving is proven to be effective.

According to Lee (2022), the ability of the student in problem-solving, memory, and learning is improved substantially by solving brain teasers regularly. Another study that supports the result of this study is The Effect of Brain Teaser Games on the Attention of Players Based on Hormonal and Brain Signals Changes by Aliyari et al (2021) where findings suggest that "Brain teaser games positively influence the central nervous system and activate the stress pathway, resulting to changes in brain signals and subsequently increased cognitive components, such attentiveness among players".



On the contrary, there were also studies that opposes the findings of this study.

CONCLUSION

This study investigated the effect of brain teasers on the performance of students through problem-solving. The findings of this study showed that integrating brain teasers to enhance students' performance through problem-solving is quite successful. As seen in the data, the pretest scores of Grade 8 - Quartz (Control Group) and Grade 8 - Granite (Experimental Group) were almost the same. It means that in terms of their performance through problem-solving using modules alone, both groups' performance is almost identical. On the other hand, the post-test scores generated a different result. Although both groups increased in the test result, grade 8 granite (experimental) has a remarkable increase compared to grade 8 quartz (control). Pretest and posttest results for both groups have significant differences however, the experimental group with the integration of brain teasers had a more noticeable increase in scores compared to the control group. Based on the results and analyzed data, the researcher therefore concluded that there is a significant difference in the posttest scores between control and experimental group. It was determined that integrating brain teasers in printed modular distance learning was effective for students during the pandemic. Even with less supervision from teachers, brain teasers helped students develop skills that enhanced their performance through problem-solving. Thus, the result of this study revealed that the integration of brain teasers in printed modular distance learning to enhance performance through problem-solving was proven to be effective.

This study proposes a new vision to the Department of Education, especially to science supervisors and science head teachers to plan and create lessons that incorporate brain teasers as an enhancement tool in printed modular distance learning as it was determined to be effective for students. This study can also be used as basis for school heads and science department heads to craft LAC sessions as to the integration of brain teasers to printed modular distance learning students.

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