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Enhancing Understanding Skills of the Students through Content-Based Recreational Activities

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ABSTRACT: This research determined the effects of content-based recreational activities in enhancing the understanding skills of students in terms of skill-algorithm, properties principles, and use and application. This also assessed the significant difference in the pretest and posttest scores of the students. Moreover, the researcher used the descriptive and pre-experimental research design among the 82 grade 7 students. Validated pretest and posttest questionnaires revolved around the topic of operations of polynomials and were scored using a rubric. Survey questionnaires were also given to students on the perception of the students using games and puzzles as recreational activities. Frequency, percentage distribution, independent t-test, and paired t-test were utilized to statistically analyze the data. Findings revealed that there is a significant difference in the posttest scores of respondents in skill algorithm, properties principles, and used and application skills when tested to $p<.05$. However, there is no significant relationship between the perception of the students on the use of content-based recreational activities to understanding skills of the students. The research recommended using the recreational activity plan, especially the content-based recreational activity strategy, to improve the Mathematical Understanding Skills such as skill-algorithm skills and properties principle skills of the students.

KEYWORDS: content-based recreational activities, understanding skills

THE PROBLEM AND ITS BACKGROUND

INTRODUCTION

A distinctive subject and an essential component of the school curriculum is Mathematics. It serves as a tool for the advancement of every other Science. Whether we know it or not, we use Mathematics in many aspects of life, but this subject prevails many negative emotions. Most of the students find it difficult to understand and have a hard time figuring out the solutions to the problems revealed in their module. It is also noteworthy that students don't like mathematics due to boredom, self-efficacy beliefs, and task value beliefs. In this case, one of the main challenges to mathematics teachers is to create a positive attitude in students toward learning mathematics. Even so, there may be some abstractions in mathematics. However, it is the math instructor's responsibility to generate enough interest in classroom activities to prevent the perception of mathematics as a dry and tedious subject. The curriculum and textbook, which instruct the instructor to use recreational activities for good and successful mathematics learning, are the major tools to address all these and turn mathematics into a loved and pleasurable topic for everyone. Therefore, Teachers should be aware of students' beliefs and interrelations of those in learning mathematics to employ more effective teaching strategies and improve students' mathematics learning by reducing their negative beliefs (Gafoor,2015).

Recreational activities play a significant part in the learning of mathematics, the development of a variety of problem-solving skills, and the growth of logical and creative thinking. The educational usefulness of recreational mathematics is now widely acknowledged, which benefits math underachievers by reducing their fear-psychosis of the subject and turning them into math lovers. All of mathematics is beautiful to someone who loves it. One finds a vast reservoir of joy when a mathematical issue is successfully solved. The mandatory but fascinating fundamental topic of mathematics is taught in schools. Making mathematics entertaining is largely due to recreational mathematics. Experience has shown that mathematical modeling can facilitate understanding the fundamental concepts in mathematics. (*Recreational Activities in Developing Mathematics Learning | Dr. V.K. Maheshwari, Ph.D*, n.d.)

Moreover, Content-Based Instruction (CBI) refers to teaching second languages in which the lessons are structured around the knowledge or skills the students will learn rather than a linguistic or other kind of syllabus. Both in language instruction and in popular culture, the term content has gained popularity. Although the term content has many implications in language learning, it is most often used to refer to the material or subject matter we learn or express through language rather than the language itself.

Enhancing Understanding Skills of the Students Through Content-Based Recreational

Language training initiatives that prioritize meaning are not new. Suggestions enabling translation, explanation, and definition, as well as strategies fostering demonstration, imitation, miming, and using objects, photographs, and multimedia presentations.

Students' engagement in mathematics is not always easy, and most students do not enjoy mathematics as a course of study. When most students dislike mathematics, it can be difficult to engage them in it. Developing pupils' critical thinking and problem-solving abilities was a dual priority of the Philippines' mathematics curriculum (DepEd, 2016). Despite strongly emphasizing mathematics in the curriculum, the Philippines has one of the lowest PISA 2018 scores (National Report of the Philippines, 2018). PISA measures students' ability to think critically and solve problems in math, Science, and reading. The test questions ask students to use their knowledge and practical problem-solving skills rather than memorizing information (Vitangcol, 2019). This finding indicates that, compared to other pupils in the world, Filipino students have poor critical thinking and problem-solving abilities.

Based on the results of international studies such as the National Research Council (NCR), In comparison to other countries, American students scored poorly. One of these reports is prompted by the No Child Left Behind legislation, which says that all children must perform at the proficient or advanced level in mathematics based on state-wide assessments. As a result, mathematics education is at the top of the national policy agenda to enhance American students' mathematics skills, particularly those in upper elementary and middle school grades who require the greatest attention (NCR, 2009). The same issue has been identified in mathematics instruction in Philippine schools.

Mathematics educators have exerted efforts to claim interest in the study to meet the problems of mathematics learning. According to Carandang (2006), the request for excellence is one of the fundamental aspirations of a developed society. The search for ever-expanding attainment of basic education appears to be a basic instinct of mankind. The desire for excellence pervades every aspect of human life. This, more so, is sought in education. The goal of quality education is based on the nature of the learners, the nature of the curriculum, the nature of the professional staff, and the outputs of the learners are brought through changing the environment. Qualities must be viewed in terms of outcomes. The educated person should display specific competencies in specific areas. Those include changes in mathematics teaching and instructional outcomes.

A good example of easing this connotation in mathematics is recognizing appropriate tools such as manipulating resources, measuring equipment, calculators and computers, smartphones and tablet PCs, and the Internet. (K-12 BEC Module,2016). Moreover, Bloom's Taxonomy (1956) discussed that the level of learning that students can acquire varies across learning experiences and depends on the nature of the experience, the developmental levels of the participating students, and the duration and intensity of the experience that students can acquire.

Therefore, the researcher used content-based recreational activities in teaching mathematics to help students enhance mathematical understanding skills to engage in mathematics daily. Thus, its value goes beyond the classroom and the school; therefore, it must be learned comprehensively and with much depth.

The researcher, a Junior High School Mathematics teacher in a public secondary school in the district of Infanta, Division of Quezon, teaching Mathematics 7, deemed it important to help address the concern of every school head and teacher to improve the students' understanding skills in mathematics. The researchers believe students' understanding skills are enhanced by using content-based recreational activities as instructional tools. These recreational activities were one of the answers on how to develop the understanding skills of the learners. They helped them focus on the important information within the understanding skills that promoted effective learning. Those aids greatly impact a student to be a more proactive participant in a life-long learning process. It also provided the necessary framework for students to complete a task meaningfully by helping them to solve the problem step-by-step, identify the mathematical identities/properties used in the problem, apply them, and so much more.

BACKGROUND OF THE STUDY

Mathematics is an essential topic in the school curriculum and is vital in both daily life and the study of other subjects. However, it is widely held that most students hate mathematics due to various variables relating to instruction and learners' interests in the subjects (Gafoor,2015).In the revised K to 12 Curriculum, Mathematics for Grades 7 to 10 provides a solid foundation for Mathematics for Grades 11 to 12. More importantly, it provides necessary concepts and life skills needed by Filipino learners as they proceed to the next stage in their lives as learners and as citizens of the Philippines. It can also be seen that Mathematics from K-10 is a skills subject (K to 12 BEC, 2013).

Moreover, educational reforms may address the present status of Mathematics instruction, especially the performance of fourth-year students in the Division of Quezon province in the National Achievement Test during the school year 2014-2015. Langgas National High School has a Mathematics MPS of 33.43%. The data reveals that the results of the MPS seem abreast of the standard passing rate, which is 75% and the lowest among subjects taken by the students. It also shows that students struggle to understand mathematics's basic concepts and vital elements.

According to Idulsa (2017), Learners differ in learning readiness, interest, and learning preferences, which should be considered when planning lessons for varied instruction. Tomlinson explained that readiness is a student's attitude toward the task, as seen by the teacher. Students' readiness corresponds to their current skills, resulting in growth. The learners' interest is a potent motivator

that plays an important part in selecting the activity and how it will be carried out in the classroom since it piques their curiosity and passion. Finally, students' learning preferences should be highlighted because kids learn best when they study in their preferred manner.

Concerning this, the researcher wants to use content-based recreational activities as instructions to grade 7 students who are mostly learners simply being high-energy or enjoying physical activity, preferring to move around a lot and not to sit still. They like to do things rather than read about them, don't enjoy reading, may have trouble understanding what they've read. It is observable that the grade 7 students in the school are very playful in different academic subjects. However, during the time of Mathematics, they are very quiet, which resulted in poor understanding of the students do not focus on the classroom discussion and the mindset is on different recreational activities like mobile games, sipak, teks, habulan, bunong braso, etc. due to two years of staying home brought by the pandemic where interacting with peers is also stopped.

Despite its strategic location where internet access is limited, the school continuously assesses and upgrades its facilities, services, faculty members, and specialized instruction for the realization of the aim of the Department of Education to create a globally competitive graduate. The school also adopts the battle cry of its division, Bawat Bata Kinakalinga, to address individual differences and provide services for all students' holistic development and well-being through quality teaching, which is necessarily student-centered to help most students.

In this case, the teachers are constantly improving and innovating their teaching tactics and instruction to meet their students' diverse requirements and ensure that students are effectively progressing based on assessments to meet the standards of internationally competitive graduates.

The researcher wished to determine the effectiveness of the Content-Based Recreational activity in teaching mathematics to enhance the understanding skill of the student's subject by assessing the two classes in grade 7. The sections will undergo instruction through content-based Recreational activity as a strategy.

The researcher, being a member of this school, chose the mentioned research to help in the promotion of quality education and provide all potential help in planning and implementation of academic programs of the school for whatever possible help this study may bring.

THEORETICAL FRAMEWORK

This study is anchored in theories, which are Jerome Bruner's Theory of Development: Representation, the Theory of Multiple Intelligences developed by Howard Gardner, and the Visual, Auditory, and Kinesthetic (VAK) Learning Style proposed by Neil Fleming.

Cognitive learning theory and Second Language Acquisition (SLA) research provide the theoretical foundations for Content-Based Instruction. According to cognitive learning theory, students undergo three phases of gaining literacy skills: cognitive, associative, and autonomous. Learners notice and attend to information in working memory during the cognitive stage, eventually creating a poor mental depiction of task requirements. In the associative stage, learners develop and strengthen this representation while still paying attention to rules and occasionally requiring outside assistance when doing the job. Finally, in the autonomous stage, the task representation is refined so learners can do the task automatically and independently. Anderson (1983). Scaffolding facilitates progression through these stages by providing considerable instructional support during the early stages of learning and gradually eliminating this support as students grow more adept at the task (Chamot & O'Malley, 1994; Vygotsky, 1978).

In the Theory of Development by Jerome Bruner, He believed that learning should begin with directly manipulating objects. He also promotes using algebra tiles, coins, and other items that could be manipulated in teaching mathematics. (Jerome Bruner's Theory of Development: Discovery Learning & Representation - Video & Lesson Transcript | Study.com, n.d.).

According to Howard Gardner's Theory of Multiple Intelligences, *intelligence* is the ability to solve problems or create products valued within one or more cultural settings (Frames of Mind: The Theory of Multiple Intelligences, 1983). According to his idea, visual-spatial learners learn best when they are taught via written, modeled, or diagrammed instruction and visual media (The Visual-Spatial Learning Style, n.d.).

However, according to the Visual, Auditory, and Kinesthetic (VAK) Learning Theory proposed by Fleming in the 1920s, most people prefer to learn in one of three ways: visual, auditory, or kinaesthetic. According to him, visually-dominant learners acquire and retain knowledge more effectively when it is given in the form of images, diagrams, and charts. A kinaesthetic learner, on the other hand, craves a tactile experience. They prefer a hands-on approach and benefit from the ability to touch or feel an object or learning prop (VAK Learning Styles - Learning Skills from MindTools.com, n.d.).

Constructivism is the principle of learning by doing, it may be used in the digital age through game-based learning, in which individual students can learn how to solve problems and make decisions by playing games. The interactive tasks can also be changed. According to a Chinese saying, Tell me, and I'll forget; show me, and I may remember. Involve me, and I'll understand. With game-based learning tools, engaged students and workers can relish learning rather than seeing it as a burden (Rapini, Sarina 2012).

Enhancing Understanding Skills of the Students Through Content-Based Recreational

According to Alan Amory, We don't learn from games. We learn through them. Computer games can be effective learning tools when they include social interactions and dialogue among learners and between learners and teachers, and students' performance can consequently be improved (Thato Foko, 2008). Based on social constructivism, game-based learning allows group members to blend their prior experiences in various scenarios with each individual's knowledge.

Elements of the game can be used as rewards since they can condition students to have a specific learning response that will aid in information retention. Based on this notion, these games are known as edutainment and are typically test-oriented. This game style promotes exceptional focus and memory retention (Ladley et al., 2013).

Situated learning in games is the utilization of information in context by creating a setting close to reality so that students can easily transfer the material into the real world (Aristidis Protopsaltis, 2011). Learners will see instant in-game consequences (Trybus, Jessica 2012) that will help them understand the game's learning goals better. The approach highlights the importance of creating authentic experiences in games that will take place in a real-world setting, such as apprenticeship. Such simulations are commonly used in the military, hospitals, and other training facilities.

According to Csikszentmihalyi (1990), this aids in learning during a game when students experience increased focus, intrinsic motivation, a lack of concern for the self, an altered sense of time, and effortless involvement.

The proponent adapted the theoretical idea cited that paved the way for the realization of the study.

CONCEPTUAL FRAMEWORK

The conceptual framework shown that before the application of content-based recreational activities, the pre-test were given to the group of students. After the pre-assessment, the researcher teaches the lesson using content-based recreational activities that enhanced the understanding skills of the students and the post-test were given after the discussion of in the last topic in a unit.

Pretest-posttest designs, which can be utilized with or without control groups, were used in both experimental and quasi-experimental research (Salkind, 2012). The researcher conducted this study to determine the significant effects of utilizing Content-based Recreational Activities in enhancing students' understanding skills in Mathematics 7. It was presumed that the independent variables might influence the dependent variables in this field of endeavor as presented in the following paradigm.

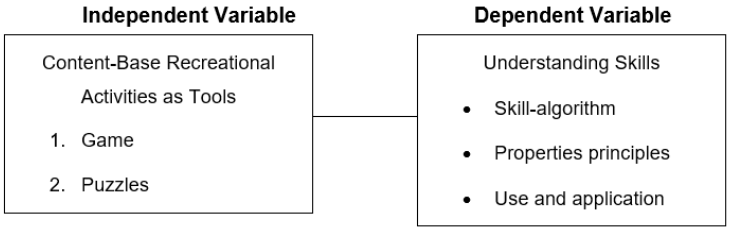

Figure 1. Research Paradigm

STATEMENT OF THE PROBLEM

This study aimed to determine the effectiveness of Content-based Recreational activities in enhancing the understanding skills of students on Mathematics 7 in Langgas National High School for the School Year 2022-2023.

Specifically, it seeks to answers to the following questions:

1. What is the Pre-test score of grade 7 students in Mathematics before exposure to Content-based recreational activity material a to skills:

1.1 skill-algorithm;

1.2 properties principles; and

1.3 use and application?

2. What is the Post test score of grade 7 students in Mathematics after exposure to Content-based recreational activity material a to skills:

2.1 skill-algorithm;

2.2 properties principles; and

2.3 use and application?

3. What is the level of students' agreement on the perception of using content-based creational activities as to:

3.1 game; and

3.2 puzzle?

4. Is there a significant difference between the pretest and post test score of students in mathematics 7?

HYPOTHESES

After careful study the following hypothesis are considered:

1. There is no significant difference between the pretest and post test score of students in mathematics 7.

Scope and Limitations of the Study

The focused of the study were to find out if there is a significant effect on the Content-based Recreational activities in enhancing the cognitive performance of students on Mathematics 7 in Langgas National High School for the School Year 2022-2023.

This study conducted among the 82 Grade 7 students of Langgas National High School.

The researcher conducted posttest among Grade 7 students and employ the content-based recreational activities as instructional material for the study.

Significance of the Study

The following may benefit from the results of this study:

Students. The result of the study may help them use the opportunity to learn with fun with recreational activities at their own speed; develop and enhance skills. This may greatly influence learning by providing students with a meaningful framework to relate existing knowledge to new information.

Teachers. The result of the study may assist them to discover and explore the lessons or the topics. They can make use of the time effectively in other concerns, in aiding those students' needing remediation.

Teachers that use this resource may use it to resolve lessons and connect new concepts to existing knowledge throughout a class, resulting in meaningful learning. At the end of a lesson, students' abilities will be categorized, and structure content can be assessed.

Administrator. The result of the study may help them adapt and utilize the practical information to the different learning along fun learning which is essential for students' success in every curriculum area and academic pursuit.

Researcher. The result of the study may inspire the future researchers to make use of various content-based recreational in teaching not only in Mathematics but the other subjects as well.

This served as a springboard for the next researcher who wishes to explore other facets of recreational activities.

Definition of Terms

In order to understand the study, the following terms will be defined operationally:

Game. It is a type of recreational activity that help the learners understand mathematical concept and develop mathematical understanding skills.

Puzzle. It is a type of recreational Activity that makes the understanding skills in Mathematics develop learning more interesting and developed reasoning and logical thinking.

Recreational Activity. It is an activity help in developing understanding skills in mathematics connections with the content that can form positive attitude towards Mathematics.

Understanding skill. This is the ability of the student to present step-by-step of solving the problem, identify the mathematical properties used in solving the problem, and able to apply the concept in real life scenario that will be discussed through the use of Content-based recreational activities.

REVIEW OF RELATED LITERATURE

This chapter presented the review of related literature and studies that are important to the research for this study and or helped support the stand of the researcher relative to the nature of the subject.

In education, Student engagement in education refers to the level of attention, curiosity, interest, optimism, and passion that students demonstrate when learning or being taught, as well as the level of motivation they have to learn and succeed in their education. When students are actively involved in the class, they learn and retain more. Students who are engaged in their work are more likely to persevere and find satisfaction in completing their assignments (Davis, 2017). Thus, teachers should always search for new and exciting teaching strategies that will keep their students motivated and engaged.

As a result, mathematics as a school subject must be studied thoroughly and thoroughly. In basic education levels K-10, the two primary objectives of mathematics are Critical Thinking and Problem Solving. Scriven and Paul (1987) define critical thinking as the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from or generated by observation, experience, reflection, reasoning, or communication as a guide to belief and action. Polya (1945 & 1962) defines mathematical problem solving as finding a way around a difficulty, around an obstacle, and finding a solution to an unknown problem. These two objectives will be met through a structured and rigorous curriculum content, as well as a well-defined set of high-level abilities. A well-defined collection of high-level abilities and procedures, acceptable values and attitudes, and appropriate instruments, considering Filipino learners' diverse settings. The curriculum includes five core areas based on the framework developed by MATHTED & SEI (2010): Numbers and Number Sense, Measurement, Geometry, Patterns and Algebra, and Probability and Statistics. Knowing and understanding; estimating, computing, and solving; visualizing and modeling; representing and communicating; conjecturing, reasoning, proving, and decision-making; and applying and connecting are the specific abilities and processes to be developed. Accuracy, originality, objectivity, perseverance, and productivity are also important traits and attitudes to cultivate. We acknowledge the importance of

using appropriate tools when teaching mathematics. Manipulative objects, measuring instruments, calculators and computers, and smart phones are examples.

The mathematics curriculum encourages students to learn by asking pertinent questions and finding new ideas. Students learn when they use personal experiences to find facts, relationships, and concepts (Plasabas, n.d.).

On Recreational activities

Recreational mathematics is a sort of optimistic activity that involves mathematical reasoning or skills to participate in. It is typically accessible to a broad spectrum of people and can be used effectively to drive interaction with and deepen comprehension of mathematical ideas or concepts. Recreational mathematics can be used in education to engage students and help them improve mathematical skills, as well as to keep them interested during procedural practice and to challenge and stretch them. It can also make cross-curricular connections, such as to mathematics history. In undergraduate studies for both participation inside traditional curriculum and extra-curricular interest. Aside from that, there are possibilities to build critical graduate-level problem-solving and communication abilities. The design of a curriculum titled 'Game Theory and Recreational Mathematics' is discussed. This allows students enjoyment and play while also developing graduation skills. It covers combinatorics, graph theory, game theory, and algorithms/complexity while constructing a Pólya-style problem-solving approach. The examination of problem-solving as a process is outlined. Student response suggests that students enjoy the module's goals, benefit from the explicit emphasis on problem-solving, and grasp the active nature of the learning. (The Potential of Recreational Mathematics to Support the Development of Mathematical Learning: International Journal of Mathematical Education in Science and Technology: Vol 50, No 7, n.d.).

Recreational mathematics is critical to make mathematics entertaining. Experience has shown that mathematical fun, activities, and games can help students acquire the fundamental principles of mathematics. Mathematics can be made into a game and so become child's play. Classroom experiences clearly show that mathematical puzzles, riddles, and other similar activities create an open-minded attitude in children and aid in the development of clear thinking. Shakuntala Devi rose to prominence by transforming simple mathematical truths into games, puzzles, and other forms of entertainment. Ramanujan is no exception, despite his well-known mathematical accomplishments. In contrast, a large percentage of pupils despise mathematics due to a lack of pleasure and other factors in mathematics textbooks as well as classroom transactions. There is a huge potential for successful mathematics learning at the basic level through recreational games, magic, and other means that not only assist learners overcome fear psychosis but also help them build a clear sense of arithmetic. The investigator in this study explored the place of enjoyment, which is recreational activities in studying mathematics, namely in the classroom and school textbook. This publication highlights the study's findings, notably at the primary level. (dubey, n.d.).

As cited in the study of Sofian & Rambely (2020) The application of fuzzy conjoint analysis (FCA) can be used to measure the effectiveness of game and recreational activity (GaRA). Due of the fuzziness in determining individual perceptions, the analysis was employed. A survey of 1494 children who attended a Mathematics Discovery Camp organized by a UKM research group was used for this study. The purpose of this study is to examine the efficacy of modules offered to build affection and trust in Mathematics through various elements. There were 11 games played for the participants, and their impressions were measured based on the evaluation of six attributes. To collect students' choices for each game and recreational activity module, a seven-point Likert scale approach representing seven language terms was employed. The evaluation using fuzzy conjoint model implicated the successfulness of a fuzzy approach to evaluate fuzziness obtained in the Likert-scale, and has shown its ability in ranking the attributes from most preferred to least preferred.

Moreover, according Van putten et. Al. (2022) This study looked at the performance and attitudes of sixth graders in the mathematics classroom to identify the developmental impacts of cooperative games in the form of game-based worksheets. Games are considered to increase learning by providing pleasurable emotional experiences. Non-digital game-based learning options are available, inexpensive, allow for social engagement while learning, and require little baseline skills. This study investigated the learning potential provided by non-digital, textbook-based game worksheets for math students. In this case study, a quasi-experimental design was adopted, and tests were given before and after an intervention. A statistical analysis of the test results using the Mann-Whitney U-test revealed that the intervention on the subjects of multiplication and division had a beneficial impact. The data also indicate that the collaborative games improved learners' confidence, skills, and understanding of mathematics.

The study by Alanazi (2020) explores the influence of active recreational mathematical games (ARMG) on the math anxiety and performance of first-grade male students. The sample was divided into two groups: an experimental group (N=28) that received ARMG in addition to traditional teaching techniques, and a control group (N=30) that received only traditional teaching methods. The ARMG comprised of 24 sessions spread out over two months. Students were required to attend three 45-minute sessions per week. The results demonstrated a substantial negative association (r=-0.482; p0.05) between students' arithmetic anxiety and performance. Between the experimental and control groups, there was a significant difference (= 0.05) in math anxiety and

performance. The experimental group scored lower on math anxiety and higher on performance than the control group. Taking these findings into account, the study makes various recommendations and ideas for improving math education with ARMG./p.

Wiersum, (2012) This study presents a theoretical approach to studying mathematics teacher knowledge and the circumstances for its development. Following that, some enjoyable activities and games are offered. As a result, this paper provides teachers with information that may be valuable in better understanding the nature of games and activities, as well as their role in mathematics teaching and learning. At the age of ten, students can concentrate for no more than 20 minutes throughout a class. A lesson in primary and secondary schools, on the other hand, lasts 45 minutes and 50 minutes in universities. What a symbiotic relationship! To address this issue, we employ a variety of approaches to capture their attention. Because both children and adults like playing games, we may use games and activities to teach and learn mathematics. Experience has shown that games may be extremely effective learning tools. Are some games superior to others? What educational advantages do video games provide? How can you incorporate games into math lessons? How can you tell the difference between a 'activity' and a 'game'? How might such an approach be used to teach students specializing in electrical engineering and informatics?

Citing the study of Legazpi, Hernandez (2010) in her study discussed the so-called picture mind as an interference tool in teaching a primary level. This shows that there is really an effect among the pupils to retain the lesson in their mind; thus, giving an opportunity for the pupils to develop the thinking skills. When pupils actively participate in the activity, they learn to develop mental images of the system and occurrences. Creating a picture in the mind allows children to add a sense of order and rationality to their observations, as well as engage reasons for change such as mind-on method provides learners the opportunity to grow intellectually and better in their own problem solving and critical thinking.

Moreover, it has been cited by the authors that recreational activities appeared to be an effective strategy to improve critical thinking of the students. When used in classrooms, they provide students with tools to make fun while learning to promote both verbal and non-verbal mode of development. Thus, proper instruction and guide would be needed among students in using these aids. Besides, describing the recreational activities purpose and usage will make these aids more effective strategy in teaching.

Recreational mathematics is a fun way for students to study and understand mathematical concepts. This study demonstrates that implementing recreational mathematics has a substantial impact on learning achievement and motivation. (Aksoy et al., 2017)

Reyes (2015) in his study, Multiple Representation Approach and the Students' Conceptual Skills in Science, focused in the use of Multiple Representation in Teaching fourth year Physics and its effect to the students'' conceptual skills at Col. Lauro D. Dizon Memorial National High School, S.Y. 2014-2015. The researcher used numerical and graphical representation in delivering his lesson in Science as one of the independent variables of the study. He revealed that the use of multiple representation approach is an effective teaching method in enhancing the conceptual skills of the students.

A research by Dimaculangan (2012) entitled Effectiveness of Constructivist Environment in Learning Science 6 attempted to determine the effectiveness of constructivist approaches in teaching and pupils' achievement in elementary science at Crisanto Guysayko Memorial Elementary School in Nagcarlan, Laguna. The study proves that teaching and learning in a constructivist environment using the POE approach was effective. In this study she cited concept mapping as part of the strategy based on the constructivist view of knowledge acquisition. She also stressed an advantage in the use of concept map as it provides a visual image of the concept under study in a tangible form.

A study of Udjaja et al., (2018) The purpose of this study is to merge multimedia components and mathematics learning content to create an interactive math learning application. The Game Development Life Cycle (GDLC) research and design approach was employed, which includes initiation, pre-production, production, testing, and release. The game's content is created using gamification and the expert system concept. This study produced an interactive learning game to help students understand mathematic subjects. The purpose of this program is to assist students learn arithmetic in an interactive and interesting fashion, as well as to distribute math material simply..

Almanza (2014) in her study Textual and Picto-Textual Representational Formats in Assessing Performance in Mathematics of Grade 8 Students at Colegio De San Juan De Letran-Calamba for the Academic Year 2013-2014 determined the effectiveness of textual and picto-textual representational forms of assessment in the performance of 8th Grade Mathematics students at the Colegio de San Juan de Letran-Calamba. The study found out that students assessed using picto-textual such as performed better than those students assessed through textual form.

From the study, In effort to engage secondary school students' awareness towards Science, Technology, Engineering and Mathematics (STEM), the Recreational Mathematics programme is designed. The main objective of this programmed is to promote secondary school students' interest towards Mathematics subject. The success of the Recreational Mathematics program was evaluated through various activities. Data on 91 students was obtained, and 75% of the students agreed that the program administration was successful. More than half of the students were interested in the facilitators' and mentors' manner. They loved learning about this topic through mathematics games and activities. Nonetheless, there will be a hurdle in carrying out this program. It was discovered that 96% of pupils were unaware of the value of STEM and, more especially, the importance of mathematics. These findings indicate that STEM programs, particularly for students in remote areas, should be continued.(Hassan et al., 2021)

Enhancing Understanding Skills of the Students Through Content-Based Recreational

For the purpose of this study, the following are some of the recreational activity utilized to evaluate its effectiveness in teaching Mathematics 7 concepts which are described below:

The role of games in mathematics teaching is to help students develop and reinforce their mathematical skills and understandings in an engaging and interactive way. Games make learning math fun and enjoyable for students, increasing their motivation to actively participate and learn. It provides an opportunity for students to practice and reinforce math concepts, skills, and procedures in a repetitive manner. This repetition helps in consolidating learning and improving retention. This allow students to apply mathematical concepts and skills in real-life or simulated situations, enhancing their understanding of how math is used and its relevance to the real world. Many math games require students to solve problems, make strategic decisions, and think critically. This helps develop their problem-solving skills and logical reasoning abilities.it often involve interaction with peers, promoting collaboration and communication skills. Students discuss strategies, explain their thinking, and engage in mathematical discourse, further enhancing their understanding of math concepts. This can be adapted to suit different ability levels, allowing for differentiated instruction and personalized learning experiences. They can provide a challenging experience for advanced students while offering support and scaffolding for struggling learners.

Games provide a low-stakes environment where students can experiment, take risks, and make mistakes without fear of failure or judgment. This helps build their confidence in approaching mathematical challenges. It can facilitate the transfer of math skills and knowledge to novel situations. By repeatedly applying concepts in different game scenarios, students develop flexibility and the ability to transfer their learning to various contexts. Games promote active engagement and hands-on learning experiences, as students manipulate objects, make decisions, and interact with the game environment. This active involvement increases their understanding and retention of mathematical concepts.

Overall, games play a crucial role in making mathematics teaching and learning more enjoyable, interactive, and effective, ultimately leading to improved mathematical proficiency among students.

The game provides cognitive, emotive, and operative engagement. That is, the game must include a level of difficulty; otherwise, children would become bored and no learning will occur. The game should be entertaining to play and should encourage participation and discourse. Is merely allowing youngsters to play the games sufficient? Certainly not! This is where I start getting serious. If children play a Math game at school or at home without reflecting afterwards, they have likely squandered an opportunity to learn. It is critical that children think about the mathematics involved in the game, the problems they faced, and the methods they used. Often, we don't know if children learned anything while playing a game unless we ask some very strategic reflection questions which can be answered verbally or recorded in written form. (Games for Teaching and Learning Mathematics – Engaging Maths, n.d.)

Puzzle Based Learning is a novel teaching and learning system that focuses on problem-solving skills development. Most of the following requirements are met by these educational puzzles: Generality: Educational puzzles should explain some universal mathematical problem-solving principles. This is quite important. Most people think that the only way to learn problem solving is to solve problems; nevertheless, this activity must be supplemented by strategies offered by an instructor. These broad approaches would enable the future solution of previously unforeseen challenges. Simplicity: Educational problems should be simple to say and remember. These broad techniques would allow for the future resolution of hitherto unanticipated difficulties. Educational issues should be easy to say and remember. This is also important since easy problems increase the chances that the solution strategy (which involves some universal mathematical problem-solving principles) will be remembered. Eureka moment: Educational problems should annoy problem solvers! A puzzle should be fascinating because the solution is counter-intuitive: problem solvers normally start their quest for the solution with intuition, and this method usually leads them wrong... Eventually a Eureka! When the correct way to solving the challenge is recognized (Martin Gardner's Aha!), the moment is achieved. The Eureka moment is accompanied by a sense of relief; the frustration felt throughout the process disappears, and the problem-solver may feel rewarded for their intelligence in eventually solving the challenge. The Eureka factor also means that instructional problems should have simple but not obvious answers. Educational puzzles should be enjoyable; otherwise, it is simple to lose interest in them! Entertainment is frequently a byproduct of simplicity, irritation, the Eureka factor, and a interesting setting (for example, a casino environment, a battle against dragons, or dumping eggs from a tower) (What Is Puzzle Based Learning? – Puzzle-Based Learning, n.d.).

It is suggested here that incorporating puzzles into the teaching of other disciplines improves students' learning by helping them build problem-solving and independent-learning skills while also enhancing their willingness to pursue mathematics. The authors define a puzzle as a puzzling problem that either has a solution that requires substantial imagination - perhaps a lateral thinking solution - or results in an unexpected, even counter-intuitive or seemingly paradoxical solution. Specific puzzle variants may aid student learning, but specificity can also conflict with ideal simplicity, diminishing a puzzle's pedagogical effectiveness. It is difficult to categorize puzzles by level of complexity, whether of the puzzle as a whole or of the underlying mathematics, because this depends on the student's background and experience. Classroom experiences of using puzzles in engineering teaching are described here, with some puzzles that illuminate these issues(Thomas et al., 2013).

Enhancing Understanding Skills of the Students Through Content-Based Recreational

Understanding a piece of mathematics from the perspective of mathematics education differs for the policymaker, mathematician, teacher, and student. The policymaker must comprehend the significance of that piece to the learner at a certain time and location. The mathematician must grasp the possibility for fresh concept invention, consideration of new and previously unsolvable problems, and discovery of new conclusions. The instructor must have a broad awareness of pedagogy, concepts, difficulties, and connections and generalizations of what happens in the classroom. Mathematical activity consists of concepts and problems or questions: we use and invent concepts to answer questions and problems; we submit questions and problems to delineate notions. The student is the central figure in mathematics education, and because well-known treatises on the understanding of problem solving exist, this paper has primarily dealt with the understanding of a concept in mathematics from the standpoint of the student, that is, the learner's standpoint. This understanding, in our opinion, has at least five components. According to this viewpoint, a person has a complete knowledge of a mathematical concept if he or she can deal effectively with the skills and algorithms related with the concept, with the properties and mathematical reasons (proofs) concerning the concept, and with the uses and applications of the concept. Although these aspects are obviously connected when attached to a particular concept, we call them dimensions of understanding because each aspect can be mastered relatively independently of the others. The understanding of concepts, five dimensions are necessary:

The skills-algorithm component of understanding is concerned with the methods and algorithms required to get answers. This dimension encompasses understanding of procedures and algorithms, which Usiskin (2012) and others argue is considerably deeper than what has been dubbed procedural understanding or procedural fluency (see Kilpatrick et al., 2001; Long, 2005). comprehension and ability to do a skill invariably involves a fundamental comprehension of the underlying notion and necessitates a wide range of talents. This aspect of comprehending mathematical concepts is primarily addressed in school classrooms and is found in systematic type assessments.

The property-proof knowledge of concepts is concerned with the fundamental principles of, for example, the number system and operations. It may be claimed that a technique is only truly understood when the mathematical qualities that underpin it can be identified. Knowing the qualities and being able to 'show' that the technique works allows one to confidently apply the procedure to new challenges. We can contrast conceptual understanding with procedural understanding here, however as previously noted, this distinction must be modified.

The use-application knowledge of mathematics is concerned with the practical applications of mathematics. A person may grasp how to conduct a technique and why his way works, but they cannot truly comprehend unless they know when, why, and how to use the skill and procedure. Applications, rather than being higher order thinking, are a different form of thinking, according to Usiskin (2012).

Generally, recreational activities are beneficial in teaching and learning. They make study interesting and efficient by applying, analyzing and understanding mathematical information.

Policy Guidelines on Daily Lesson Preparation for the K to 12 Basic Education Program affirms the guidelines of the K to 12 teacher as a facilitator of learning and strictly implemented the guidelines in preparing lessons through the Daily Lesson Log (DLL) or Detailed Lesson Plan (DLP), whereas; teachers are mandated to use constructivism approach in making their lessons to provide learners with opportunity to arrange or re-order their ideas and develop information that is meaningful to them. It also allows teachers to reflect on what students need to learn, how students learn, and how to best aid the learning process. These guidelines also aim to empower teachers to deliver quality instruction that recognizes the diversity of learners in the classroom, is committed to learners' success, allows the use of a variety of instructional and formative assessment strategies, including the use of information and communication technologies (ICTs), and enables the teacher to guide, mentor, and support learners in developing and assessing their learning across the curriculum. (DepEd Order No. 42 s. 2016).

On the other hand, the 2015 Education for All (EFA) focused on the calls of UNESCO functional literacy to ensure that all Filipinos have the capacity to read, write and do math at a level that is sufficient for the country in which a particular person resides. The government established four key objectives for the EFA initiative as support for K–12 reform: providing education options for all out-of-school adults and young people; eliminating dropouts and repetition during the first three years of school; encouraging all Filipino children to complete a full cycle of basic schooling to a satisfactory level at every grade; and committing to the attainment of basic education competencies for all.

In a study entitled Effective Teaching Strategies, Faculty Development (2008) pointed out that quality instruction is constantly student-centered. It strives to assist most and all students in their learning. As a result, the emphasis should not only be on pedagogical skills, but also on creating a learning environment that meets the students' individual requirements. pupils should also understand why they are working so that they may relate to other pupils and obtain assistance if necessary.

A study Content-Based Recreational Book Reading and Taiwanese Adolescents' Academic Achievement The relationship between reading for pleasure and language proficiency is well known, but research on the connection between content-based leisure reading and academic achievement across subject areas is rare. The findings suggest that reading for pleasure in one subject area may increase achievement in that subject area, and in some cases, reading in other subject areas may also be

beneficial. A reading program that encourages kids to read independently can advance academic success and disciplinary literacy. (Chen et al., 2016)

A study The Role of Practical Activity in Teaching and Learning of Science and Students- Academic Performance and Retention stated that the study investigated the role of practical activities on students 'performance and retention in Science. The study highlighted on the efficacy of the Science laboratory and role of the laboratory in the teaching and learning of Science. To guide the research, two null hypotheses were proposed. The study used a non-equivalent pretest-posttest control group design that was quasi-experimental. The sample for the study consisted of 150 JSS3 students from three public secondary schools. Three entire classes were chosen, resulting in three experimental and one control groups. The Science Performance Test (SPT) was the instrument used to collect data. The instrument's dependability was determined using the Kudar-Richardson formular-20, which provided reliability coefficients of 0.87 and 0.86 for the performance and retention tests, respectively. The data obtained were analyzed using analysis of covariance, with hypotheses evaluated at the 0.05 level of significance. The result of the study showed a significant effect of practical activities in the teaching and learning of Science, Mathematics and technology education. Students who were taught Science using practical-activities outperformed their counterparts taught without practical-activities. More so, Studies revealed a strong influence of practical-activities on students' retention of Science concepts. Based on findings of the study conclusions were drawn and it was recommended among others that the use practical -activities can serve as enhancers in the teaching and learning of Science performance and retention.(Anon n.d.)

It has been identified by the different authors in various researches the effectiveness of recreational activities, wherein students improved and performed well in their academic performances. It is in this matter that the above thesis, the recreational activities as aided tool in enhancing academic performance of Grade 7 students in Mathematics proved to be helpful and beneficial in providing knowledge and information in multiple directions. Thus, this research shows the similarity on the findings of the above authors on the utilization of recreational activities as an efficient device.

RESEARCH METHODOLOGY

This chapter presents the methods and procedures used in the study. Particularly, this chapter includes the description of research design, research setting, population and sampling technique, data gathering procedure, research instrument and statistical treatment of data.

Research Design

The methodologies used in this study were descriptive and pre-experimental research designs the latter comprises a posttest that conducted in 2 section of Grade 7. The purpose of this design is to determine the effects of content-based recreational activities in teaching Mathematics at Langgas National High School, School Year 2022-2023.

Respondents of the Study

This research was conducted at Langgas National High School, Infanta, Quezon, during S.Y. 2022-2023 utilizing students in the Grade-7 Level as respondents.

Table 1. Distribution of Respondents by Gender

Gender	No. of Respondents
Male	48
Female	34
Total	**82**

Sampling Technique

This study used of the cluster sampling since the researcher utilized all the two section of grade 7 to test the effectiveness of content-based recreational activities in Mathematics subject which is basically intended to Junior High School students.

Research Procedure

The researcher observed the following procedures in conducting the study.

The researcher first prepared a draft of the research instrument as the primary source of information. This includes the lesson plans for the experiment, survey questionnaire, and pre and post-test. After the validation of the instrument, revisions were made, and the final version of the instrument was used in the study.

The researcher presented a letter to the principal of Langgas National High School and asked for permission to conduct the study. The researcher asked for approval to use 82 Grade 7 students during the third Quarter of the School Year 2022-2023 for experimentation and access to the records of the students needed for the completion of the study.

The students undergo content-based recreational activities; the researcher makes recreational activities such as games and puzzles with mechanics based on the lesson's content executed during the activity part of the lesson. Follow-up questions focused on the dimension of understanding skills in mathematics as teaching strategies to be facilitated by the researcher throughout Unit II of the

grade 7 Mathematics. The first day of week 1 was for pre-assessment, and the following days were for the experiment. On day 1 of the first lesson, the class started with a greeting, prayer, and checking of attendance as part of the daily routine. The daily routine researcher gave the first game with mechanics followed by process questions in activity parts of the lesson, which led to the topic. Another game was given to the same as the first game, process questions answered by the students leading to the discussion. On day 2, a puzzle was given to the students as part of the application. On day 3, the researcher gave a problem as part of the evaluation, finding three understanding skill such as skill algorithm, properties principle, and use and application rubrics were used in checking the same process were done on the three other lessons and the last day of the unit II is for post-assessment. The results were recorded and employed in the study.

Moreover, survey questionnaires were also administered to measure students' perception of using content-based recreational activities.

Research Instrument

The tools that administered in this research are different content-based recreational activity as independent variables. The instruments that employed were the performance of the students in pretest and posttest which validated by the experts in the field which serve as the major instruments employed to gather the data needed. The result of the scores of the said sections were tabulated, analyzed and interpreted. The data gathered using a researchers made-test in chosen topic in Mathematics 7. A teacher-made test composed of 45 items for all the selected topics discussed in the Second Quarter.

The following steps were followed in the construction and validation of the teacher-made test.

Content Validation. The researcher constructed a rubric based on the objectives of the lessons before the construction of the test items. It included the selected topics of the researcher made instruction. The test items were inspected and evaluated by the research adviser, schools' principal, master teacher and one of the mathematics teachers of the school where the researcher conducted the study for comments and suggestions. It was also reviewed by an editor for necessary corrections on the clarity of directions, language used, correct usage of grammar and content. The researcher made a necessary corrections and revision after the experts validated the test.

Statistical Treatment of Data

The problems of the study were answered by analyzing and interpreting the data gathered through the use of the following statistical treatments.

Mean, percentage and standard deviation were computed to analyze the result of the perceptions of the respondents. The Pearson Product Moment of Correlation Coefficient, often referred to as the Pearson r-test, was utilized to measure the strength of relationship between content-based recreational activities and understanding skills. Researcher used t-test to determine if there is a significant difference between pretest and posttest among the understanding skills.

PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA

This part of the study presents the collected and analyzed data from 82 Grade 7 students of Langgas National High School with the use of the pretest and posttest questionnaires on Mathematical Understanding Skills to collect the necessary data. Likewise, the pretest and posttest were both in five questions that will be checked using rubric. Hence the highest scores were three (3) in each skill. In total, there are 15 highest score per skill.

Pre-test score of Grade 7 students in Mathematics before exposure to Content-based recreational activity.

Table 2. Pre-test score of Grade 7 students in Mathematics before exposure to Content-based recreational activity material as to Skill-algorithm, Properties principle, and Used and application.

Score	*Skill-algorithm*		*Properties principle*		*Used and Application*		*Verbal Interpretation*
	f	**%**	**f**	**%**	**f**	**%**	
13-15	11	13.4	18	22.0	0	0	**Excellent**
10-12	6	7.3	9	11.0	1	1.2	**Very Good**
7-9	15	18.3	12	14.6	3	3.7	**Good**
4-6	17	20.7	21	25.6	4	4.9	**Fair**
0-3	33	40.2	22	26.8	74	90.2	**Poor**

Shown in table 1 are the pretest scores of the respondents on Mathematical Understanding skills. In Skill-algorithm with the given data on pretest, majority of the students were identified within the poor level (40.2%) scoring 0-3 points. The table also shows that only 11 or 13.4% of them got an excellent score ranges from 13-15.

However, in properties principle skills in solving mathematical problems. The pretest data revealed that most of the students are poor (26.8%) who scored 0-3 while 18 of them got a score of 13-15 (22%) and with a verbal interpretation of excellent. Moreover, pretest scores of the respondents on mathematical understanding skills in terms of used and application. Data on pretest scores

revealed that before treatment proper, most of the students are poor (90.2%) scoring 0-3 points and none of them scores 13-15.

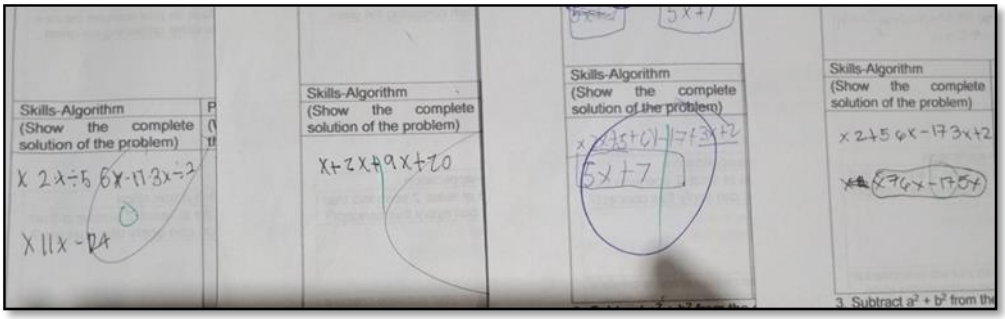

Figure 2. Sample answers of the respondents in terms of Skill algorithm.

The figure 2 shows the scores of the respondent in pretest in which the respondent. The findings imply that the students mostly cannot provide correct process seen in the picture above the student asked to find the perimeter of the given polygon and the answers were 0-1 point, because the students attempt to follow the rules but unable to show the process on how they arrived with the correct answer the students didn't arrange and combining similar terms before performing the operation which resulted mostly in the poor stage in pretest most of the student got zero point since no evidence of attempting to solve the mathematical problem.

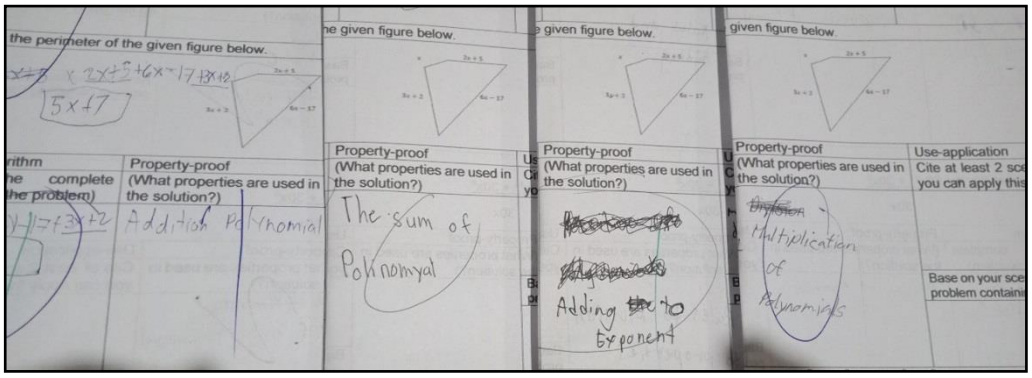

Figure 3. Sample answers of the respondents on Properties Principle

The results imply that students had a hard time or difficulty in identifying as well as the stating properties used applied in solving operation on polynomials as shown in the picture above the student got 1 point the student tries to determine the properties being applied in solving the mathematical problem but unable to provide all which resulted to poor level, since the student can't show the process in solving the problem the student also can't state the properties used. However, it also implies that some of them can identify and stated the mathematical properties and principles nearly accurate and with missing data.

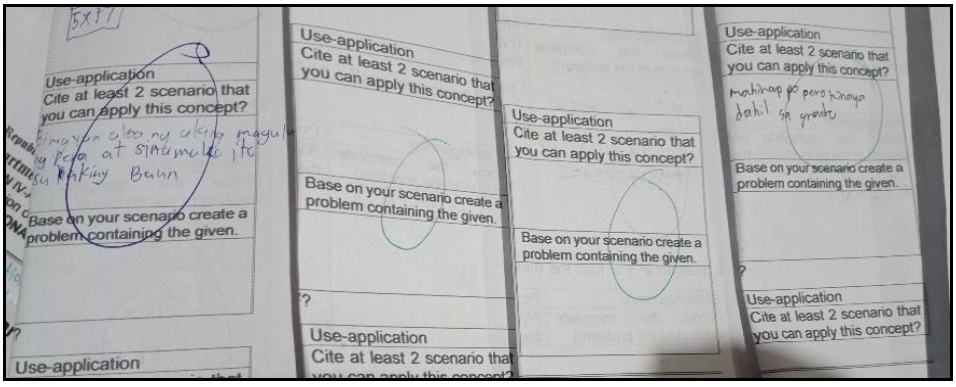

Figure 4. Sample answers of the respondents on used and application

Figure 4 imply that the students are in the poor level before the start of the experiment. Majority of them cannot provide scenarios where they can apply real life concept with a number particularly on creating problem based on the given polynomial equation.

Post test score of Grade 7 students in Mathematics after exposure to Content-based recreational activity

This section comprehensively illustrates the score after the utilization of content-based recreational activities in Mathematics Lessons for grade 7 students focusing on Understanding Skill in terms of skill-algorithm, properties principle, and used and application.

Table 3. Posttest score of Grade 7 students in Mathematics before exposure to Content-based recreational activity material as to Skill-algorithm, Properties principle, and Used and application.

Score	*Skill-algorithm*		*Properties principle*		*Used and Application*		*Verbal Interpretation*
	f	**%**	**f**	**%**	**f**	**%**	
13-15	19	23.2	46	56.1	4	4.9	**Excellent**
10-12	38	46.3	20.7	20.7	5	6.1	**Very Good**
7-9	14	17.1	13	13	8	9.8	**Good**
4-6	8	9.8	7.3	7.3	34	41.5	**Fair**
0-3	3	3.7	2.4	2.4	31	37.8	**Poor**

Illustrated in table 3 are posttest scores of the respondents on mathematical Understanding skills. In terms of Skill-algorithm the data revealed that majority of the students got rating scores of 10-12 (46.3%) with a verbal interpretation of excellent. However, only three of them obtained a score of 0-3 with a verbal interpretation of poor.

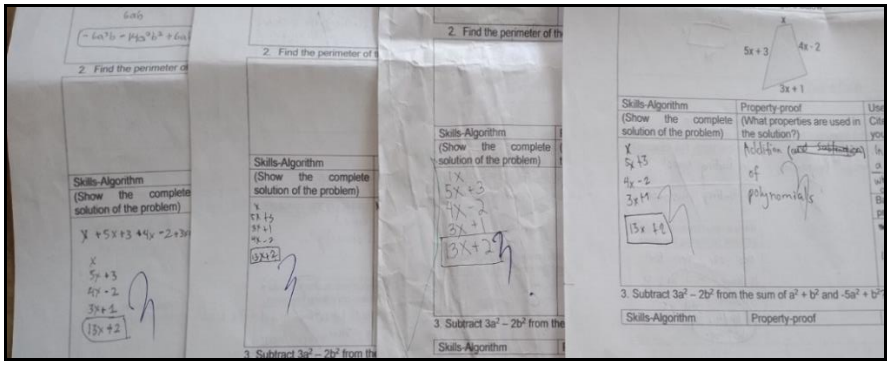

Figure 5. Sample posttest answers of the respondents on skill algorithm

The result implies that the utilization of content-based recreational activities in Mathematics Lessons for grade 7 students helps them to provide solutions completely and following step by step procedures as seen in the picture above the student arrange the given and align its similar term below and performed the operation given which was reflected in their scores.

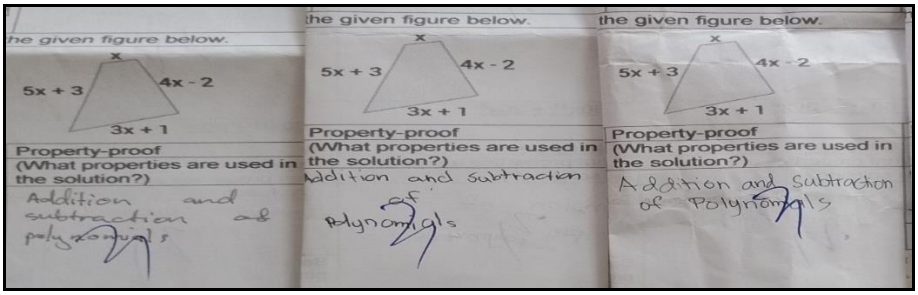

Figure 6. Sample posttest answers of the respondents on properties principles

Moreover, the posttest scores of the respondents on mathematical Understanding skills in terms of properties principles. The posttest scores revealed that most of the respondents got rating scores of 13-15 (56.1%) and interpreted as excellent. However, only two of them scores 0-3 with a verbal interpretation of poor.

Based on the results, as shown in figure 6 researcher can infer that after the utilization of the content-based recreational activities students can now identify the mathematical properties that underlie the procedure. Furthermore, students were improved their skills as they can provide the final answers completely and correctly.

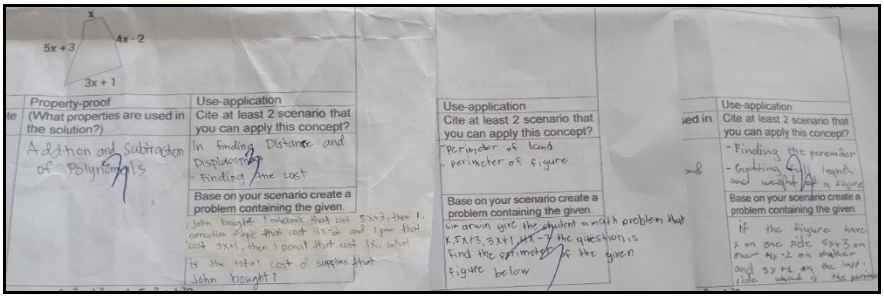

Figure 7. Sample posttest answers of the respondents on used and applications

As to skills in use and application, out of 82 students 34 of them got a score of 4-6 which is interpreted as fair. It is also observed that 31 of them got a score of 0-3 (37.8%) which is interpreted as poor. It is also noteworthy, that only 4 of them got a score of 13-15 which interpreted as excellent. The result implies that majority of them failed because they were having a difficulty in citing real life scenarios about polynomials and creation of problem which the questions require.

Level of students' agreement on the perception of using content-based recreational activities as to game

Table 4. Level on the perception of using content-based recreational activities as to game

Indicators	Mean	SD	Verbal Interpretation
1. Understand mathematical concepts.	4.41	0.75	Agree
2. Develop mathematical skills.	4.27	0.80	Agree
3. Know mathematical facts.	4.16	0.88	Agree
4. Learn the language and vocabulary of mathematics	3.96	0.88	Agree
5. Develop ability in mental mathematics	4.20	0.85	Agree
6. Develop a variety of connections with the content that can form positive memories of learning.	4.34	0.91	Agree
7. Develop positive attitude towards Mathematics.	4.27	0.86	Agree
8. Develop my problem-solving skills, critical thinking skills, decision making skills etc.	4.28	0.84	Agree
Overall	**4.24**	**0.58**	Agree

Legend: 1.0-1.49 (Strongly Disagree)/1.50-2.49 (Disagree)/ 2.50-3.49 (Moderately Agree)/3.50-4.49 (Agree)/ 4.50-5.0 (Strongly Agree)

Table 4 shows that respondents have a common agreement on game use. It can be gleaned from the table that all items have a mean score of 3.96 to 4.41, which is interpreted as agree.

Table 4 also shows that indicator 1, understand mathematical concepts, got the highest mean score of 4.41. Games help the students to understand mathematics concepts through visual representation. Games often use visual representations like graphs or diagrams to help students understand concepts better. This can be especially beneficial for visual learners who need to see the concepts to understand them. It also provides active Learning, which means students can learn by doing rather than just reading or listening. This approach can lead to a deeper understanding of mathematical concepts. Games also can provide immediate feedback to students on whether they are solving problems or understanding concepts correctly. This can help students to correct mistakes and learn from them quickly. It is also designed to accommodate different levels of mathematical ability and is adaptable to different learning styles. This means that each student can learn at their own pace, helping them to grasp concepts more effectively. Games can be designed to contextualize mathematical concepts in a real-life situation, allowing students to see how math can be applied in the real world. This can make the concepts more concrete and relevant, leading to a better understanding.

Games also help students develop a positive attitude towards mathematics, such as games can make learning mathematics fun, which helps students engage with and enjoy the subject. Games can help build confidence when students succeed in solving problems or completing challenges. Games can reinforce mathematical concepts by allowing students to apply the skills they have learned in a fun and interactive way. This can help students to feel more confident and positive towards the subject. Games involve teamwork that can help students to work together and learn from each other. This can create a positive attitude towards mathematics by showing that Learning can be collaborative. Games can help reduce anxiety towards mathematics by providing a low-stress and enjoyable way to learn and practice mathematical concepts. This can lead to a positive attitude towards the subject by reducing negative feelings associated with it.

The study of Aksoy, Çankaya, and Taşmektepligil (2017) stated that Recreational mathematics is an activity designed to make students happy to learn and understand mathematical concepts. This research shows the effect of the implementation of recreational mathematics on learning achievement and learning motivation significantly, and indicator 4 got the lowest mean score of 3.96. It has an overall mean score of 4.24.

The findings imply that games can help to develop a positive attitude towards mathematics by making it engaging, fun, and interactive. It also provides an interactive and engaging way of Learning, which can help students understand mathematical concepts. Games also offer the opportunity for immediate feedback, personalized Learning, and the real-life context for understanding mathematical concepts.

Table 5. Level on the perception of using content-based recreational activities as to puzzle

Indicators	Mean	SD	Verbal Interpretation
1. Encourage mathematical reasoning and logical thinking.	4.28	0.76	Agree
2. Develop strategic thinking.	4.01	0.85	Agree
3. Develop construction of ideas.	4.15	0.93	Agree
4. Improve fundamental operations of mathematics.	4.12	0.95	Agree

5. Development of problem solving, critical thinking skills, decision making skills etc.	4.12	0.99	Agree
6. Develop a variety of connections with the content that can form positive memories of learning.	4.21	0.78	Agree
7. Encourage mathematical reasoning and logical thinking.	4.17	0.80	Agree
Overall	**4.15**	**0.57**	**Agree**

Legend: 1.0-1.49 (Strongly Disagree)/1.50-2.49 (Disagree)/ 2.50-3.49 (Moderately Agree)/3.50-4.49 (Agree)/ 4.50-5.0 (Strongly Agree)

Table 5 shows the perception of the respondents in the use of puzzle recreational activities. It reveals that most of the respondents agreed in all indicators. Item no. 1 Encourage mathematical reasoning and logical thinking got the highest mean score of 4. 28. Puzzles can encourage mathematical reasoning and logical thinking in several ways: Puzzles often require the identification of patterns and sequences, which are essential for mathematical reasoning. By recognizing patterns, students can identify the underlying structure of a problem and understand how to apply this structure to similar problems in the future. Puzzles require problem-solving skills, which are important mathematical skills. As students work through a puzzle, they must consider different strategies, test their ideas, and adjust based on feedback to find the correct solution. Many puzzles require the use of spatial reasoning, which is an important mathematical skill. Spatial reasoning involves visualizing objects in different positions and understanding their relationships to one another. Puzzles often require logical deduction, which is essential for mathematical reasoning. Students must use what they know to make inferences about what they do not know in order to solve the puzzle and puzzles often require sustained effort and perseverance, which are important skills in math. Students must have the motivation and determination to push through challenges and try different approaches until they find the solution.

However, indicator no. 2 Develop strategic thinking got the lowest mean score of 4.1 and standard deviation of 0.85. generally, it has an over-all mean score of 4.15 which mean students are likely to engage themselves in puzzle creational activities as it helps to develop their creativity and curiosity and also enhance their conceptual understanding, critical thinking skills, problem-solving strategies.

Empirically, the result in this table agrees with the findings of the study of Klymchuk (2017) who suggested that approaches such as puzzle-based learning not only could contribute to developing students' mathematical understanding, but also contribute to improving students' problem solving, thinking, and reasoning skills.

Overall, puzzles provide an engaging way for students to develop and practice mathematical reasoning and logical thinking skills. By working through puzzles, students can develop problem-solving skills, spatial reasoning, logical deduction, and perseverance, which can help them succeed in mathematics and other subject areas.

Table 6. Summary Level on the perception of using content-based recreational activities

Recreational Activities	Mean	SD	Verbal Interpretation
Games	4.24	0.58	Agree
Puzzle	4.15	0.57	Agree
Overall	4.20	0.58	Agree

Legend: 1.0-1.49 (Strongly Disagree)/1.50-2.49 (Disagree)/ 2.50-3.49 (Moderately Agree)/3.50-4.49 (Agree)/ 4.50-5.0 (Strongly Agree)

Table 6 shows the summary of level on the perception of respondents on the use of content-based recreational activities in teaching mathematics. It is seen that the overall mean of the student in games and puzzle were 4.24, 4.15 and interpreted as agree respectively. Overall, the mean score is 4.20 and interpreted as agree. The result implies that perceptions of the respondents on recreational activities helped in developing understanding skills of students. Recreational activities make learning math more fun and engaging for students. When they are actively involved in hands-on activities, games, puzzles, or interactive tasks, students are more likely to be motivated and interested in the subject. This increased engagement can foster a deeper understanding of mathematical concepts.

In addition, many recreational math activities involve tangible materials that students can physically manipulate. For example, using blocks, counters, or puzzles can help students visualize and understand mathematical concepts like number sense, patterns, geometry, and algebra. This concrete representation makes abstract mathematical ideas more accessible and easier to comprehend.

Furthermore, Recreational activities often require students to solve puzzles or play mathematical games that involve problem-solving. These activities encourage critical thinking and logical reasoning, as students figure out strategies, identify patterns, and make connections. Developing these problem-solving skills helps students understand how to approach and analyze mathematical problems effectively. Recreational math activities frequently have connections to real-life situations or scenarios. This makes the mathematics taught more relatable and meaningful to students. By engaging in these activities, students can see the practical applications of the mathematical concepts they are learning, enhancing their understanding and appreciation of the subject.

Finally, recreational math activities promote collaboration and communication among students. By working together, discussing strategies, explaining solutions, and sharing ideas, students can deepen their understanding of mathematical concepts. These activities foster peer learning, providing students with different perspectives and approaches to problem-solving. Conceptual Understanding: Recreational activities often encourage students to explore mathematical concepts from different angles, facilitating a deeper conceptual understanding. Rather than simply memorizing formulas or procedures, students can develop their own understanding through hands-on experiences, observations, and discoveries. This helps them build a solid foundation of mathematical knowledge that can support future learning.

By incorporating recreational activities into mathematics teaching, educators can create a positive and stimulating learning environment that promotes students' development of understanding skills and enhances their overall mathematical comprehension.

Table 7. Test of difference between the pretest and posttest scores in Mathematics 7

Understanding Skills	Pre-test		Post test		T	df	Sig. (2-tailed)
	Mean	SD	Mean	SD			
Skill-algorithm	5.61	4.80	10.27	3.15	-6.832	81	0.000
Properties principles	7.38	4.64	12.01	3.49	-7.657	81	0.000
Use and application	0.84	2.22	4.57	3.53	-7.603	81	0.000

Legend: Sig (2-tailed) ≤ .05 (Significant); Sig (2-tailed) ≥ .05 (Not significant)

Table 7 shows that there is a significant difference in the performance of students in pre-test and posttest score in three (3) understanding skills namely Skill-algorithm, properties principles, and used and application. The Sig. (2-tailed) of .000 corresponding to the three (3) understanding skills signifies the difference.

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

This chapter consolidates the summary of findings gathered, the conclusions drawn from the findings and the recommendations formulated for further researches.

SUMMARY OF FINDINGS

The following are the salient findings of the study:

The respondents' perception in the use of game recreational activities has an over-all mean of 4.24 and standard deviation of 0.58 interpreted as agree. Respondents' perception in the use of puzzle recreational activities has an over-all mean of 4.15 and with standard deviation of 0.57 interpreted as agree. In summary the Use of content-based recreational activities show that the respondents Agree.

As to skill performance of Grade 7 students in Mathematics 7, the data show that the students' post–test score got mostly 10-12 points interpreted as Very Good in Skill-algorithm, 13-15 points Excellent in Properties principle, and 4-6 points Fair in Use and application.

Using the Test of Difference in the Understanding Skills of the Students using Content-based Recreational Activities it was found out that there is significant difference in the post-test scores of respondents in skill-algorithm, properties principles and use and application skills when tested to $p<.05$.

CONCLUSION

Based on the findings of the study, the conclusions were drawn: the null hypothesis stating that there is no significant difference between the pretest and post test score of students in mathematics 7 is not sustained.

RECOMMENDATIONS

Based on the results and conclusions posted in the study, the following recommendations are hereby formulated:

1. Through the findings of the study, administrators may provide teachers more trainings and seminars on the new and innovative teaching instruction which can address the increasing needs of different types of learners specifically on the use of content-based recreational activities so that teachers may develop a lesson which is congruent to the recreational activities needed for the topic. Those recreational activities help the students in Skill-algorithm and Properties principle Mathematical Understanding skill may serve better tools for educators to measure the growth and assessing students' progress.
2. The findings of the study may give insights to teachers in using different teaching instructions which can be effective in the teaching learning process. Teachers may develop a lesson with full utilization of the use of recreational activities because students find it interesting to use during the lesson.
3. Future researchers may as well consider the use of content-based recreational activities in enhancing Understanding skills as Use and application skill must inquire prior skills in reading comprehension incorporate them into their studies to further validate the findings of the study.
4. Based on the result of the study, it has been viewed that the level/scores of the students had a minimal increase on the used and application. It is attributed on the students' readiness and capability in constructing sentences. The comprehension level of the

students is also a detrimental factor. The researcher highly recommended that the students should be well-versed in using the second language to facilitate learning comprehensively. Language teachers would play a pivotal role in increasing students' comprehension. Language development is highly recommended.

ACKNOWLEDGMENT

The researcher wishes to extend his sincerest and profound gratitude and appreciation to the numerous people who shared their precious time, ideas, and effort in accomplishing this work. Special thanks are given to the following:

First and foremost, to Almighty God for the gift of life, for the gift of knowledge he gave us, for providing the researcher with the strength and perseverance for the successful completion of this study;

Laguna State Polytechnic University for catering learners who want to broaden their knowledge and capabilities, and for always pushing students in the institution to do their best and for providing quality education for all;

Dr. Mario R. Briones, President of Laguna State Polytechnic University and Chairman of the panel, for his unceasing support towards the development of Graduate Studies at LSPU;

Dr. Eden C. Callo, Vice President of Academic Affairs: for her words of encouragement, for sharing her insights and expertise with the graduate studies students;

Prof. Joel M. Bawica, LSPU-SPC Campus Director, for his exemplary commitment and support to the University;

Dr. Edilberto Z. Andal, Dean of the College of Teachers Education Graduate Studies and Applied Research, for his valuable suggestions and assistance in the improvement of the manuscript;

Mr. Allen E. Pasia, his thesis adviser, provided him with guidance, time, effort, valuable suggestions, ideas, comments, and professional assistance, as well as words of encouragement and unending support, that made this study possible;

Engr. Manuel Luis R. Alvarez, researcher's statistician, for sharing his expertise in statistical works and research, for his time in answering queries, and for his support and effort in completing this study;

Mrs. Annaliza P. Del Rosario, her subject specialist, for sharing her expertise for the comments and suggestions in the initial development of this study, which helped to clarify and make the study's focus possible;

Mr. John Vincent C. Aliazas, his technical editor, for the expert skill and knowledge; so much appreciation for the time and effort for the assistance in accomplishing this study;

His research instrument validators, **Mr. Jaybert R. Saron**, Public School District Supervisor (General Nakar District II), **Mrs. Fe B. Santos**, Master Teacher I (SHS), **Mrs. Melanie V. Mirandilla**, Master Teacher II (SHS), of Infanta National High School for being generous in spending their valuable time in evaluating the instruments and for contributing their insightful comments, suggestions, and skills to enhance the instruments of this study;

Mr. Emerson P. Portales, Principal I of Langgas National High School, for his permission to conduct the study on the Grade 7 Students of LNHS and for his utmost support and encouragement to the researcher;

To the **Respondents of the Study**, the Grade 7 students of Langgas National High School, for their invaluable cooperation in conducting the study with sincerity and truthfulness.

LNHS colleagues, his workmates, for the words of encouragement, for lending their helping hands, and for extending their support throughout the research procedure;

The researcher's parents, **Mr. Conrado R. Sapico** and **Mrs. Agrifina T. Sapico**, for their guidance, encouragement, support, and love, which gives him the motivation to keep going;

His siblings, **Sheryl, Judith**, and **Jude T. Sapico**, for the company, assistance, love, and patience in assisting him in completing this study;

His wife, **Maria Elena P. Sapico**, for always being considerate supportive, and providing him with unconditional support throughout this study.

Last but not least, to all **AUTHORS** whose works have been utilized in this study and to all persons whose names were not mentioned yet who have made the greatest contribution directly and indirectly in making this research study possible

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APPENDICES

Appendix A

LETTER TO THE SUPERINTENDENT

Republic of the Philippines
Department of Education
Region IV-A
SCHOOLS DIVISION OF QUEZON PROVINCE

1st INDORSEMENT
June 1, 2023

Respectfully returned to **Arwin T. Sapico** Researcher, **Laguna State Polytechnic University,** San Pablo, City, approving the hereto attached request to conduct a study entitled "Enhancing Understanding Skills of the Students Through Content-Based Recreational Activities."

Proper coordination with the school heads, teachers and students within the Division of Quezon is advised so as to ensure that the provisions of DepEd Order No. 9, s. 2005 (Instituting Measures to Increase Engaged Time-On-Task and Ensuring Compliance Therewith) shall be observed.

ROMMEL C. BAUTISTA, CESO V
Schools Division Superintendent

LORENA S. W[illegible]SUMBAT, Ed.D.
Chief Edu[illegible] Supervisor

Paregs5/31/2023

DEPEDQUEZON-TM-SDS-04-012-003

"Creating Possibilities, Inspiring Innovations"
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Email Address: quezon@deped.gov.ph
Website: www.depedquezon.com.ph

Appendix B

LETTER TO THE PRINCIPAL

LAGUNA STATE POLYTECHNIC UNIVERSITY
INTEGRITY. PROFESSIONALISM. INNOVATION.
San Pablo City Campus

COLLEGE OF TEACHER EDUCATION
Graduate Studies and Applied Research

January 28, 2023

EMERSON P. PORTALES
School Principal
Infanta District
Infanta, Quezon

Dear Sir:

Greetings of Peace!

The undersigned, a student of Laguna State Polytechnic University, San Pablo City Campus is conducting a research entitled **"ENHANCHING UNDERSTANDING SKILLS OF THE STUDENTS THROUGH CONTENT-BASED RECREATIONAL ACTIVITIES".**

In this connection, I am requesting permission from your good office to allow me to conduct the above-mentioned research study in your school.

I fervently look forward for your positive response. Thank you very much and God Bless!

Very respectfully yours,

ARWIN T. SAPICO
Researcher

Noted:

ALLEN E. PASIA
Research Adviser

Approved:

EMERSON P. PORTALES
School Principal
Infanta District
Infanta, Quezon

Appendix C

LETTER TO THE VALIDATORS

LAGUNA STATE POLYTECHNIC UNIVERSITY
INTEGRITY. PROFESSIONALISM. INNOVATION.
San Pablo City Campus

COLLEGE OF TEACHER EDUCATION
Graduate Studies and Applied Research

JAYBERT R. SARON, MEM, MathEd
Public Schools District Supervisor
General Nakar District 2

Dear Ma'am/Sir:

Greetings of Love and Prosperity!

I am **ARWIN T. SAPICO,** taking up Master of Arts in Education major in Mathematics at Laguna State Polytechnic University-San Pablo City Campus presently conducting a study entitled **"ENHANCHING UNDERSTANDING SKILLS OF THE STUDENTS THROUGH CONTENT-BASED RECREATIONAL ACTIVITIES"** as part of my requirements in Graduate Studies and Applied Research.

I would like to ask your approval for the research instrument to be used in measuring the variables needed in the study. Attached herewith is the copy of the questionnaire to be administered for the said research. Your comments and suggestions will be highly appreciated and will be of great help to this undertaking.

I am hoping for your favorable response and wholehearted consideration on this matter.

Thank you very much and God Bless!

Sincerely yours,

ARWIN T. SAPICO
Researcher

Noted:

ALLEN E. PASIA
Research Adviser

Approved:

JAYBERT R. SARON, MEM, MathEd
Public Schools District Supervisor

LAGUNA STATE POLYTECHNIC UNIVERSITY
INTEGRITY. PROFESSIONALISM. INNOVATION.
San Pablo City Campus

COLLEGE OF TEACHER EDUCATION
Graduate Studies and Applied Research

Dear Ma'am/Sir:

Greetings of Love and Prosperity!

I am **ARWIN T. SAPICO,** taking up Master of Arts in Education major in Mathematics at Laguna State Polytechnic University-San Pablo City Campus presently conducting a study entitled **"ENHANCHING UNDERSTANDING SKILLS OF THE STUDENTS THROUGH CONTENT-BASED RECREATIONAL ACTIVITIES"** as part of my requirements in Graduate Studies and Applied Research.

I would like to ask your approval for the research instrument to be used in measuring the variables needed in the study. Attached herewith is the copy of the questionnaire to be administered for the said research. Your comments and suggestions will be highly appreciated and will be of great help to this undertaking.

I am hoping for your favorable response and wholehearted consideration on this matter.

Thank you very much and God Bless!

Sincerely yours,

ARWIN T. SAPICO
Researcher

Noted:

ALLEN E. PASIA
Research Adviser

Approved:

MELANIE V. MIRANDILLA
MT - II

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LAGUNA STATE POLYTECHNIC UNIVERSITY
INTEGRITY. PROFESSIONALISM. INNOVATION.
San Pablo City Campus

COLLEGE OF TEACHER EDUCATION
Graduate Studies and Applied Research

LENISA A. AUDITOR
TEACHER - II
MATHEMATICS COORDINATOR

Dear Ma'am/Sir:

Greetings of Love and Prosperity!

I am **ARWIN T. SAPICO,** taking up Master of Arts in Education major in Mathematics at Laguna State Polytechnic University-San Pablo City Campus presently conducting a study entitled **"ENHANCING UNDERSTANDING SKILLS OF THE STUDENTS THROUGH CONTENT-BASED RECREATIONAL ACTIVITIES"** as part of my requirements in Graduate Studies and Applied Research.

I would like to ask your approval for the research instrument to be used in measuring the variables needed in the study. Attached herewith is the copy of the questionnaire to be administered for the said research. Your comments and suggestions will be highly appreciated and will be of great help to this undertaking.

I am hoping for your favorable response and wholehearted consideration on this matter.

Thank you very much and God Bless!

Sincerely yours,

ARWIN T. SAPICO
Researcher

Noted:

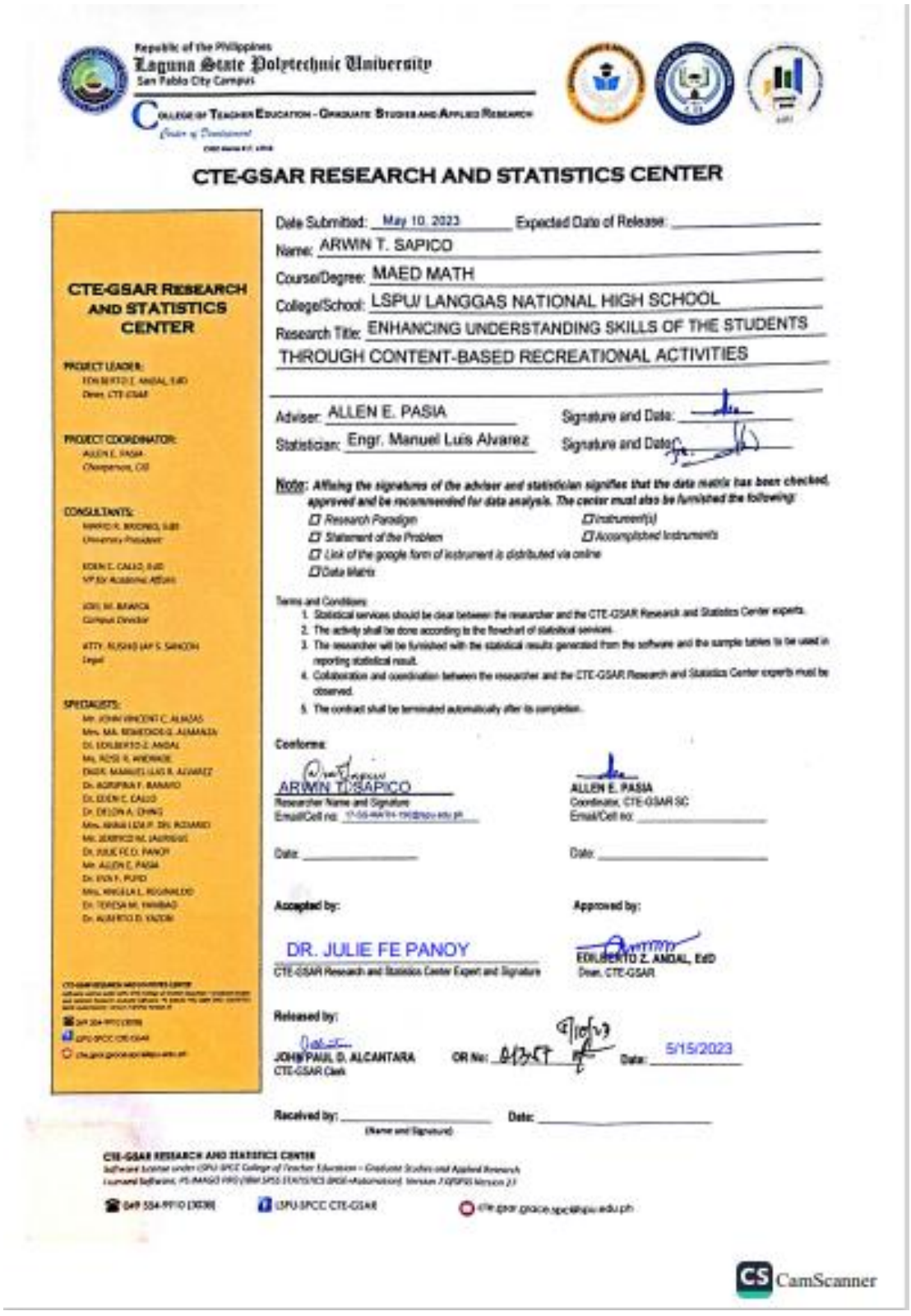
ALLEN E. PASIA
Research Adviser

Approved:

LENISA A. AUDITOR
MATHEMATICS COORDINATOR

Appendix D

SERVICE CONTRACT



Republic of the Philippines
Laguna State Polytechnic University
San Pablo City Campus
College of Teacher Education - Graduate Studies and Applied Research

CTE-GSAR RESEARCH AND STATISTICS CENTER

CTE-GSAR Research and Statistics Center

Project Leader:
Edilberto Z. Andal, EdD
Dean, CTE-GSAR

Project Coordinator:
Allen E. Pasia
Chairperson, CSE

Consultants:
Mario R. Briones, EdD
University President

Eden C. Calio, EdD
VP for Academic Affairs

Jon M. Binarao
Campus Director

Atty. Alvin Jay S. Sanchon
Legal

Specialists:
Mr. John Vincent C. Almazan
Mrs. Ma. Benedicta G. Almazan
Dr. Edilberto Z. Andal
Ms. Rose R. Andrade
Engr. Manuel Luis B. Alvarez
Dr. Agripina F. Banario
Dr. Eden C. Calio
Dr. Delon A. Chino
Mrs. Annie Lou P. Dela Rosario
Mr. Jerrico M. Jauregui
Dr. Julie Fe D. Panoy
Mr. Allen E. Pasia
Dr. Eva F. Pujio
Mrs. Angela L. Reginaldo
Dr. Teresa M. Tambao
Dr. Alberto D. Yazon

Date Submitted: May 10, 2023 Expected Date of Release: _____

Name: ARWIN T. SAPICO

Course/Degree: MAED MATH

College/School: LSPU/ LANGGAS NATIONAL HIGH SCHOOL

Research Title: ENHANCING UNDERSTANDING SKILLS OF THE STUDENTS THROUGH CONTENT-BASED RECREATIONAL ACTIVITIES

Adviser: ALLEN E. PASIA Signature and Date: _____

Statistician: Engr. Manuel Luis Alvarez Signature and Date: _____

Note: *Affixing the signatures of the adviser and statistician signifies that the data matrix has been checked, approved and be recommended for data analysis. The center must also be furnished the following:*

- ☐ *Research Paradigm*
- ☐ *Statement of the Problem*
- ☐ *Link of the google form of instrument is distributed via online*
- ☐ *Data Matrix*
- ☐ *Instrument(s)*
- ☐ *Accomplished Instruments*

Terms and Conditions:

1. Statistical services should be clear between the researcher and the CTE-GSAR Research and Statistics Center experts.
2. The activity shall be done according to the flowchart of statistical services.
3. The researcher will be furnished with the statistical results generated from the software and the sample tables to be used in reporting statistical result.
4. Collaboration and coordination between the researcher and the CTE-GSAR Research and Statistics Center experts must be observed.
5. The contract shall be terminated automatically after its completion.

Conforme:

ARWIN T. SAPICO
Researcher Name and Signature
Email/Cell no: [redacted]

Date: _____

ALLEN E. PASIA
Coordinator, CTE-GSAR SC
Email/Cell no: _____

Date: _____

Accepted by:

DR. JULIE FE PANOY
CTE-GSAR Research and Statistics Center Expert and Signature

Approved by:

EDILBERTO Z. ANDAL, EdD
Dean, CTE-GSAR

Released by:

JOHN PAUL D. ALCANTARA
CTE-GSAR Clerk

OR No: [redacted] Date: 5/15/2023

Received by: _____ Date: _____
(Name and Signature)

CTE-GSAR RESEARCH AND STATISTICS CENTER
Software license under LSPU-SPCC College of Teacher Education - Graduate Studies and Applied Research
Licensed Software: PS-MAGO PRO (IBM SPSS STATISTICS BASE-Multinational) Version 7 (SPSS Version 27)

049 554-9910 (3038) LSPU-SPCC CTE-GSAR cte.gsar.grace.spc@lspu.edu.ph

CamScanner

Appendix E

LETTER FOR THE DISTRIBUTION OF QUESTIONNAIRE

LAGUNA STATE POLYTECHNIC UNIVERSITY
INTEGRITY. PROFESSIONALISM. INNOVATION.
San Pablo City Campus

COLLEGE OF TEACHER EDUCATION
Graduate Studies and Applied Research

February 20, 2023

EDILBERTO Z. ANDAL, EdD
Dean, CTE-Graduate Studies and Applied Research
Laguna State Polytechnic University

Dear Sir/Madam:

Greetings of Peace!

I am **ARWIN T. SAPICO,** a student at the Graduate School and Applied Research at Laguna State Polytechnic University, San Pablo City Campus. I am currently working on my study entitled, **"ENHANCING UNDERSTANDING SKILLS OF THE STUDENTS THROUGH CONTENT-BASED RECREATIONAL ACTIVITIES".**

I would like to ask your approval for the research instrument to be used in measuring the variables needed in the study. Attached herewith is the copy of the Questionnaire, Lesson Plan and pre and post-test to be administered for the said research. Rest assured that all corrections, suggestions and recommendations of the panel of examiners during the research proposal were incorporated. In light of this, I would like to ask for your permission to implement the study.

Your approval on this matter will be great help in the conduct and completion of the present study.

Sincerely yours,

ARWIN T. SAPICO
Researcher

Noted:

ALLEN E. PASIA
Research Adviser

Approved:

EDILBERTO Z. ANDAL, EDD
Dean, CTE GSAR

Appendix F

LESSON PLANS

LESSON PLAN in MATHEMATICS 7

CONTENT STANDARD	PERFORMANCE STANDARD
The learner demonstrates understanding of key concepts of algebraic expression, the properties of real numbers as applied in linear equations and inequalities in one variable.	The learner is able to model situations using oral, written, graphical, and algebraic methods in solving problems involving algebraic expressions, linear equations, and inequalities in one variable.

I. Objectives

The learner will be able to add Polynomial. **(M7AL-IId-2)**

- Find the sum of a polynomial
- Appreciate the importance of knowing how to add polynomials in real-life situations

Topic : Addition and subtraction of polynomials
References : • Making Connections in Mathematics, 1st Year, pages 113 - 120
Materials Needed : • laptop, television, marker, speaker

I. Procedure

Activity	
Teacher's Activity	**Student's Activity**
1. Greetings to the Class	Good Morning Sir!
2. Prayer	A student will lead the prayer
3. Checking of Attendance	The class monitor will check the attendance and give the list to the teacher.
A. Reviewing previous lesson (Like term and unlike term **MATH-UNO TAYO** **Mechanics:** **1.**The class will be grouped into 5. 2.Each group will be given an Uno card with additional special card. 3.The group will play UNO. 4.Winners will receive 100 million points. Process Questions: 1.How do you find the activity? 2.What are the rules in playing this card? 3.How will you relate this game in polynomials? Adding polynomials? 4.How do we add polynomials? **ACTIVITY** **The Class is Sinking** Mechanics of the Activity (20 mins) 1.The Class will be grouped into 5. (Same group) 2.The teacher will give each student a colored paper containing the different variable/kinds/types. 3.The teacher will give signal to group themselves in same variable/kinds/types. 4.The leader of the group will add the given within the group and post it on the board. 5.corresponding points will be given as followed. Followed the steps correctly- 25 Million Pts See the pattern in the activity-25 Million Pts Add correctly the given- 25 million Pts Explanation---25 million pts Total ----------100 million Points 6.The group that will get highest score will be declared as winner and received 50 million points.	The students will answer the activity as review of the previous lesson.
A. Analysis	
Guide Questions: a. Which are like terms? Unlike terms? b. How are polynomials with like terms added? c. How are polynomials with unlike terms added?	Students will answer the questions based on their perceptions regarding the activity.

B. Abstraction	
• To add polynomials, simply combine similar terms. To combine similar terms, get the sum of the numerical coefficients and annex the same literal coefficients. If there is more than one term, for convenience, write similar terms in the same column	Students will listen to the teacher about the additional concept on adding polynomials.
C. Application	
Mechanics: 1.The students will answer addition polynomials puzzle to the students. 2.They will answer the given puzzle and will be scored according to correct answer they will get.	Students will answer the puzzle

7x	+	___	+	$2y^2$	+	5	_____
		+					
		X^2					
		$10x+ x^2$	+	$3x^2$		_____	
				+			
				$12x^2$	+	__	$12x^2+2y$
	$5x^2$	+		___			

II. Evaluation

1. Find the sum of (2x + 3) + (5x + 1).

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Site at least 2 scenario that you can apply this concept.
		Base on your scenario create a problem containing the given.

Prepared by:

ARWIN T. SAPICO
Mathematics Teacher

LESSON PLAN in MATHEMATICS 7

CONTENT STANDARD	**PERFORMANCE STANDARD**
The learner demonstrates understanding of key concepts of algebraic expression, the properties of real numbers as applied in linear equations and inequalities in one variable.	The learner is able to model situations using oral, written, graphical, and algebraic methods in solving problems involving algebraic expressions, linear equations, and inequalities in one variable.

I. Objectives

The learner will be able to subtract Polynomial. **(M7AL-IId-2)**

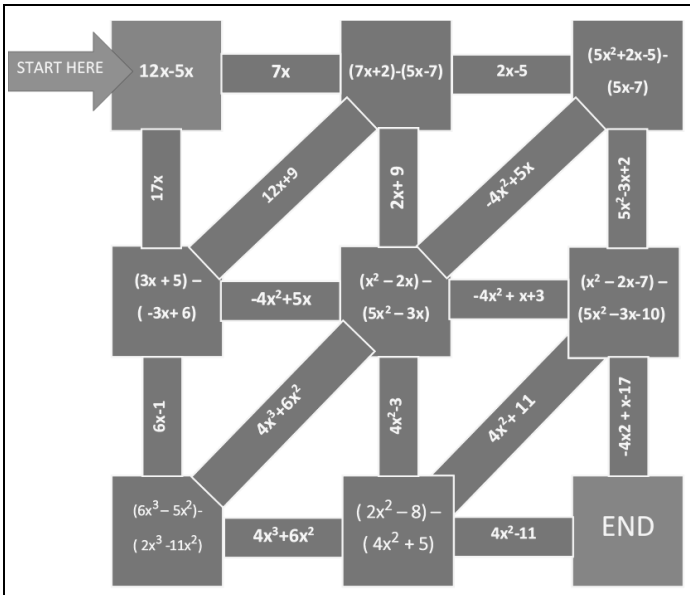
- Find the difference of a polynomial
- Appreciate the importance of knowing how to subtract polynomials in real-life situations

Topic : Addition and subtraction of polynomials
References : • Making Connections in Mathematics, 1st Year, pages 113 - 120
Materials Needed : • laptop, television, marker, speaker

II. Procedure

Activity	
Teacher's Activity	**Student's Activity**
1. Greetings to the Class	Good Morning Sir!
2. Prayer	A student will lead the prayer
3. Checking of Attendance	The class monitor will check the attendance and give the list to the teacher.
A. Reviewing previous lesson **Emoji Mo! Show MO!** **Mechanics: (5 mins)** • The class will be given a Happy and Sad Emoji. • They will raise a if the statement is correct. If not, raise a . • Every correct answer has equivalent points. 1------ 20 million points	The students will answer activity as review of the previous lesson.

2------ 40 million points 3------ 60 million points 4------ 80 million points 5------ 100 million points 1. 9 - (-8) = 1_____ 2. 9 + (- 8) = -17 _____ 2. (– 9) + 8 = - 1_____ 4. (- 9) + (- 8) = - 1_____ 5. (- 9) + 8 = 17 _____ **ACTIVITY** **What's Inside my Bag?** Mechanics of the game (20 mins) 1.The class will be grouped into 5. 2.Each group will look inside their bags and bring out the following items: black pens, pencils, and notebooks. 3.The will complete the materials needed 17- notebooks 8-black pens 3- pencils 4.Use these materials in completing the following statements and write it on the manila paper provided by the teacher. 10 notebooks – 7 notebooks=____ notebooks 8 black pens – 3 pencils = ____ black pens - ____ pencils 5. Now replace black pens with the variable **a**, pencils with **b**, and notebooks with **x**. 10 notebooks – 7 notebooks =____ notebooks 10x – 7x = ___x 8 black pens – 5 pencils = ____ black pens - ____ pencils 8a – 3b = ___a - ___b Followed the steps correctly- 25 Million Pts See the pattern in the activity-25 Million Pts subtract correctly the given- 25 million Pts Explanation---25 million pts Total ----------100 million Points 6. The group that will get highest score will be declare as winner and receive 50 million points.	
D. Analysis	
Guide Questions: From the given examples, a. Can you subtract unlike terms? b. How are polynomials subtracted? c. Are there similarities between subtraction of integers and subtraction of polynomials?	Students will answer the questions based on their perceptions regarding the activity.
E. Abstraction	
Rules for Subtracting Polynomials • To subtract polynomials, change the sign of each term in the subtrahend and then add it to the minuend.	Students will listen to the teacher about the additional concept on subtracting polynomials.
F. Application	
Mechanics: 1.The class will be grouped into 10. 2.The teacher will give addition and subtraction polynomials puzzle to the students. 3.The teacher will give instructions on how the puzzle will be answered. 4.The grouped will be graded according to the following: 4.1.Finished and traced the puzzle from the starting to end----25 pts 4.2.Try to traced the puzzle but did not finish--------- 15 points 4.3.Did not perform the activity- 0 point	Students will answer the puzzle



III. Evaluation

1. Find the difference of (3y + 5) – (-3y + 6).

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Site at least 2 scenario that you can apply this concept.
		Base on your scenario create a problem containing the given.

Prepared by:

ARWIN T. SAPICO
Mathematics Teacher

LESSON PLAN in MATHEMATICS 7

CONTENT STANDARD	PERFORMANCE STANDARD
The learner demonstrates understanding of key concepts of algebraic expression, the properties of real numbers as applied in linear equations and inequalities in one variable.	The learner is able to model situations using oral, written, graphical, and algebraic methods in solving problems involving algebraic expressions, linear equations, and inequalities in one variable.

I. Objectives

The learner will be able to multiply and Divide Polynomial (M7AL-IIe-2).

a. Multiply polynomials

b. Solve problems involving multiplying polynomials

c. Apply multiplying polynomials in real life situation

Topic : Multiplication of polynomials
References : • Making Connections in Mathematics, 1st Year, pages 113 - 120
Materials Needed : • laptop, television, marker, speaker

II. Procedure

Activity	
Teacher's Activity	**Student's Activity**
4. Greetings to the Class	Good Morning Sir!
5. Prayer	A student will lead the prayer
6. Checking of Attendance	The class monitor will check the attendance and give the list to the teacher.
B. Reviewing previous lesson **FLASH MINE LAW**	The students will answer activity as review of the previous lesson.

Recall the laws of exponent using flashcards by giving the product.

Mechanics.

1. The class will go to their respective groups.
2. Instruction about the game will be given.
3. The teacher will show Flashcard and code.
4. If the group know the answer they will say MINE and code. if the other group want to steal the points they will say STEAL and code, and if the other group want to grab the points they will say GRAB and code. Every correct answer will be given 200 million points.
5. If the group give an incorrect answer corresponding deduction will be given.

- Miner- Minus 100 million Points
- Steal- Minus 150 million points
- Grab- Minus 200 million points

6. The group having highest points declare as winner and will receive addition 100 million points.

Process Questions:

1. How do you find the activity?
2. You recall the laws of exponent?
3. What will happen to the exponent if you multiply the two similar variables?
4. How do we multiply polynomials?

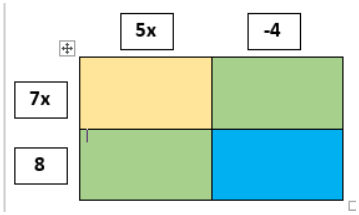
ACTIVITY

Poly-Multiplication Table

Mechanics of the game (30 mins)

1. The class will go to their respective groups.
2. Each group will be given a set of tables to be used in the game proper.
3. The teacher will explain how the game will be done.

- Multiply 7x and 5x answer will be placed at the colored orange box, multiply 7x and -4 answer will be place at colored green top box, multiply 8 and 5x answer will be placed at colored green bottom box and last multiply 8 and -4 answer will be placed at color blue box.



4. The game is 5 rounds with different set of given.
5. Every correct answer in each round will be graded as follow;

Followed the steps correctly- 25 Million Pts

See the pattern in the activity-25 Million Pts

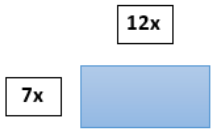
Multiply correctly the given- 25 million Pts

Explanation---25 million pts

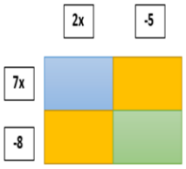
Total ----------100 million Points

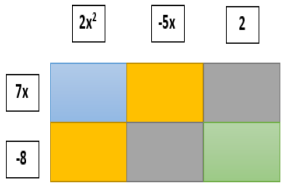
6. The group that will get highest score will be declare as winner and receive 50 million points.

Round 1



Round 2



Round 3 	
G. Analysis	
Guide Questions: From the given examples, 1. Based on the laws of exponents, how are you going to multiply two monomials? 2. How do you multiply a monomial by a polynomial? What property of real number can we apply? 3. How do you multiply two binomials? What are the methods of multiplying two binomials? 4. How do you multiply two polynomials?	Students will answer the questions based on their perceptions regarding the activity.
H. Abstraction	
Rules in Multiplying Polynomials A. To multiply a monomial by another monomial, simply multiply the numerical coefficients then multiply the literal coefficients by applying the basic laws of exponent. B. To multiply monomial by a polynomial, simply apply the distributive property and follow the rule in multiplying monomial by a monomial. C. To multiply binomial by another binomial, simply distribute the first term of the first binomial to each term of the other binomial then distribute the second term to each term of the other binomial and simplify the results by combining similar terms. This procedure is also known as the F-O-I-L method or Smile method. Another way is the vertical way of multiplying which is the conventional one. D. To multiply a polynomial with more than one term by a polynomial with three or more terms, simply distribute the first term of the first polynomial to each term of the other polynomial. Repeat the procedure up to the last term and simplify the results by combining similar terms.	Students will listen to the teacher about the additional concept on Multiplying polynomials.
I. Application	
POLYNOMIAL BINGO Mechanics: 1. Just like in regular BINGO, you'll cross off the numbers on your card as the game progress but instead of calling out numbers, the teacher we'll be giving you polynomials (multiplication) to solve. 2. As you solve each problem, cross off the corresponding product (its answer) on your card if you have it. 3. Cross off 5 boxes in a row (horizontally, vertically, diagonally) to win. 4. The students will decide where they were going to place the following $2x^2$, $35x^2 + 12x - 36$ $2x^3 + 8x^2 - 32x + 16$, $-12x^3-6x$ $48x^2 + 4x - 4$, 56 $25x^2 + 5x - 30$, -5x $6x^2 - 20x + 6$, 4x+4, $24x^3 + 8x^2 + 6x+4$ $30x^2 + 55x + 25$ $48x^2 - 18x - 3$ $30x^2 - 8x - 64$ $36x^2 - 6x - 12$ 5. The students first completed the pattern will get 100 million points	Students will play BINGO

III. Evaluation

1. Find the product of $5y\ (3y^2 + 4y - y2)$.

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept.
		Base on your scenario create a problem containing the given.

Prepared by:

ARWIN T. SAPICO
Mathematics Teacher

LESSON PLAN in MATHEMATICS 7

CONTENT STANDARD	**PERFORMANCE STANDARD**
The learner demonstrates understanding of key concepts of algebraic expression, the properties of real numbers as applied in linear equations and inequalities in one variable.	The learner is able to model situations using oral, written, graphical, and algebraic methods in solving problems involving algebraic expressions, linear equations, and inequalities in one variable.

I. Objectives

The learner will be able to multiply and Divide Polynomial (M7AL-IIe-2).

a. Divide polynomials

b. Solve problems involving Division polynomials

c. Apply division of polynomials in real life situation

Topic : Division of polynomials
References : • Making Connections in Mathematics, 1st Year, pages 113 - 120
Materials Needed : • laptop, television, marker, speaker

II. Procedure

Activity	
Teacher's Activity	**Student's Activity**
7. Greetings to the Class	Good Morning Sir!
8. Prayer	A student will lead the prayer
9. Checking of Attendance	The class monitor will check the attendance and give the list to the teacher.
C. Reviewing previous lesson (Division of integers and law of exponent in division) **MY Speed** Mechanics of the game (20 mins) 1. The class will be grouped into 5. 2. Each member of the grouped will run in the given 50-meter distance. The leader will serve as timer to get the time cover of each member. 3. After getting the time of each member they are going to compute for the Speed =distance/time 4. Use these data in completing the following statements and write it on the manila paper provided by the teacher. 50 distance /___ time=_____ Speed 5. Now replace distance with the variable **a**, time with **b**, and speed with **x**. 50 a /___ b=_____ x Followed the steps correctly- 25 Million Pts	The students will answer activity as review of the previous lesson.

See the pattern in the activity-25 Million Pts subtract correctly the given- 25 million Pts Explanation---25 million pts Total ----------100 million Points 6.The group that will get highest score will be declare as winner and receive 50 million points.	
J.Analysis	
Guide Questions: From the given examples, 1. Using the examples how do we divide polynomials? 2. How do we divide monomial by another monomial? 3. How do we divide polynomial by a monomial? 4. How are the operations of division and multiplication related to each other? 5. What is the significance of this lesson in your everyday life?	Students will answer the questions based on their perceptions regarding the activity.
K. Abstraction	
Rules in Dividing Polynomials 1. To divide polynomial by a monomial, simply divide each term of the polynomial by the given divisor. 2. To divide polynomial by a polynomial with more than one term (by long division), Simply follow the procedure in dividing numbers by long division. These are some suggested steps to follow: 1) Check the dividend and the divisor if it is in standard form. 2) Set-up the long division by writing the division symbol where the divisor is outside the division symbol and the dividend inside it. 3) You may now start the Division, Multiplication, Subtraction and Bring Down cycle. 4) You can stop the cycle when: a) the quotient (answer) has reached the constant term. b) the exponent of the divisor is greater than the exponent of the dividend	Students will listen to the teacher about the additional concept on Multiplying polynomials.
L. Application	
Mechanics: To find out whether the students understood how to divide polynomials and to discover their weakness, call each student to answer on the board. Do this as group competition. 1.The class will go to their respective groups 2.The teacher will give them manila paper and pentel pen to use in the activity. 3.The teacher will post the given problem on the board. 4.The grouped will answer what they can within 30 mins. 5.After 30 mins the group will post the manila paper on the board for checking. 6.The group with a lot of answer will declare as winner and will receive 500 million points. Sample problems $(x^2 - 6x - 7) \div (x + 1)$ $(2x^2 - 13x + \ ) \div (x - 6)$ $(3a^2 + 11a - 20) \div (3a - 4)$ $(x^2 - 3x + 4) \div (x - 1)$ $(2m^2 - 5m + 5) \div (2m + 1)$ $(2x^2 - 4x - 6) \div (x + 3)$	The class will do the group activity

$(2x^2 + 3) \div (x - 1)$ $(3x^3 - 2x^2 + 7) \div (3x - 2)$ $(y^3 + 7 + 3y) \div (y + 3)$ $(4x^4 + 3x^2 + 4) \div (2x + 3)$	

III. Evaluation

The distance covered by car in 3x hours is $27x^3 + 9x^2 - 3x$. Find thee rate of the car.

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept.
		Base on your scenario create a problem containing the given.

Prepared by:

ARWIN T. SAPICO

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Appendix G

RUBRICS

Scoring Rubric based on the criteria in evaluating Understanding Skills

Understanding Skills	3 points	2 points	1 point	0 point
Skill-algorithm	The students correctly followed all the rules and clearly show the process on how they arrived with the right answer without error.	The students correctly followed some of the rules and show the process on how they arrived with the correct answer with minor error.	The student attempts to follow the rules but unable to show the process on how they arrived with the correct answer.	No evidence of attempting to solve the mathematical problem.
Properties principles	The students were able to state all the properties applied in solving mathematics the problem.	The students were able state some of the properties applied in solving the mathematical problem.	The student tries to determine the properties being applied in solving the mathematical problem.	The student was not able to give the properties applied in solving the mathematical problem.
Used and application	The students were able to cite at least 2 scenarios where they can apply the given concept and able to create a problem base on their scenario.	The students were able to cite at least 2 scenarios where they can apply the given concept and able to create a problem base on their scenario.	The students were able to cite 1 scenario where they can apply the given concept but not able to create a problem base on their scenario.	The student was not able to apply what they have learned and was not able to formulating real life problem.

Enhancing Understanding Skills of the Students Through Content-Based Recreational

Appendix H

PRE-TEST

PRETEST

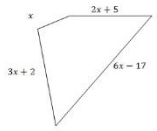
NAME: _____ SCORE: _____

Instruction: Read and analyzed each problem and answer what is being ask in the table.

2. Simplify the given expression $3a^3b + 4a^2b^2 - 7a^3b + 2ab - 5a^2b^2 + 10a^3b$

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the expression)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept.
		Base on your scenario create a problem containing the given.

3. Find the perimeter of the given figure below.



Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept?
		Base on your scenario create a problem containing the given.

4. Subtract $a^2 + b^2$ from the sum of $3a^2 – 2b^2$ and $-5a^2 + b^2$?

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept?
		Base on your scenario create a problem containing the given.

5. Find the product of $5y(3y^3 + 4y – y^2)$.

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that we can apply this concept?
		Base on your scenario create a problem containing the given.

5.Find the quotient $\frac{60x^{12} + 60x^{11} + 30x^8}{30x}$

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept?
		Base on your scenario create a problem containing the given.

Enhancing Understanding Skills of the Students Through Content-Based Recreational

Appendix I

POST TEST

POST TEST

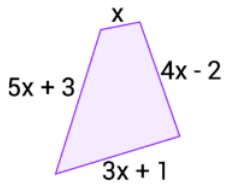
NAME: _____ SCORE: _____

Instruction: Read and analyzed each problem and answer what is being ask in the table.

1. Simplify the given expression $4a^3b+6a^2b^2-104a^3b+6ab-20a^2b^2$

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the expression)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept.
		Base on your scenario create a problem containing the given.

2. Find the perimeter of the given figure below.



Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept?
		Base on your scenario create a problem containing the given.

3. Subtract $3a^2 – 2b^2$ from the sum of $a^2 + b^2$ and $-5a^2 + b^2$?

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept?
		Base on your scenario create a problem containing the given.

4. Find the product of $3y^2 (2y^2 + 4y – y^3)$.

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept?
		Base on your scenario create a problem containing the given.

5.Find the quotient $\frac{60x^{12} + 60x^{11} + 30x^8}{5x^4}$

Skills-Algorithm	Property-proof	Use-application
(Show the complete solution of the problem)	(What properties are used in the solution?)	Cite at least 2 scenario that you can apply this concept?
		Base on your scenario create a problem containing the given.

Appendix J

QUESTIONNAIRE FOR THE RESPONDENTS

ENHANCING UNDERSTANDING SKILLS OF THE STUDENTS THROUGH CONTENT-BASED RECREATIONAL ACTIVITIES.

Directions: Kindly fill in the necessary information on the space provided for the answer.

Part I. RESPONDENT'S PROFILE

Name: _____

(optional)

Part II. CONTENT-BASED RECREATIONAL ACTIVITIES FACTORS

5 Strongly Agree
4 Agree
3 Moderately Agree
2 Disagree
1 Strongly Disagree

Direction: Given below are reasons as a result when any form of content-based recreational activity is used when a lesson is presented. You may agree or disagree to any one of them. Please indicate your response by checking (v) the option of your choice using the scale below.

	Indicators	**5**	**4**	**3**	**2**	**1**
Respondents' Perception on the Use of Mathematical Game						
Games helps me...						
1.	Understand mathematical concepts.					
2.	Develop mathematical skills.					
3.	Know mathematical facts.					
4.	Learn the language and vocabulary of mathematics					
5.	Develop ability in mental mathematics					
6.	Develop a variety of connections with the content that can form positive memories of learning.					
7.	Develop positive attitude towards Mathematics.					
8.	Develop my problem-solving skills, critical thinking skills, decision making skills etc.					
Respondents' Perception on the Use of Mathematical Puzzle						
Puzzle helps me...						
1.	Encourage mathematical reasoning and logical thinking.					
2.	Develop strategic thinking.					
3.	Develop construction of ideas.					
4.	Improve fundamental operations of mathematics.					
5.	Development of problem solving, critical thinking skills, decision making skills etc.					
6.	Develop a variety of connections with the content that can form positive memories of learning.					
7.	Encourage mathematical reasoning and logical thinking.					

_____