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Effect of anchored instruction on problem solving skills of Grade 10 students

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ABSTRACT

This quasi-experimental research design investigated the effect of using Anchored Instruction strategy on Problem Solving Skills of Grade 10 students of Nicomedes R. Tubar Sr. National High School for the school year 2025-2026. The participants of this study were the Grade 10 students of Nicomedes R. Tubar Sr. National High School, for the school year 2025-2026. The participants of this study were the two sections of Grade 10 students of Nicomedes R. Tubar Sr. National High School, composed of sixty (60) students for the school year 2024-2025, thirty (30) students from section Harmony and thirty (30) students from Simplicity. The data in this study was gathered using a 50-item researcher-made Problem Solving skills test to measure the Problem Solving skills of the Grade 10 students. The descriptive statistics used in the study were the mean, percentage, frequency count, and standard deviation. Moreover, for inferential statistical tools, the t-test for independent and dependent samples was used. The alpha level of significance was set at 0.05. Based on the results, the major findings of the study were the following: The problem solving skills of Grade 10 students in the pretests both the experimental and the control groups was “very low”. While after the intervention, students in the experimental group had “high” problem solving skills and the control group was “moderate”. There was no significant difference between the problem solving skills of Grade 10 students in the pretest of the control and experimental groups. There was a significant difference between the problem solving skills of Grade 10 students in the pretest and posttest of the control group and between the pretest and posttest of the experimental group. There was a significant difference in the problem solving skills of Grade 10 students between the posttests of the control and experimental groups. The effect size of the Anchored Instruction strategy in the problem solving skills of the Grade 10 students was large.

Keywords: Anchored instruction, problem solving skills, quasi-experimental research.

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INTRODUCTION

Global educational frameworks have consistently recognized problem solving as a fundamental component of mathematics education and an essential competency for learners in the twenty first century. The National Council of Teachers of Mathematics emphasizes that problem solving lies at the heart of mathematical proficiency, while international assessments continue to reveal persistent deficiencies in students' ability to apply mathematical knowledge

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in authentic situations. In Indonesia, the Programme for International Student Assessment identified significant gaps in students' problem-solving abilities, highlighting systemic issues in curriculum implementation and instructional approaches that limit learners' capacity to apply mathematics effectively in real world contexts. These findings underscore the urgent need for educational reforms that prioritize the development of problem solving and critical thinking skills (Mailisman et al., 2020). Similar concerns are evident in the Philippine educational context. Findings from the Trends in International Mathematics and Science Study (TIMSS, 2019) and the Programme for International Student Assessment (PISA, 2022) demonstrate that many Filipino students continue to perform below the expected proficiency levels in mathematics, particularly when tasks require reasoning, critical analysis, and the application of mathematical concepts to real life situations. According to the PISA 2022 country results, students' overall mathematics performance remained largely unchanged from 2018. Although the achievement gap between high and low performers narrowed because of modest improvements among lower performing students, the proportion of learners performing below the baseline proficiency level remained statistically unchanged, indicating that substantial challenges in mathematics learning continue to persist (OECD, 2023).

These international and national findings reflect broader concerns regarding students' ability to transfer mathematical knowledge beyond routine exercises into authentic problem-solving situations. Classroom observations further reinforce this concern. The researcher observed that when Grade 10 students were presented with real world mathematical problems, many experienced difficulties identifying the objectives of the tasks, interpreting relevant information, organizing solution procedures, and visualizing mathematical relationships necessary to solve the problems effectively. Rather than approaching problems strategically, students frequently performed irrelevant calculations, struggled to break complex tasks into manageable steps, and became frustrated when they failed to obtain correct solutions. Such experiences often resulted in avoidance of challenging mathematical tasks and contributed to lower academic performance. The researcher believes that persistent difficulties in mathematical problem solving may eventually contribute to mathematics anxiety, reduce students' willingness to engage in cognitively demanding tasks, and hinder the development of critical thinking abilities that are essential for lifelong learning.

Addressing these challenges requires instructional approaches that promote active engagement, meaningful learning, and authentic application of knowledge rather than mere procedural memorization. One instructional innovation that has demonstrated considerable promise is Anchored Instruction. Anchored Instruction is an instructional approach that situates learning within meaningful and realistic contexts through narrative based or video-based scenarios that require learners to apply mathematical knowledge and problem-solving strategies to authentic situations. Rather than presenting isolated exercises, this approach immerses learners in realistic environments where knowledge acquisition and problem solving occur simultaneously, making it particularly beneficial for students who experience difficulties in mathematics (Bottge et al., 2015). Choo et al. (2025) further explained that Anchored Instruction integrates multimedia resources, explicit instruction, hands on learning experiences, and authentic tasks to transform diverse classrooms into engaging learning environments. Through the integration of technology and meaningful real-world contexts, the approach bridges the gap between theoretical understanding and practical application, thereby promoting deeper conceptual understanding, increased engagement, and improved problem-solving skills. Moreover, Anchored Instruction is firmly grounded in constructivist principles, emphasizing that learners actively construct knowledge through exploration, collaboration, analysis, and reflection. By utilizing narrative driven contexts and technological tools, students become active participants in solving problems while simultaneously strengthening collaboration,

critical thinking, sustained engagement, and the transfer of learning across different contexts (Choo et al., 2025).

The instructional principles underlying Anchored Instruction stand in marked contrast to the conventional approach commonly employed in mathematics classrooms. Conventional instruction is generally characterized as teacher centered, textbook driven, and examination oriented, focusing primarily on the transmission of knowledge through lectures and emphasizing memorization and factual recall rather than higher order thinking skills (Williams, 2013, as cited in Rabino, 2019). According to Tularam and Marchisella (2018), traditional instruction positions the teacher as the principal authority while students primarily receive information through direct explanation, demonstrations, and repetitive practice. Similarly, Soni and Dwivedi (2020) described conventional instruction as heavily dependent on memorization, drills, and procedural exercises that prioritize algorithmic competence over conceptual understanding. Although such approaches may enhance computational accuracy and factual recall, they often provide limited opportunities for learners to engage in reasoning, inquiry, exploration, and authentic problem solving. Consequently, students may become passive recipients of knowledge, reducing their capacity to think creatively, analyze mathematical situations critically, and connect classroom learning with real world applications.

The importance of strengthening mathematical problem solving extends well beyond improving academic achievement. Problem solving serves as a foundation for developing logical reasoning, critical thinking, informed decision making, and adaptability, all of which are essential competencies for addressing challenges encountered in everyday life. Through meaningful engagement with mathematical problems, learners acquire systematic approaches to analyzing situations, generating possible solutions, evaluating alternatives, and making informed decisions that can be transferred across academic disciplines and practical contexts (Art of Problem Solving, n.d.). Problem solving skills likewise encompass the ability to identify and define problems clearly, formulate and evaluate possible solutions, implement appropriate actions, and reflect upon outcomes to improve future performance. Within educational settings, these competencies contribute not only to improved academic achievement but also to the development of adaptable and resilient learners capable of responding effectively to complex situations both inside and outside the classroom (Cleverism, n.d.).

The present study is grounded in Constructivist Theory, which posits that learning is an active process in which individuals construct knowledge through experience, interaction, and reflection rather than passively receiving information from teachers. Constructivism emphasizes that learners interpret new information by connecting it with prior knowledge, continuously refining or restructuring their understanding as they encounter new experiences. This perspective views learners as active participants who develop knowledge by questioning, exploring, and evaluating ideas within meaningful learning environments (Singh & Shailza, 2025). Complementing this perspective is Lev Vygotsky's Theory of the Zone of Proximal Development, which emphasizes that learners achieve higher levels of understanding when provided with appropriate guidance and support from teachers or more capable peers. Through scaffolding, students receive the necessary assistance to accomplish tasks that would otherwise be beyond their independent capabilities, thereby facilitating the gradual development of higher cognitive processes and greater learning independence. Together, these theoretical perspectives provide a strong conceptual foundation for Anchored Instruction by emphasizing authentic learning experiences, collaborative problem solving, guided inquiry, and active knowledge construction.

Collectively, the reviewed literature demonstrates a broad consensus regarding the importance of developing students' problem-solving abilities while simultaneously revealing persistent weaknesses in mathematics achievement at both international and national levels. Existing studies consistently support the educational value of constructivist, technology integrated, and authentic instructional approaches such as Anchored Instruction. However, despite growing evidence of its effectiveness in enhancing mathematical understanding and problem solving, limited research has examined its application among Grade 10 learners within the local educational context of Nicomedes R. Tubar Sr. National High School. This contextual gap provides a compelling rationale for the present investigation. Guided by Constructivist Theory and Vygotsky's Theory of the Zone of Proximal Development, this study sought to determine the effect of Anchored Instruction on the problem-solving skills of Grade 10 students of Nicomedes R. Tubar Sr. National High School during the School Year 2025 to 2026, with the goal of generating empirical evidence that may contribute to improving mathematics instruction and strengthening students' problem-solving competencies.

Statement of the problem

The main purpose of this study was to investigate the effect of Anchored Instructions Strategy on the problem-solving skills of Grade 10 students of Nicomedes R. TubarSr. National High School, Pase, San Dionisio, Iloilo for School Year 2025-2026.

Specifically, this study sought to answer the following questions:

1. What are the problem-solving skills of Grade 10studentsin the pre-tests and post-tests of the control and the experimental groups?
2. Is there a significant difference in the problem-solving skills of Grade 10studentsin the pre-tests of the control and the experimental groups?
3. Is there a significant difference in the problem-solving skills of Grade 10studentsin the pre-tests and post-tests of the control and the experimental groups?
4. Is there a significant difference in the problem-solving skills of Grade 10 students in the post-tests of the control and the experimental groups?
5. What is the effect of Anchored Instructions Strategy on the problem-solving skills of Grade 10students?

METHODOLOGY

This study was conducted to determine the effect of Anchored Instruction on the problem-solving skills of Grade 10 learners of Nicomedes R. Tubar Sr. National High School, school year 2025-2026. The study employed a quasi-experimental research design, specifically the pretest–posttest non-equivalent control group design. According to Best and Khan, as cited by Tropico (2015), a quasi-experimental design closely resembles a true experimental design; however, it differs in that it does not involve the random assignment of participants to either the control or experimental group. Instead, existing groups are utilized, making it suitable for real-world educational settings where randomization may not be feasible. While they were less rigorous than true randomized controlled trials, they can still provide valuable insights into the effects of interventions in real-world settings (Schweizer, 2016). This design is commonly used in classroom experiments when the experimental and control group are such naturally assembled groups as intact classes that may have collective similarity in characteristics.

In this design, the experimental group was represented as O1, followed by the intervention denoted as X, followed by the posttest denoted as O3, while the control group was represented as O2, without the intervention, followed by the posttest denoted as O4, with both groups observed across the same time frame covering the pretest and posttest periods. In the

pretest-posttest control group design, the intervention or treatment was introduced to the experimental group but withheld from the control group. Before the introduction of the intervention, a survey observation, and testing was done in both the experimental group (O1) and control group (O2). After the intervention to the experimental group, another observation or testing (posttest) was administered to both groups (O3 and O4), respectively. The pretest determined whether the two groups had truly collective similarity at the start of the experiment. The two posttests (O3 and O4) were then compared (Falcis, 2016).

The Anchored Instruction strategy was used for the experimental group and conventional strategies of teaching for the control group. The independent variables were the Anchored Instruction and conventional strategies, and the dependent variable was the problem-solving skills of the Grade 10 learners. The descriptive statistics that were used in the study were the mean, Cohen's d, and standard deviation. The inferential statistics was the t-test set at 5% level of significance.

The participants of this study were two sections composed of sixty (60) Grade 10 students of the Nicomedes R. Tubar Sr. National High School, school year 2025-2026. Section Harmony was composed of thirty (30) students and section Simplicity was composed of thirty (30) students. The number of participants for both groups was determined by comparing their average grades in Mathematics during the first quarter for School Year 2025-2026 to ensure similarity of both groups. Elimination of students in each group was made until their grades became comparable using t-test for independence. To determine which section was assigned to the control or experimental group, the names of the two sections were written on a piece of paper and then rolled. The researcher assigned the first drawn paper to the experimental group, and the second paper that was picked was assigned as the control group. Students who were assigned to the experimental group were exposed to the use of Anchored Instruction; on the other hand, the students who were assigned to the control group were taught using conventional strategies of teaching problem solving.

The problem-solving skills of the students were assessed using a 10-item researcher-made problem-solving test. Each item was worth 5 points, making a total of 50 points for the entire test. The test items were designed to cover key topics in Mathematics 10, specifically permutations and combinations, aligned with the Most Essential Learning Competencies (MELCs) for the first half of the third grading period. A rubric was employed to evaluate the students' problem-solving skills, focusing on both accuracy of computation and effectiveness of execution. Prior to the construction of the test, a Table of Specifications (TOS) was developed to ensure that each topic was appropriately represented and proportionally weighted, thereby enhancing the validity of the assessment. Prior to the use of the instrument, the problem-solving test underwent content validation by three Mathematics teachers of Nicomedes R. Tuba Sr. National High School. All suggestions and recommendations were incorporated into the assessment tools.

To interpret the problem-solving skills of the Grade 10 learners for the control and experimental groups, a mean score scale was used, wherein a mean score ranging from 40.01-50.00 was described as Very High, a mean score ranging from 30.01-40.00 was described as High, a mean score ranging from 20.01-30.00 was described as Average, a mean score ranging from 10.01-20.00 was described as Low, and a mean score ranging from 0.00-10.00 was described as Very Low.

The researcher employed three phases in the conduct of the study: the pre-experimental phase, the experimental phase, and the post-experimental phase. During the pre-experiment phase, the researcher secured permission from the School Principal of Nicomedes R. Tubar Sr. National High School to allow the researcher to conduct the study and use the Grade 10 students

enrolled for the school year 2025-2026 as respondents of the study. The researcher obtained parental consent for their children's participation in the study through a formal written request. Students were also informed about their involvement in the study, and an orientation was conducted to explain the objectives, procedures, and other relevant details. Upon receiving approval, the researcher identified the groups for the study by randomly selecting rolled papers containing the names of the sections, thereby designating the experimental and control groups. To ensure the comparability of both groups, the number of participants was determined by analyzing and comparing their average Mathematics grades from the First Quarter of the School Year 2025–2026.

Prior to the actual implementation of the study, the researcher prepared the problem-solving skills tests for both the pretest and posttest, along with other instructional materials necessary for the lessons. The completed problem-solving skills test was submitted to three Mathematics teachers of Nicomedes R. Tubar Sr. National High School and a panel of experts for face validation. Their suggestions and recommendations were carefully considered and incorporated into the final revision of the instrument to enhance its validity. Before the start of the lesson, the teacher administered the pretest in a face-to-face manner to both the experimental and control groups. The result of the pretest was checked, recorded, and tabulated for analysis using the appropriate statistic.

During the experiment proper phase, the researcher first oriented the experimental group on how to use Anchored Instruction, while the control group was taught using conventional strategies of teaching. The study was conducted for four (4) weeks, or twenty days. The researcher handled both groups. The schedule for the control group was 2:30-3:15 PM and for the experimental group was from 3:15-4:00 PM, from Monday to Thursday.

The students in the experimental group, who were exposed to Anchored Instruction, engaged in different activities made by the researcher every day, four days a week. On the first week, the Most Essential Learning Competency involved illustrating the permutation of objects (M10SP-IIIa-1). The students were taught using Anchored Instruction. During the first week, the lesson began with a video, "Introduction to Permutations," that introduces a realistic situation related to the topic in dealing with the concepts of permutations. The video served as an anchor around which all learning activities were structured. During the second week of class, the learning competency involved solving problems involving permutations. The lesson used a YouTube video, "Solving Problems Involving Permutations," which focuses directly on word problems involving permutations at the start of the class. The video served as an anchor around which all learning activities were structured. The learning competency of illustrating combination of objects, at the third week of class, involved (M10SP-IIIc-1) students being given an anchored video, "Intro to Combinations," along with activities and exercises associated with combination. During the intervention, students engaged in several problem-solving exercises focusing on combinations, allowing them to apply the learned concepts in various contextual situations. During the fourth or final week of class, the Most Essential Learning Competencies (MELCs) focused on differentiating permutations from combinations of objects taken r at a time (M10SP-IIIc-2) and solving problems involving permutations and combinations (M10SP-IIId-e-1). In this phase, students engaged in the video "The Organic Chemistry Tutor – Permutations and Combinations Word Problems" and were provided various exercises and activities aimed at distinguishing between permutations and combinations. Students were also tasked to solve contextualized and real-life mathematical problems that required the application of permutation and combination concepts to enhance their problem-solving and analytical skills. The researcher provided learning activity sheets and exercises based on Anchored Instruction to promote accurate, detailed analysis and comprehension of mathematical procedures.

At the end of each session, students completed an assessment to evaluate their understanding of the lesson. Students were also encouraged to explain the processes and computations involved in their solutions to demonstrate conceptual mastery. Throughout the discussion, the researcher presented situational problems related to real-life contexts, allowing students to deepen their understanding of mathematical problem-solving. The competencies covered in the intervention were systematically distributed across four weeks. During the first week, students focused on illustrating permutations of objects, developing a foundational understanding of how arrangement and order affect outcomes. In the second week, the lessons emphasized solving problems involving permutations, allowing students to apply the concept in various contextualized situations. The third week was devoted to illustrating combinations of objects, highlighting instances where order is not a determining factor. In the fourth week, students were guided to differentiate permutations from combinations of objects taken r at a time and to solve real-life and mathematical problems involving both permutations and combinations. This progressive sequencing of competencies ensured continuity of learning and deepened conceptual understanding of counting principles in Mathematics 10.

An alternative set of tasks and activities was provided to the control group, ensuring that they received instruction parallel in content but different in approach from the experimental group. The control group engaged in traditional teacher-directed activities such as lectures, guided practice, and written exercises. These tasks were designed to cover the same competencies while maintaining the use of conventional teaching methods, allowing for a valid comparison of learning outcomes between the two groups. During each session, students were organized into groups and assigned specific activities aligned with the lesson for the day. Through these group-based tasks, students explored the given concepts and topics using conventional methods to facilitate understanding of the lesson content. As for the control group, from the first to the fourth week, the control group was taught through lectures and guided practice sessions on the different mathematical concepts included in the curriculum. The teacher facilitated the lessons by explaining theories, demonstrating sample problems, and providing step-by-step solutions. To reinforce learning, students were given home assignments and reflective questions that served as formative assessments of their daily learning progress. At the end of the instructional period, an application quiz was administered to assess the students' overall mastery of the topics covered and to determine the effectiveness of the traditional lecture-based approach compared to the experimental group exposed to Anchored Instruction.

The post-test was administered at the end of the fourth week. It consisted of the same problem-solving test used during the pre-test; however, the arrangement of the test items was modified to prevent recall and ensure the validity of student responses.

During the post-experiment phase, after the experimental phase, the researcher carried out several tasks related to data organization and analysis. The post-test data from both the control and experimental groups were carefully tabulated and encoded using the Microsoft Excel application for initial organization and verification. Subsequently, both the pre-test and post-test results were processed and analyzed using the Statistical Package for the Social Sciences (SPSS) software to determine the effectiveness of the intervention. All data gathered were handled with the highest level of confidentiality to ensure the privacy and integrity of the participants' information.

The data gathered were subjected to computer-processed statistics using the Statistical Package for Social Sciences (SPSS) Software. The mean was used to describe the level of Problem-Solving Skills of the Grade 10 students both in the control and the experimental groups. The standard deviation was used to determine the homogeneity and heterogeneity of

the scores that were obtained by the students in the pretest and posttest. The t-test for dependent samples was used to determine the significant difference between the pretest and posttest of the experimental group and the pretest and posttest of the control group. The t-test for independent samples was used to test the significant difference between the pretest result of the experimental and control groups and the posttest of the respondents. Cohen's d was used to determine the effect size, indicating the standardized difference between two means.

RESULTS AND DISCUSSION

This study was conducted with the full participation of sixty (60) Grade 10 students of Nicomedes R. Tubar Sr. National High School, school year 2025-2026, equally distributed between section Harmony as the experimental group and section Simplicity as the control group, with thirty (30) students in each. The study utilized a quasi-experimental research design, specifically the pretest posttest non-equivalent control group design, with sections assigned to their respective groups through a random draw of rolled papers. A 10-item researcher-made problem-solving test, validated by three Mathematics teachers and covering permutations and combinations, served as the primary data collection instrument, with student performance interpreted through a five-level descriptive scale ranging from 0.00-10.00 as Very Low to 40.01-50.00 as Very High. The gathered data were analyzed using descriptive statistics, specifically the mean and standard deviation, and inferential statistics, specifically the t-test for independent samples, the t-test for dependent samples, and Cohen's d, all set at the 5% level of significance. The following discussion presents and interprets these results in direct relation to the objectives of the study, which sought to determine the effect of Anchored Instruction on the problem-solving skills of Grade 10 learners.

Data revealed that the level of problem-solving skills of Grade 10 students in the pretests of both the control and the experimental group is very low ($M = 6.80$; $SD = 3.02$ and $M = 6.40$; $SD = 2.92$, respectively). After four weeks of intervention, the posttest data showed that the control group registered an increase in problem-solving skills from very low to moderate ($M = 26.63$; $SD = 4.04$), while those exposed to the Anchored Instruction Strategy improved from very low to high ($M = 32.47$; $SD = 4.32$). The very low pretest scores of both groups imply that the students had not yet developed an understanding of how to handle or solve problems involving permutations and combinations prior to the intervention, suggesting that the topic was difficult for many of them. Because the pretest scores of the two groups were nearly identical, both groups may be considered to have started from a position of collective similarity in ability. This further implies that students in both groups may have lacked prior knowledge of the basic ideas and strategies needed for effective problem solving, as well as sufficient exposure to activities that build such skills. Without adequate practice in real-life problem-solving or critical-thinking tasks, and without training to think carefully and break problems into smaller parts, students may struggle to arrive at solutions, particularly when motivation to attempt difficult tasks is low.

The increase in problem-solving scores from pretest to posttest in both groups indicates that students genuinely improved when exposed either to the Anchored Instruction strategy or to the conventional method of teaching. The control group reached an average level of problem-solving skill, while the experimental group achieved a higher mean gain, suggesting that Anchored Instruction is more effective than the conventional method of teaching. The higher performance of students exposed to Anchored Instruction may be attributed to the manner in which the strategy presents lessons through real-world stories, videos, and problem situations, which makes tasks feel realistic and meaningful and increases student engagement and motivation. Through Anchored Instruction, students are encouraged to think deeply, analyze situations, and connect ideas and skills, which helps build stronger problem-solving abilities.

The rich information embedded in the anchor videos requires students to pick out important details, analyze them, and decide how to apply them, much as they would in real situations, while naturally practicing critical observation such as recognizing patterns, cause and effect relationships, and changes occurring within the presented scenario. The engaging and lively presentation of Anchored Instruction videos further captures students' interest and attention, making learning more exciting and meaningful and encouraging more active participation, which in turn strengthens problem-solving skills.

Although the conventional teaching strategy is teacher-centered and relies mainly on lectures and discussions, students in the control group were still able to demonstrate improvement in their mathematics performance, though their results only reached an average level. This may be attributed to certain limitations of the conventional approach, which does not always accommodate the different learning styles of every student and may result in limited engagement, fewer opportunities for hands-on practice, and a learning environment in which students mostly listen rather than actively participate. This suggests that Anchored Instruction is a powerful tool for effectively improving students' problem-solving skills. These findings conform to the study of Roberto (2025), in which the problem-solving skills of Grade 10 learners in the pretests of both the control and experimental groups were low, while after the intervention, learners in the control group attained average problem-solving skills and those in the experimental group attained high problem-solving skills. However, the present findings disagree with the study of Elisan (2019) on the effect of visual representation on the mathematics performance of Grade 9 students, in which both groups demonstrated low performance in the pretest, with the control group later achieving a moderate performance level and the experimental group attaining a high-performance level after the intervention. The findings likewise disagree with those of Bolivar (2022), who reported that Grade 7 non-numerate students demonstrated a very low level of proficiency in the four fundamental operations in the pretests for both groups, with the control group later reaching a low proficiency level and the experimental group reaching a very high proficiency level following the intervention.

Data further show that there is no significant difference in the problem-solving skills of Grade 10 students in the pretests of the control and the experimental groups, $t(58)$, $p > 0.00$. This absence of a significant difference implies that both groups started with similar levels of mathematics problem-solving skills, suggesting comparable prior knowledge, abilities, and background experiences before the intervention was introduced. It also implies that neither group held an academic advantage at the outset of the study, which strengthens the fairness and validity of the research design. This result further suggests that both groups were in need of support in developing their problem-solving skills, underscoring the importance of implementing an effective instructional strategy such as Anchored Instruction. The lack of a significant difference may likewise indicate that students in both groups had limited exposure to higher-order thinking tasks, non-routine problems, rich mathematical discussions, real-life problem contexts, or reflective thinking exercises prior to the study, and may also be attributed to the test having been aligned with common learning standards and administered identically to both groups. This finding conforms to the study of Elisan (2019), which found no significant difference between the pretest scores of the two groups in mathematics performance, and agrees with the study of Bolivar (2024), which revealed no significant difference in the mathematics performance of Grade 7 students between the pretests of the control and experimental groups. Hence, the null hypothesis stating that there is no significant difference in the problem-solving skills of Grade 10 students in the pretests of the control and experimental groups is hereby accepted.

Results further show that there is a significant difference in the problem-solving skills between the pretest and posttest of students in the control group using conventional strategies, t (29) = 42.87515, p = .000. Likewise, there is a significant difference in the problem-solving skills between the pretest and posttest of students in the experimental group using the Anchored Instruction Strategy, t (29) = 50.276, p = .000. These significant differences imply that students' problem-solving skills improved under both conventional teaching and Anchored Instruction, indicating that both groups learned and improved over the course of the study. Students in the control group showed significant improvement, moving from a very low level in the pretest to an average level in the posttest, implying that conventional teaching also contributed meaningfully to students' learning through consistent teacher explanations, classroom discussions, and guided practice, even without the use of specialized instructional tools such as anchored instructional videos. Although the improvement in the control group was not as pronounced as in the experimental group, the result confirms that conventional teaching remains helpful and effective in many classroom settings. This finding is parallel to the study of Roberto (2025), which found a significant difference in the problem-solving skills of Grade 10 learners between the pretests and posttests of the control group, and agrees with the study of Bolivar (2024), which reported significant differences in the problem-solving skills of Grade 7 non-numerate students between the pretests and posttests of the control group. However, it disagrees with the study of Rabino (2019), which indicated no significant difference in the mathematics performance of Grade 7 students between the pretest and posttest of the control group. Thus, the null hypothesis stating that there is no significant difference in the problem-solving skills of Grade 10 students in the pretest and posttest of the control group is hereby rejected.

The significant difference between the pretest and posttest scores of the experimental group implies that Anchored Instruction was highly effective in improving students' problem-solving skills. The substantial increase in scores indicates that students benefited not only from additional practice but also from the meaningful and engaging manner in which lessons were delivered through real-life situations, videos, and story-based tasks that connected learning to everyday experience, helping students better understand concepts, remember procedural steps, and apply their knowledge in solving problems. This marked improvement further suggests that students in the experimental group were more actively involved in the learning process, exploring, observing, analyzing, and discussing the scenarios presented to them rather than merely listening to the teacher, a level of participation that supports deeper thinking and stronger reasoning skills. Because lessons were presented in contexts students could visualize and relate to, they were more motivated and interested, which increased their effort and performance. The significant results also imply that Anchored Instruction supported higher-order thinking by teaching students to identify important information from the videos, filter out unnecessary details, and make decisions on how to approach a problem, skills essential for real problem-solving, while also encouraging teamwork, communication, and the sharing of ideas that helped students learn from one another and refine their understanding. The improvement in the experimental group's scores further indicates that students responded positively to learning that is visual, interactive, and meaningful, with anchor materials helping them connect abstract concepts to concrete situations and see the relevance of mathematics in real life, thereby increasing motivation and performance. Overall, the significant differences observed in both groups show that instruction, whether conventional or Anchored Instruction, helped students improve their problem-solving skills, though the substantially larger increase in the experimental group suggests that Anchored Instruction provided richer, more interactive, and more effective learning experiences. This result supports the study of Bolivar (2024), which found significant differences between the pretest and posttest scores of the experimental group, and conforms to the study of Cariaso (2023), which found a significant difference in the

problem-solving skills of BEED students between the pretests and posttests of the experimental group. It further confirms the study of Roberto (2025), which reported a significant difference in the problem-solving skills of Grade 10 learners between the pretests and posttests of the experimental group, and agrees with the study of Piansay (2016), which found a significant difference in the mathematics performance of Grade Six pupils between the pretests and posttests of the experimental group. Thus, the null hypothesis stating that there is no significant difference in the problem-solving skills of Grade 10 students in the pretest and posttest of the experimental group is hereby rejected.

Data also show that there is a significant difference in the problem-solving skills of Grade 10 students in the posttests of the control and the experimental groups, $t(58) = 5.402$, $p = .000$, in favor of the experimental group using the Anchored Instruction strategy. This significant difference implies that the Anchored Instruction strategy applied to the experimental group had a positive influence on students' problem-solving skills, resulting in higher performance relative to the control group. This finding suggests that adopting Anchored Instruction can yield higher post-intervention performance, particularly on tasks requiring analysis, strategy selection, and justification, since exposure to real-life problems and rich contextual scenarios encourages students to carefully analyze information, identify key details, and select appropriate strategies for solving a problem, resulting in greater confidence, efficiency, and capability in applying the right strategies across different mathematical situations. By integrating engaging videos with real-world tasks that require analysis, decision-making, identification of relevant details, and justification of reasoning, Anchored Instruction effectively enhances critical thinking and analytical skills, immersing students in meaningful contexts and encouraging them to be active participants in the learning process. This result is parallel to the study of Bayarcal and Tan (2023), who found a significant difference in the problem-solving achievement levels of Grade 8 students between the posttest scores of the control and experimental groups when the Open-Ended Approach was used, and confirms the findings of Bolivar (2024), who found a significant difference in the mathematics performance of Grade 7 non-numerate students in the posttests of the control and experimental groups. However, this study disagrees with the findings of Piansay (2016), which showed no significant difference in the mathematics performance of Grade Six pupils in the posttests of the control and experimental groups. Therefore, the null hypothesis stating that there is no significant difference in the problem-solving skills of Grade 10 learners in the posttests of the experimental and control groups is hereby rejected.

The computation of effect size revealed that the Anchored Instruction Strategy has a large effect on the problem-solving skills of Grade 10 students, $d = 1.39$, based on the posttest means and standard deviations of the control group ($M = 26.63$; $SD = 4.04$) and the experimental group ($M = 32.47$; $SD = 4.32$). This large effect implies that the Anchored Instruction Strategy is highly effective in enhancing students' problem-solving skills and in promoting meaningful learning and substantial performance gains. It suggests that the real-world scenarios, engaging videos, contextualized tasks, and opportunities for active participation embedded within Anchored Instruction significantly enhance students' understanding and application of mathematical concepts, while also supporting deeper cognitive processing and helping students build more lasting and transferable problem-solving skills. In practical classroom terms, this level of effect indicates that integrating the Anchored Instruction strategy produces a degree of learning growth that would be visible and meaningful, supporting basic procedural understanding while allowing students to connect mathematical ideas to real-life situations and promoting deeper comprehension. The large effect further implies that Anchored Instruction addresses critical learning needs that conventional methods

may not fully reach, encouraging students to think critically, justify decisions, create step-by-step processes, analyze information, and explore multiple solution paths, while continuously enhancing motivation, engagement, and confidence, and helping students persist when faced with challenging tasks. The dynamic visual, auditory, contextual, and spatial features of the anchor videos ensure retention and engagement, providing opportunities for students to apply knowledge in meaningful contexts and enabling clearer comprehension, stronger critical thinking, and more confident problem-solving performance. This result agrees with the study of Roberto (2025), which found that the effect size of a ChatGPT application on the problem-solving skills of Grade 10 learners was large, but disagrees with the findings of Reliente (2019), who found that the effect size of the Agile Learning Approach on the mathematics performance of Grade 10 students was very large.

Taken together, these findings directly address the objectives of the study by demonstrating that Grade 10 learners in both the control and experimental groups began the intervention with very low and statistically comparable levels of problem-solving skill, that both conventional teaching and the Anchored Instruction strategy produced statistically significant improvements in these skills over the four-week intervention period, and that the Anchored Instruction strategy produced significantly greater gains than the conventional approach, as confirmed by the significant posttest difference in favor of the experimental group and by the large effect size of $d = 1.39$. These results affirm that Anchored Instruction, through its use of real-world anchors, contextualized video-based scenarios, and opportunities for active analysis and decision-making, is a substantially more effective strategy than conventional, teacher-centered instruction for developing the problem-solving skills of Grade 10 learners in the areas of permutations and combinations. This contribution reinforces existing literature on contextualized and technology-supported instruction while extending it to the specific competencies and setting examined in this study. These findings provide the empirical basis for the summary of findings, conclusions, and recommendations presented in the succeeding chapter.

CONCLUSION

Based on the findings of the study, several conclusions were drawn. The Grade 10 students in both the control and experimental groups acquired very low problem-solving skills as reflected in the pretest results. This very low performance prior to the intervention indicates that students may have had limited exposure to essential mathematical concepts and problem-solving strategies in previous grade levels, leading to difficulty in applying basic problem-solving skills. Their limited ability to comprehend problem situations, identify relevant information, and select appropriate solution strategies suggests gaps in both conceptual understanding and strategic thinking, indicating that students had not yet internalized key problem-solving processes such as organizing steps, planning, evaluating, and checking the accuracy of their solutions. The very low pretest scores further denote weaknesses in prior instruction or in students' engagement with mathematics, which may have contributed to poor self-confidence and difficulty in interpreting problems, selecting appropriate approaches, and executing multi step solutions, suggesting that students had not yet mastered the logical reasoning skills required for effective problem solving. This also reflects insufficient practice in reasoning, analyzing, proving, and evaluating mathematical situations, skills that are fundamental to identifying, synthesizing, understanding, representing, and applying concepts needed to develop higher order thinking. Since both groups exhibited very low performance in the pretest, it can be concluded that they were relatively equivalent before the intervention, which strengthens the validity of the study by demonstrating that any posttest improvements can be attributed to the intervention rather than to pre-existing differences between the groups.

After the intervention, students in the experimental group attained high results while students in the control group attained average results in their problem-solving skills, and a comparison of pretest and posttest performance revealed an increase in problem solving skills in both groups. This indicates that genuine improvement in students' problem-solving skills occurred following exposure to either the Anchored Instruction strategy or the conventional method of teaching, although the Anchored Instruction strategy proved more effective than the conventional approach. This substantial improvement in the experimental group may be attributed to the realistic and meaningful scenarios embedded in the strategy, which provided context rich learning experiences that strengthened students' analytical thinking, reasoning, and application of mathematical concepts. This further indicates that incorporating anchored, video based lessons as an instructional intervention offered learning experiences that were more engaging, contextualized, and cognitively demanding than traditional approaches, helping students connect mathematical ideas, apply strategies more confidently, and internalize concepts at a higher level, and that the strategy can serve as an effective supplementary approach for improving problem solving skills by encouraging students to explore problems, analyze situations, and decide what strategies to use.

There was no significant difference in the problem-solving skills of Grade 10 students in the pretests of the control and experimental groups, which may be attributed to the homogeneity of the students within each group and the similarity of their problem-solving abilities prior to the introduction of the intervention. This finding indicates that both groups had similar levels of prior knowledge, exposure, and learning experiences before the intervention, resulting in similar baseline performance, and suggests that students from both groups encountered the same instructional approaches and learning conditions in previous grade levels, leading to equivalent foundational skills. Since neither group had an advantage at the start, the uniformity of their pretest scores reflects comparable previous learning experiences, instructional backgrounds, and curriculum exposure, confirming that both groups began the study at the same baseline. This means that any improvements observed after the intervention are more likely the result of the teaching strategy used rather than a pre-existing advantage of one group over the other, and that there was no bias in the selection of the students for the study, since both groups showed similar levels of performance in the pretest. This collective similarity suggests that the learners began the study with comparable backgrounds and abilities, which likely contributed to their similar problem-solving performance at the outset and further affirms that the groups were suitable for inclusion in the study.

The significant difference in the problem-solving skills between the pretest and posttest of Grade 10 students exposed to the Anchored Instruction strategy demonstrates that the strategy had a meaningful impact on students' problem-solving skills. This indicates that integrating the Anchored Instruction strategy was effective in improving students' problem-solving abilities, as they demonstrated substantial growth after being exposed to real world, context-based learning tasks. The improvement implies that the strategy helped students better understand mathematical concepts, think critically, and apply appropriate solution methods, and further shows that the approach provided meaningful learning experiences that strengthened students' reasoning, engagement, and confidence in solving problems. The effectiveness of Anchored Instruction indicates that the approach provided students with real world, meaningful scenarios that made mathematical concepts easier to understand and apply, allowing students to become more engaged and confident, to understand mathematical concepts more deeply, and to demonstrate clear gains in their ability to reason, analyze, and solve problems. Through this approach, students were able to explore problems, analyze situations, and construct their own understanding instead of relying on memorized steps, while

also benefiting from increased opportunities for collaborative learning in which they discussed ideas, compared strategies, and learned from one another. At the same time, the significant difference between the pretest and posttest of the control group implies that the conventional teaching method was still effective in enhancing students' problem-solving skills. Although the improvement was not as substantial as that of the experimental group, the results show that traditional instruction, such as teacher led discussions, step by step demonstrations, and guided practice, can still support students in understanding procedures and solving routine problems, helping learners strengthen their basic computational skills, recall familiar strategies, and apply previously learned techniques. This progress suggests that, even without innovative approaches such as Anchored Instruction, conventional teaching can still contribute to skill development, particularly when lessons are clearly explained, examples are provided, and students are given opportunities to practice solving problems, although the smaller gain relative to the experimental group indicates that the traditional method may be less effective in promoting deeper reasoning, real world application, and higher order thinking.

The significant difference between the posttest results of the control and experimental groups indicates that the intervention applied to the experimental group, the video based Anchored Instruction strategy, had a strong and positive influence on students' problem-solving skills, resulting in a high level of performance. This reflects that Anchored Instruction provides richer, more meaningful learning experiences compared to traditional approaches, as immersing students in realistic situations helps them understand mathematical concepts in context, encourages deeper reasoning, and allows them to practice applying their knowledge to practical challenges. It also reflects that students benefit from visual, narrative-based learning, which supports engagement, motivation, and sustained focus, and highlights that Anchored Instruction promotes higher order thinking skills, such as analyzing information, making decisions, and evaluating solutions, abilities that are essential for strong problem-solving performance. Overall, this significant difference demonstrates that the Anchored Instruction strategy is a highly effective method for enhancing students' mathematical understanding and problem-solving abilities.

Finally, the Anchored Instruction strategy was found to have a large effect on the problem-solving skills of Grade 10 students, indicating that the strategy was highly effective in helping learners understand mathematical ideas more deeply and apply them more confidently in solving problems. This large effect shows that the use of real life, video-based scenarios allowed students to connect mathematics to practical situations, making lessons more meaningful and easier to understand, and suggests that the strategy engaged students actively, encouraged critical thinking, and helped them develop stronger reasoning skills. The strong impact of the intervention indicates that students benefited from learning mathematics through meaningful, real-world scenarios that helped them connect concepts to practical situations, with the video-based anchors providing visual and contextual cues that supported comprehension, increased engagement, and sparked curiosity, leading to greater motivation to participate in problem solving tasks. The strategy further encouraged students to think critically, analyze information, and explore multiple solution pathways, helping them develop higher order reasoning skills, while collaborative tasks within the anchored activities allowed learners to share ideas, discuss strategies, and learn from one another, further strengthening their confidence and mathematical thinking.

Taken together, these findings lead to the overall conclusion that the Anchored Instruction strategy was highly effective in enhancing the problem-solving skills of Grade 10 students. The significant improvement from pretest to posttest in the experimental group demonstrates that video based, context rich learning experiences support deeper understanding and more meaningful engagement with mathematical concepts, enabling learners to apply mathematical ideas more confidently, think more critically, and approach unfamiliar problems

with greater competence compared to those taught using conventional methods. While traditional instruction still contributed to some improvement in the control group, the gains observed were noticeably smaller, underscoring the superior impact of anchored, real world learning scenarios. The study therefore concludes that Anchored Instruction is a powerful and effective pedagogical approach that supports higher order thinking, active learning, and improved problem solving performance, and on this basis it is recommended for adoption as a valuable instructional strategy for mathematics teaching at the junior high school level, particularly in developing learners' competencies in permutations and combinations and other topics that require analytical and contextualized problem solving.

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