

The Influence of Social Trends-Based Instruction on Students' Mathematical Problem-Solving Skills

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Abstract This study investigated the influence of social trends-based instruction on students' problem-solving skills in mathematics of finance lesson. The study employed a quasi-experimental design, comparing a social trends-based instruction group with a conventional instruction group. The participants of this study were the two intact classes of Bachelor of Science in Hospitality Management students of North Eastern Mindanao State University, Philippines. The study used researcher-made test based on National Council for Mathematics Teachers principles and standards to assess students' math problem-solving skills. The test was found to be both valid and reliable. The findings revealed that both instructional methods resulted in improvements in students' problem-solving skills as reflected in their pre-test and post-test mean scores. However, the social trends-based group demonstrated a more substantial increase, suggesting its potential as a more effective method. Statistical analysis using ANCOVA showed a significant difference in post-test scores between the two groups, suggesting that the type of instruction used had a significant impact on student performance. By connecting mathematics to real-world social trends, students became more engaged and motivated to learn. The study underscores the potential of social trends-based instruction to improve student learning and suggests the need for further research to explore the long-term impact of social trends-based instruction on student achievement in mathematics.

Keywords: social trends-based instruction, teaching method, problem-solving skills

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1. Introduction

1.1. Background

Mathematics education provides students with the fundamental skills they need to succeed in many different fields [1]. This means that math education gives students a wide range of skills that can help them excel in school, in their jobs, and in their daily lives. It encourages students to be curious, think critically, and solve problems, all of which are important for success in today's world. However, most students did not value mathematics because they did not see its importance in their lives [2]. This causes them to have difficulty learning the subject area because their perception of the subject may affect achievement level [3].

Recent international assessments, such as the Program for International Student Assessment (PISA) 2022 and the Trends in International Mathematics and Science Study (TIMSS) 2019, have revealed that Filipino students continue to struggle in math, reading, and science compared to their peers worldwide. These assessments indicate no significant improvement since 2018. Furthermore, the National Achievement Test (NAT) results from the 2022-2023 school year show poor

academic performance in math, reading, and science among Filipino learners. This trend extends to the tertiary level, where many first-year college students in state colleges and universities struggle with math, often leading to negative attitudes towards the subject. A study on mathematics competencies at West Visayas State University found that while college students excelled in basic math skills like scientific notation, exponential expressions, and ratio and proportion, they struggled with data analysis and problem-solving [4].

Students with consistently poor math performance may eventually lose interest and stop trying to learn [5]. One common reason for this underperformance is ineffective teaching methods [6]. As educators, we must emphasize the importance of math education and ensure it receives proper attention. However, current teaching methods often rely heavily on abstract concepts and rote learning [7]. This approach lacks real-world connections and can lead to student disengagement and a belief that math is irrelevant [8]. To improve student motivation and achievement, we need to explore new teaching methods that make math more engaging and meaningful.

One promising approach to teaching math is context-based instruction. This method involves using real-world examples to teach concepts, making learning more practical and engaging [9]. Several studies have shown

that teachers believe context-based instruction can improve students' problem-solving skills [10]. Additionally, researchers have found that this approach can boost students' interest, attitudes, and motivation towards math [11]. Furthermore, studies have indicated that context-based teaching helps students connect math concepts to their daily lives [12]

Another approach gaining popularity in math education is the integration of social justice. This involves incorporating principles of fairness and equity into math instruction. Studies have shown positive outcomes from this approach. [13]. argues that social justice in education ensures fair treatment and a safe learning environment for all students. [14] highlight its role in addressing social, cultural, economic, and political issues. Emphasizing that social justice should be a core goal of all education, including math. By including social justice issues in the math curriculum, students can better understand the world around them and apply math to real-world problems [15].

Though context-based instruction and social justice integration in math education have shown outcome, there are several challenges and limitations. Educators have reported issues such as time constraints, difficulty in selecting appropriate contexts, lack of resources, and challenges in assessment [16]. Additionally, not all teachers have the necessary training or experience to implement social justice in math education. These challenges are like those encountered in implementing context-based instruction [17].

While many studies have focused on improving math education, none have specifically explored the use of social trends in teaching. Social trends-based instruction integrates current social events and trends from social media into the learning process. Social trends are patterns of change in society's behaviors, attitudes, and values over time. These trends are influenced by factors such as demographics, technology, culture, and economics [18] The researcher believes that social trends-based instruction could be a promising approach. [19] Argue that using social trends can make math more relevant to students' lives. By incorporating social trends, math education can become more engaging, relevant, and can help students develop critical thinking and awareness, essential skills in today's world.

This study aimed to compare the social trends-based and the traditional method of instruction. Specifically, the main objectives are to find the pretest and posttest problem-solving skills scores of the participants and determine the significant difference between the problem-solving skills of the participants exposed to social trends-based instruction and conventional instruction.

2. Related Studies

2.1. Integrative Approaches in Teaching Mathematics

Mathematics teaching needs to be innovative to regain its beauty and it can be done through many appropriate methodologies. The teaching of Mathematics has a scope of using various methods in its transaction, which are interesting and useful. An integrated approach can be an

innovative way, in which different approaches can be inculcated along with teaching of mathematics.

Integrative approaches in teaching mathematics have gained significant attention in recent years due to their potential to enhance student engagement, understanding, and problem-solving skills. This approach involves connecting mathematics with other subjects, real-world contexts, or student interests [20]

2.2. Context-Based Instruction

Previous work by different researchers shows evidence of the enhancement of students' problem-solving skills via active teaching and learning methods [10,15,21]. One of the active teaching methods that obtained much emphasis through literature is the context-based instructional approach. Context-based teaching and learning in its broadest sense describes the cultural and social environment within which students, tutors and institutions operate. This context is influenced by communications media to provide the academic community with a common culture [12]. [22] states that adult learning only takes place when this context and learning tools or methodologies come together to promote interaction between learners. For students, this usually means providing them with opportunities to test theories with real-world examples.

The contextual approaches to mathematics come out in response to the perception of students that the subject is impersonal, objective and inappropriate to everyday life [8]. Bennett (2003) defines a context-based teaching strategy as an approach used in teaching by making use of contexts and application as the starting point in developing ideas, concepts and principles for students. Context-based instructional approaches take into account students' life world' as a starting point of the teaching method. It thus refers to an instructional approach using real-life contexts and situations that students face in their everyday life as a starting point for enhancing students understanding of scientific ideas.

Some researchers [1,10] found that teachers believe the context-based approach helps students develop problem-solving skills more effectively than the traditional approach. According to the results of some researchers, teachers believe context-based instruction has the potential to increase students' interest, attitudes, and motivation for studying mathematics [4,10,15] revealed that teachers believe context-based teaching helps students link the concept of mathematics with their everyday lives. By embedding mathematics within the context of contemporary society, this instructional approach has the potential to make mathematics more meaningful, engaging, and applicable to students' lives [9].

2.3. Problem-Based Instruction

Mathematics learners need to be proficient problem solvers. Problem-solving is a dynamic and often confusing process that can be frustrating for students, but it can also be rewarding. Students should learn to explore problems and understand that making errors is just as important as knowing the correct answers. Throughout the process, students need to be perceptive to recognize whether they are moving closer to or farther from the solution (Society

Committee on Education, 2012). Any educational system to enhance and develop students' problem-solving skills to make them globally competitive. These skills can be improved by exposing students to a problem-based learning approach, where they encounter real-life problems, identify the issues, gather relevant data, propose plausible solutions, and decide on the most effective solution [9,12]

Problem-Based Instruction (PBI) has been the subject of numerous studies across various disciplines, including mathematics. While the effectiveness of PBI has been widely debated, numerous studies have shown positive outcomes. Problem-Based Instruction (PBI) is a student-centered approach where learning is driven by real-world problems. Rather than directly teaching concepts, PBI challenges students to explore, investigate, and apply knowledge to solve complex problems.

Many studies have shown that PBI significantly improves students' problem-solving abilities compared to traditional methods. Students learn to approach problems systematically, analyze information critically, and develop creative solutions. [18] examined group processes in Problem-Based Instruction classrooms. The researchers found that effective group work is crucial for the success of PBI and identified key factors that contribute to successful collaboration. Also, [21] have explored the cognitive processes involved in Problem-Based Instruction. The researchers found that Problem-Based Instruction can promote higher-order thinking skills such as analysis, synthesis, and evaluation. Further, [18] compared his study with the problem-solving skills of students taught using PBI and traditional methods. The results showed that students in the PBI group had significantly improved problem-solving skills.

Problem-based instruction can foster a deeper understanding of mathematical concepts. By applying knowledge to solve real-world problems, students construct meaning and develop a more holistic view of the subject.

Various studies and literature have identified several integrative approaches inculcated in teaching mathematics such as context-based instruction, and problem-based instruction. However, none of these studies specifically focused and employed social trends-based instruction.

2.4. Problem-Solving Skills

Mathematics requires more than just memorizing formulas and numbers; it's a language of logic that requires a structured approach to problem-solving. The process involves understanding the problem, creating a plan, executing it, and reflecting on the solution. Recent research has highlighted the importance of problem-solving skills for both academic and professional success [23,24].

Unfortunately, many Filipino students struggle with these stages, as seen in their performance on international assessments like the Trends in International Mathematics and Science Study (TIMSS). The Philippines has consistently ranked low in international assessments like the Program for International Student Assessment (PISA) and the Trends in International Mathematics and Science Study (TIMSS). This persistent underperformance highlights several key issues within the Philippine education system. The TIMSS results highlight the

significant gap in Filipino students' mathematical proficiency, particularly in problem-solving skills [25]. Also, math anxiety can negatively impact students' cognitive abilities, leading to avoidance behaviours and poor performance.

To prepare students for the future, schools should prioritize the development of these skills. Studies have shown that real-world problem-solving exercises are more effective than traditional word problems [26]. Collaborative learning, active learning, and the use of real-world examples can enhance problem-solving skills. [27]. Collaborative learning is an educational approach where students work together in small groups to learn and solve problems. This method goes beyond individual learning, encouraging students to share ideas, challenge each other's thinking, and build on each other's knowledge.

Also, Continuous Professional Development (CPD) is essential for mathematics teachers to stay updated with the latest pedagogical approaches, curriculum developments, and technological advancements. By engaging in regular CPD, teachers can enhance their teaching practices, improve student learning outcomes, and foster a love for mathematics. As stressed by [28] continuous professional development for teachers is crucial to equip them with the necessary skills to teach effective problem-solving strategies. Further, technology tools can provide interactive learning experiences and personalized support for students [28]. Learning to use technology tools to enhance teaching and learning, such as interactive whiteboards, educational software, and online resources.

By consistently exposing students to problem-solving situations and guiding them through a structured process, we can significantly enhance their problem-solving abilities.

3. Material and Method

Quasi-experimental was the design of this study. The researcher utilized quasi experimental design because this design is more generally used appropriate with school schedules and logistical problems [21]. Here, a pretest was initiated to measure students' problem-solving skills. The posttest was administered after the entire research procedures were successfully performed. The significant differences in the problem-solving skills from both the experimental and control groups were all tested. The design chart can be seen in table below:

Table 1. Chart for Pretest/Posttest Design

Group	Pre-test	Treatment	Post-test
Experimental	√	√	√
Control	√	-	√

Where:

√: With treatment of social trends-based instruction

- : Without treatment of social trends-based instruction

The participants of the study were the Bachelor of Science in Hospitality Management students at North Eastern Mindanao State University in the Philippines (S.Y 2024-2025). Two intact classes participated, randomly assigned to either the experimental or control group. Both groups likely had a mix of academic abilities. The

experimental group had 40 students (11 males, 29 females), and the control group had 40 students (9 males, 31 females).

The researchers made a test questionnaire to assess students' problem-solving skills related to mathematics of finance concepts such as: simple interest, compound interest, annuities, credit cards, stocks & bonds, and mutual funds to solve realistic problems. The test crafted was based on National Council for Teachers in Mathematics (NCTM) Standards and Principles. These principles include interpreting and comparing various concepts. These problems involved understanding the problem, planning a solution, performing calculations, and

checking the answer. The researcher also designed the test to measure any improvement in the experimental group's problem-solving skills.

Before the conduct of the pre-test/post-test, the researchers ensured its validity, meaning it measured what it was supposed to measure. Experts reviewed the test content, and a pilot test helped refine the questions. The final test showed good reliability which resulted in a Spearman-Brown coefficient of .83, meaning it produced consistent results. In scoring the test, an analytical rubric for the assessment of problem-solving skills [29]. Details about the scoring criteria and student results will be provided in Table 2.

Table 2. Analytical rubric for Problem-Solving Skills Assessment

Criteria	Indicator	5	4	3	2	1
Understand the problem	Data extraction and identification of the unknown from the problem situation presented	Extracts all the data given in the problem situation and identifies all the unknown	Extracts at least 80% of the data given in the problem situation and identifies relevant situations or unknown	Extracts at least 70% of the data given in the problem situation and identifies any of the unknown situations	Extracts at least 60% of the data given and identifies the unknown not relevant to the problem situation	Extract less than 50% of the data given and does not identify the unknown in the problem situation
Configure a plan.	Approach of strategies and/or mathematical procedures for solving the problem (equations, formulas, and so on)	The strategies and/or mathematical procedures proposed are pertinent and sufficient	The strategies proposed and/or mathematical procedures are pertinent and/or sufficient	The proposed strategies and/or mathematical procedures are relevant but not sufficient	The strategies proposed and/or mathematical procedures are not pertinent or sufficient	Does not propose strategies or mathematical procedures to solve the problem
Execute the plan	Application of mathematical concepts in solving the problem	The applied mathematical concepts are coherent and relevant for the solution of the problem	The applied mathematical concepts are coherent or relevant to the solution of the problem	The applied mathematical concepts are coherent or pertinent but not sufficient for the solution of the problem	The applied mathematical concepts present conceptual errors	Does not apply mathematical concepts to solve the problem
Look back	Satisfaction of the answer	The answer satisfies the solution to the problem to a high degree	The answer satisfies the solution to the problem	The answer satisfies the solution to the problem but not complete	The answer does not satisfy the solution to the problem	Does not present a clear answer to the problem situation posed

4. Results and Discussions

4.1. Pretest and Posttest Profiles

Table 3. Mean scores of pretest, post-test, and the standard deviation of problem solving skills test

Groups	Pretest		Post-test	
	M	SD	M	SD
Experimental	1.60	.50	3.16	.30
Control	1.55	.48	3.04	.23

As reflected in Table 3, the mean scores of pretests for problem solving skills of the students who were exposed to social trends-based instruction is 1.60 with a standard deviation of .50, this value was increased to 3.16 with a standard deviation of .30 after the implementation. Also, the mean score of pretests for problem solving skills of the students who were exposed to conventional approach was 1.55 with a standard deviation of .48 was increased to 3.04 with a standard deviation of .23 after the implementation. According to these values, it can be observed that higher scores were obtained in the problem-solving skills test of

the students who were exposed according to both social trends-based instruction and conventional approach.

The pretest mean scores for both the experimental and control groups are relatively close, indicating that the two groups started with comparable problem-solving abilities. Both groups showed improvement in problem-solving skills after the intervention. The post-test means scores for both groups are substantially higher than their respective pretest scores. This suggests that the intervention had a positive impact on the problem-solving skills of both the experimental and control groups. However, the experimental group showed slightly higher improvement than the control group. This could indicate that the intervention had a more pronounced effect on the experimental group.

The study suggests that utilizing a variety of teaching methods in mathematics and integrating mathematics with other subjects enhances students' problem-solving skills by making learning more relevant, fostering critical thinking, deepening conceptual understanding, increasing motivation, and developing essential 21st-century skills. Further, by adopting an integrative approach in the teaching of mathematics, teachers can create a more

dynamic and effective learning environment that empowers students to become confident and skilled problem-solvers [22].

4.2. ANCOVA Result

Table 4. Results of the ANCOVA for Post-Test Scores in Problem Solving Skills Test

Source of Variation	Sum of Squares	df	Mean Square	F	p
Pretest	0.0281	1	0.0281	0.481	0.490
Instructional Method	0.3201	1	0.3201	5.472	0.022
Residuals	4.5042	77	0.0585		

Table 4 shows a comparison of problem-solving skills between two instructional methods: conventional and social trends-based. The analysis focused on the participants' post-test scores, considering their pretest scores as the covariate. The results indicate a significant difference between the two methods. The statistical test (F-test) yielded a value of 5.471 with a p-value of 0.022, which is less than the significance level of 0.05. This suggests that the difference in post-test scores between the different instructional methods is statistically significant. In other words, the type of instruction used has a significant impact on student problem-solving skills.

Meanwhile, the p-value for the pretest is 0.490, which is greater than the significance level of 0.05. This suggests that the pretest scores do not have a significant impact on the post-test scores, after controlling for the effect of the instructional method. Further, the ANCOVA analysis also suggests that the different instructional methods have a significant impact on students' problem-solving skills, even after considering what they already know.

The study shows that employing different integrated teaching methods in mathematics can significantly improve students' problem-solving skills. Mathematics educators should continue to develop innovative teaching methods and utilize them in their classrooms. Mathematics instruction can benefit from a diverse range of engaging and useful strategies. An integrated approach, which involves blending various teaching methods, can be a novel and effective way to teach mathematics.

As emphasized in the study of [30] employing an integrative method to teaching mathematics can improve students' problem-solving skills by helping them develop a deeper understanding of content, and by encouraging them to think critically, creatively, and unconventionally.

5. Conclusion and Recommendation

The study revealed that both social trends-based instruction and traditional instruction methods led to significant improvements in students' mathematical problem-solving skills. However, the social trends-based method demonstrated a more pronounced outcome on student learning, particularly in terms of problem-solving abilities. This suggests that integrating real-world contexts and collaborative learning strategies can enhance student engagement and learning outcomes in mathematics.

With this, the researchers hereby recommend that tertiary

educators should continue exploring and implementing integrative approaches that connect mathematics to real-world contexts and other subject areas. Leveraging technology tools can also enhance student engagement and provide opportunities for interactive learning experiences. Lastly, incorporating strategies like problem-based learning, cooperative learning, and inquiry-based learning can foster critical thinking and problem-solving skills.

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