

Extent of Demonstration Method on Mathematics Teaching Approaches Among Senior High School Students of Mindanao State University-Sulu

Jainalyn S. Annong-Aksan
Sulu State College, Jolo, Sulu, Philippines

Author email: sscgspub@sulustatecollege.edu.ph

Date received: April 17, 2024

Date revised: May 2, 2024

Date accepted: May 6, 2024

Originality: 85%

Grammarly Score: 99%

Similarity: 15%

Recommended citation:

Annong-Aksan, J. (2024). Extent of demonstration method on Mathematics teaching approaches among senior high school students of Mindanao State University-Sulu. *Journal of Interdisciplinary Perspectives*, Vol. 2, Number 6, pp. 206-217. <https://doi.org/10.69569/jip.2024.0099>

Abstract. The demonstration method is a vital teaching tool that helps students improve their procedural knowledge through observation, imitation, and technique adaptation in solving math problems. Employing this method with different approaches can enhance students' active learning, making it even more effective for mathematics teachers to address the issue of students' low academic performance in Mathematics. This study assessed the extent of the demonstration method on mathematics teaching approaches among senior high school students of Mindanao State University-Sulu. It employed a descriptive-correlational research design with 190 student respondents selected through a stratified random sampling method. The study reveals that, among the 190 student-respondents, mainly female and aged 17-18 in grade 11, with parents having a high school education, the demonstration method is viewed positively in math teaching. While the sample represents typical senior high school students, the lack of diversity in parental education may limit generalizability. Student perceptions vary by age and grade level, with older students preferring the teacher-centered approach, and grade 12 students showing overall positive views. The study highlights the consistent effectiveness of the demonstration method across teaching approaches, underscoring the importance of efficient implementation for student perceptions. The study recommends that school heads support teachers with resources, training, and feedback, monitor the method's effectiveness on student performance, and encourage the use of the demonstration method in mathematics teaching. Parents should be informed and involved in their children's learning, while students should actively engage in the demonstration method. Future research should explore the impact of parental education on student performance and investigate the effectiveness of the demonstration method in mathematics teaching.

Keywords: Demonstration approach; Mathematics demonstrative teaching style; Parental education; Mathematics performance; Effectiveness of teaching approaches.

1.0 Introduction

The shift of the mode of delivery brought forth several difficulties. Teachers in general, and math teachers in particular, were also greatly affected by this. Not just for that but for the students as well. This referred to what happened to them as "Learning Loss." In the field of education, people were familiar with the term. It mostly referred to the opportunities for learning that were lost when there was less connection between students and teachers during in-person instruction (Wahyudi, 2021). The phrase was problematic since it placed the blame for the loss on the students (Bennett, 2023). Since learning loss typically affects the younger generation, which is the country's and state's future, it is extremely harmful, especially in the long run.

To ensure that students do not fall behind in the ASEAN countries' educational advancement, the Philippine education system might adapt its curriculum and implement creative teaching techniques in response to this issue.

As a result, math teachers ought to provide their students with creative teaching and learning strategies. For this problem, they ought to use the demonstrative approach. The math teacher did more than merely discuss the material; instead, they actively participated in a learning exercise (Labarosa, 2013). Furthermore, when students struggle to make the connection between theories and real-world applications, a demonstrative approach to teaching and learning is taken (Dr. Khan, 2020). This approach to teaching involves using real-world examples and imitations of solutions to illustrate certain processes and situations (Bahfen et al., 2020).

According to Janvic Mateo's post from 2022, the data from 2019 indicated that 90.9% of Filipino students were not able to read and comprehend a simple text. A spokesperson for the Department of Education, Michael Poa, once stated that hundreds of millions of children worldwide and their societies faced terrible consequences if they failed to learn the fundamentals of literacy, numeracy, and other subjects. These losses ran the risk of leaving a generation of students with less favorable future economic prospects (Molato-Gayares et al., 2022). Molato-Gayares et al. (2022) added that future productivity, both individually and nationally, is expected to decline. The approach of the demonstration was suitable for this circumstance. Because it made complex concepts easier for students to understand, this was an excellent teaching method (Yousafzai, 2022). Students gain mathematical skills and abilities by using this strategy.

The goal of the demonstrative teaching style was to get students interested in interacting with one another and potentially change their view of how tough the subject was. The majority of students perceived that mathematics was a strict, non-recreative science and that it was boring. Learning mathematics was one of the subjects that could be frightening (Mariyanto et al., 2023). This belief was reinforced when students' involvement in the subject was minimal, which led to low comprehension and poor performance (Mariyanto et al., 2023; Alhassan Bigson & Yussif, 2022). However, teachers should make an effort to inspire their students to study because it was their responsibility to support their critical thinking and acquisition of knowledge (Lessani et al., 2016).

With the use of the demonstration method, math teachers would be motivated, committed, and dedicated to handling the student's complexity (Haque & Sudhan Rao, 2018). Every teacher was aware that teaching mathematics presents unique challenges for them (Haser, Dogan, & Erhan, 2021). To convey content to students who are engaged in learning, math teachers must be skilled at utilizing the right learning strategies (Ayuwanti et al., 2021) that were demonstration methods as teaching approaches for them to raise their students' levels and conquer the obstacles that come with learning (Khalil, 2022).

According to Bennett (2023), students fell behind by more than .75 points in each grade level, particularly in mathematics. To tackle these issues, math teachers might help students strengthen their basic reading and numeracy skills (Angrist et al., 2021). Instead of memorization, math students need to improve their ability to follow directions from the teacher, participate actively, build on past information, and make sense of it (Emanet & Kezer, 2021). Students could increase their level of thinking and encourage involvement by using the math teacher's way as an example (Drs. Isa et al., 2020). Not only that but using this approach would make math lessons interesting (Thahir et al., 2019). Additionally, this approach helped students by enhancing their comprehension, holding their attention, and fostering lifelong learning. It could address students' learning loss by utilizing the six teaching techniques – planning, preparation, introduction, demonstration, and evaluation – that were appropriate for students of all ages (Yousafzai, 2022).

After the pandemic, many of the students are distracted by the gadgets. The students who have been addicted in using Android during previous online learning instead they abuse their devices to tend to play games, social media, and all kinds of other entertainment (Hamidi et al., 2023). This caused them a lot. According to observations, they cannot pass basic math, and forget basic calculation, and its processes to the point they do not know what to do with the math problems given by their math teachers because they fail to remember the basic or prior knowledge, they have no attention at all due to the distractions. That's why they achieve low grades. This is due to a lack of interest, motivation to learn, and courage to solve math. And sometimes it is because of the teacher's inappropriate methods and approaches to apply in the classroom. This study aims to establish that if the teachers use the demonstration method in teaching mathematics implemented properly in Mindanao State University-Sulu Senior High School there will be an improvement in the level of performance of the students.

This study also is to give answers specifically to the following research questions: What is the demographic profile of students in Mindanao State University-Sulu Senior High School Department in terms of gender, age, grade level, and parents' educational attainment?; What is the extent of impact of the demonstration method on mathematics teaching approaches among Senior High School students of Mindanao State University-Sulu in the context of subject-centered, students-centered, and teacher-centered?; Is there a significant difference in the extent of impact of demonstration method on mathematics teaching approaches among the students of Mindanao State University-Sulu when the data are grouped according to the demographic profile of the students in terms of gender, age, grade level, and parents educational attainment?; Is there a significant correlation between the extent of impact of the demonstration method on addressing learning loss among the students of Mindanao State University-Sulu in the context of subject-centered, students-centered, and teacher-centered?

2.0 Methodology

2.1 Research Design

The research design used in this investigation was the descriptive-correlational research design. According to Sirisilla (2023), researchers and scientists could obtain valuable insights into a certain group or phenomenon by utilizing the descriptive-correlational study design. This kind of study offered a thorough and precise image of the traits and actions of a specific group or subject. Jones (2021) stated in her post that descriptive-correlational research entailed gathering accurate and pertinent data on a phenomenon to pinpoint important variables and make reliable generalizations – all without intervening, affecting, or exercising control over the event. The survey research was specifically used in this study. Surveys were a subset of descriptive-correlational research in which information was gathered via questionnaires that were either self-administered or administered by interviewers (Sirisilla, 2023). Moreover, they could be conducted online, by mail, or in person, and they could gather both quantitative and qualitative data.

2.2 Research Participants

The research was conducted within the Senior High School Department situated on the campus of Mindanao State University-Sulu. Located approximately two kilometers from the center of Jolo, Mindanao State University-Sulu is positioned at Capitol Hills, Jolo, Sulu, in close proximity to the Provincial Office of Sulu. The participants in this study constituted 10% of the total student population, amounting to 191 out of 1,909 students enrolled in Grades 11 to 12 in the STEM and GAS strands during the 2023–2024 academic year. The selection of this 10% subset from the population was based on the guidance provided by Dr. Hill (1998), wherein he stipulated that for descriptive research, the sample size should be 10% of the population. In this study, the researcher employed stratified random sampling, a technique utilized when the population is classified into groups, from which respondents are chosen randomly for inclusion in the research sample. Furthermore, the selection process for this sampling method was designed to ensure impartiality, without favoring any particular student within the MSU-Sulu Senior High School department.

2.3 Research Instrument

The instruments utilized in this study were adapted from the research of Hamzah (2014), Ahmed et al. (2022), and McLain (2022), with modifications made to suit the specific context of this investigation. Subsequently, the questionnaire underwent rigorous review by a panel of two specialists, both faculty members of Sulu State College's Graduate Studies, to ensure its relevance and appropriateness to the present study and its local contexts. The questionnaire comprised two distinct sections. The first section delineated the demographic profile of the students, encompassing variables such as gender, age, grade level, and parental educational attainment. The second section investigated the impact of the demonstration method on students' mathematical teaching approaches, delineating three modalities: subject-centered, student-centered, and teacher-centered.

2.4 Data Gathering Procedure

The researcher administered the survey questionnaire onsite. The researcher provided a consent form to each adviser before administering the questionnaire attached therein was the consent form for the respondents.

2.5 Data Analysis

To analyze the data, various statistical instruments were employed for each research problem. Firstly, to address the initial research problem, the study utilized frequency distribution and percentage analysis. Secondly, in

response to the second research problem, the mean and standard deviation were calculated. Thirdly, to investigate potential differences based on gender and grade level, an independent samples t-test was conducted, while Analysis of Variance (ANOVA) was employed for the remaining profiles. Lastly, to explore correlations between variables, the researcher utilized the Pearson Product Moment Correlation. These statistical tools facilitated a comprehensive examination of the data, enabling the researcher to draw meaningful conclusions regarding the study's objectives.

3.0 Results and Discussion

3.1 Demographic Profile

Table 1 presents the demographic profile of the student-respondents in the MSU-Sulu Senior High School Department in terms of gender. The table indicates that out of 190 student respondents, it is slightly skewed toward females who make up 52.1% (99), while males account for 47.9% (91). This implies that there is a relatively equal representation of both genders among students and that there is no preference based on gender in the admission process.

Table 1. Student-respondents' demographic profile in terms of gender

GENDER	FREQUENCY	PERCENTAGE
Male	91	47.9%
Female	99	52.1%

Table 2 presents the demographic profile of the student-respondents in the MSU-Sulu Senior High School Department in terms of age. The table indicates that out of 190 student-respondents, it is highly concentrated in the 17-18 years old group which makes up 70.5% (134), while 16 years old and below, and 19 years old and above account for 13.7% (26) and 15.8% (40), respectively. This implies that most of the students are in the typical age range for senior high school and that there are fewer students who are younger or older than the average.

Table 2. Student-respondents' demographic profile in terms of age

AGE	FREQUENCY	PERCENTAGE
16 years old and below	26	13.7%
17-18 years old	134	70.5%
19 years old and above	30	15.8%

Table 3 presents the demographic profile of the student-respondents in the MSU-Sulu Senior High School Department in terms of grade level. The table indicates that it is uneven with more students in grade 11 than in grade 12. Out of 190 student-respondents, there are 105 students in grade 11 making up 55.3%, and 85 students in grade 12 accounting for 44.7%. This implies that many of the students in the MSU-Sulu, SHS department involved in this study are in grade 11.

Table 3. Student-respondents' demographic profile in terms of grade level

GRADE LEVEL	FREQUENCY	PERCENTAGE
11	105	55.3%
12	85	44.7%

Table 4 presents the demographic profile of the student-respondents in the MSU-Sulu Senior High School Department in terms of parents' educational attainment. The table indicates that out of 190 student-respondents, 40.5% (77) are high school graduates, followed by 30% (57) who hold a bachelor's degree. Parents with elementary education, master's, and Ph.D. degrees indicate fewer responses, accounting for 14.7% (28), 10% (19) and 4.7% (9), respectively. This implies that most of the students come from families where the parents have at least a high school education and could potentially influence their academic performance.

Table 4. Student-respondents' demographic profile in terms of parents' educational attainment

PARENTS' EDUCATIONAL ATTAINMENT	FREQUENCY	PERCENTAGE
Elementary graduate	28	14.7%
High school graduate	77	40.5%
Bachelor's degree holder	57	30%
Master's degree holder	19	10%
Ph.D. degree holder	9	4.7%

3.2 Extent of Demonstration Method on Mathematics Teaching Approaches *Subject-Centered*

Table 5. Extent of demonstration method on Mathematics teaching approaches in the context of subject-centered

STATEMENTS	MEAN	SD	RATING
1. My math teacher explains the mathematics lesson clearly.	4.15	.792	Agree
2. My math teacher effectively teaches the students the problem-solving process.	4.12	.903	Agree
3. My math teacher consistently checks if the students understand the topic.	4.05	.831	Agree
4. My math teacher demonstrates strong communication skills in math problem-solving.	3.87	.864	Agree
5. The lessons are well-prepared and well-organized during the demonstration.	3.93	.842	Agree
6. My math teacher's explanations and demonstrations are easily understood.	3.82	.898	Agree
7. My math teacher allows sufficient time for student responses to engage everyone.	3.77	.840	Agree
8. At the start of the lesson, my math teacher clarifies the learning objectives.	3.89	.954	Agree
9. My math teacher prepares examples that are easily understood.	3.97	.945	Agree
10. My math teacher gives an overview of the content being demonstrated.	3.86	.938	Agree
11. I prefer that my math teacher put a lot of emphasis and the analysis of content.	3.82	.931	Agree
12. I understand better if my teacher gives lots of examples.	4.19	.963	Agree
13. My math teacher emphasizes to us how/what the lesson comes out in reality.	3.95	.910	Agree
14. My math teacher explains the content of the lesson better.	4.17	.869	Agree
15. Visual resources are used to enhance math problem-solving processes.	3.92	.812	Agree
TOTAL	3.97	0.663	AGREE

Legend: 4.50-5.00 = Strongly Agree (SA), 3.50-4.49 = Agree (A), 2.50-3.49 = Moderately Agree (MA), 1.50-2.49 = Disagree (D), 1.00-1.49 = Strongly Disagree (SD)

Table 5 shows the extent of demonstration methods in mathematics teaching approaches among senior high school students of Mindanao State University-Sulu in the context of subject-centered. The results indicated that student-respondents agree that the subject-centered influences the demonstration method in mathematics teaching approaches with a total weighted mean score of 3.97 and a standard deviation of 0.663. This means that the teaching approach is favorable and consistent.

The table suggests that the teacher's methods are well-received by the students. The students agree that the teacher explains the math lessons clearly, effectively teaches the problem-solving process, consistently checks their understanding, demonstrates strong communication skills, prepares and organizes the lessons well, uses visual resources, allows sufficient time for student responses, clarifies the learning objectives, prepares examples that are easily understood, gives an overview of the content being demonstrated, puts a lot of emphasis on the analysis of the content, and gives lots of examples. The highest mean score is 4.19, which corresponds to the statement "I understand better if my math teacher gives lots of examples." This implies that the students appreciate the use of examples as a way of demonstrating the math concepts and skills. The lowest mean score is 3.77, which corresponds to the statement "My math teacher allows sufficient time for student responses to engage everyone." This implies that the students may feel that the teacher could give more time for them to participate and interact during the lesson.

According to Abanador et al., (2014) research, teachers frequently employ a teacher-centered approach, but students seem to prefer a subject-centered approach. Based on the study's findings, an enrichment program was created to help students learn effectively by enabling them to adapt to different teaching modalities. Naturally, having a solid understanding of their subject was essential for an effective teacher in the context of subject-centered learning (Morrison-Saunders & Hobson, 2013).

Student-Centered

Table 6 shows the extent of demonstration methods in mathematics teaching approaches among senior high school students of Mindanao State University-Sulu in the context of student-centered. The results indicated that student-respondents agree that the student-centered influences the demonstration method in mathematics teaching approaches with a total weighted mean score of 3.92 and a standard deviation of 0.633. This means that the teaching approach is favorable and consistent.

The table suggests that the teacher's methods are well-received by the students. The students agree that the teacher serves as a facilitator, encourages peer-to-peer interaction and collaboration, engages students actively, encourages independent practice, gives interesting group activities, and develops students' problem-solving skills. They also agree that they effectively demonstrate what they understand from the teacher, explain the math

teacher's demonstration to their peers, clearly understand simple explanations, assist each of them when they are having difficulty with the activities, are actively involved, and learn with their own, and acquire basic knowledge and practical skills from the demonstration during this approach.

Table 6. Extent of demonstration method on Mathematics teaching approaches in the context of student-centered

STATEMENTS	MEAN	SD	RATING
1. My math teacher serves as a facilitator.	3.92	.875	Agree
2. Peer-to-peer interactions are encouraged by our teacher.	3.81	.860	Agree
3. We actively engage during the lesson proper.	3.84	.952	Agree
4. Independent practice is encouraged by our math teacher.	3.87	.872	Agree
5. After the demonstration, we effectively demonstrate what we understand from our math teacher.	3.92	.967	Agree
6. We can explain the math teacher's demonstration to our peers.	3.82	.937	Agree
7. We collaborate to explore math problems.	3.90	.894	Agree
8. We clearly understand simple explanations because we listen carefully to the demonstration of the lesson.	4.06	.852	Agree
9. My math teacher gives an interesting activity.	4.01	.908	Agree
10. My math teacher encourages us to develop our problem-solving skills.	3.95	.922	Agree
11. We assist each of us when we are having difficulty with the activities given by our math teacher after demonstrating on how to solve it.	4.09	.849	Agree
12. We are actively involved and learn on our own.	3.87	.951	Agree
13. During this lesson, the classroom is often noisy and busy. Teacher-student collaboration is encouraged.	3.79	.923	Agree
14. My math teacher often gives us a group activity that we are enjoying actively participated, discussed, and shared our output to the class.	3.98	.965	Agree
15. We acquire basic knowledge and practical skills from the demonstration of this approach.	3.97	.908	Agree
TOTAL	3.92	0.633	AGREE

The highest mean score is 4.09, which corresponds to the statement "We assist each of us when we are having difficulty with the activities given by our math teacher after demonstrating how to solve it." This implies that the students have a high level of peer support and cooperation in learning math activities. The lowest mean score is 3.79, which corresponds to the statement "During this lesson, the classroom is often noisy and busy. Teacher-student collaboration is encouraged." This implies that the students have a moderate level of engagement and interaction in the lesson because some students may find the classroom environment too noisy or busy or that the teacher-student collaboration is not well-structured or balanced.

According to Ehiwario et al., (2019), the student-centered demonstration method improved the effectiveness of mathematics instruction and learning. Students learning of skills in schools was impacted by teachers' adoption of student-centered techniques (Andiema, 2016). To help students fully grasp and learn successfully about their job choices, teachers preferred to use a variety of teaching approaches rather than keeping to just one (Abanador et al., 2014). It could be concluded that the student-centered methods were more effective in terms of math achievement than the teacher-centered ones (Emanet & Kezer, 2021).

Teacher-Centered

Table 7 shows the extent of demonstration methods in mathematics teaching approaches among senior high school students of Mindanao State University-Sulu in the context of student-centered. The results indicated that student-respondents agree that the teacher-centered influences the demonstration method in mathematics teaching approaches with a total weighted mean score of 3.94 and a standard deviation of 0.679. This means that the teaching approach is favorable and consistent.

The table suggests that the teacher's methods are well-received by the students. The students agree that the teacher enforces discipline, plays an active role in the learning process, monitors students' progress by providing feedback on the assessments to evaluate them if they listen and understand the concepts, willingly explains concepts again when needed, elaborates on rules and problem-solving processes and provides clear explanations, encourages students to construct solutions following what is taught to them dependently from the teacher, practices effective classroom management, supervises and moves around to support and check during activities, and does not interact with the students during discussion of the lessons. The highest mean score is 4.09, which corresponds to

the statement “My math teacher willingly explains concepts again when needed.” This implies that the math teacher is responsive, patient, and supportive of students’ learning needs.

Table 7. Extent of demonstration method on Mathematics teaching approaches in the context of teacher-centered

STATEMENTS	MEAN	SD	RATING
1. Discipline is enforced by our teacher.	3.98	.888	Agree
2. My math teacher plays an active role in the learning process.	3.96	.942	Agree
3. My math teacher provides feedback on activities, quizzes, and assignments.	4.03	.934	Agree
4. My math teacher willingly explains concepts again when needed.	4.09	.941	Agree
5. My math teacher elaborates on rules and problem-solving processes.	3.99	.920	Agree
6. My math teacher encourages us to construct our solutions following what is taught to us.	4.03	.934	Agree
7. Effective classroom management is practiced because no one will try to disturb our math teacher during the discussions.	3.94	.833	Agree
8. My math teacher provides clear explanations.	4.04	.994	Agree
9. We are encouraged to become dependent on our math teacher.	3.78	.851	Agree
10. We become a passive learner at this time.	3.89	.893	Agree
11. My math teacher frequently supervises us during activities.	3.84	.937	Agree
12. We have no interactions with our math teacher during discussions of the lesson.	3.63	1.104	Agree
13. My math teacher monitors our progress.	3.88	.855	Agree
14. After discussion and demonstration of the lesson of our math teacher, assessment is being followed to evaluate us when we listen and understand the concepts.	4.00	.842	Agree
15. My math teacher moves around to support and check our activities.	4.07	.998	Agree
TOTAL	3.94	0.679	AGREE

The lowest mean score is 3.63, which corresponds to the statement “We have no interactions with our math teacher during discussions of the lesson.” This implies that the math teacher is not very interactive or engaging during the lesson. In China, teacher-centered instruction appears to be a successful method for teaching mathematics (Zhao, Valcke, Desoete, Sang, & Zhu, 2014). When taught using the teacher-centered approach, students from lower socioeconomic backgrounds demonstrated improved achievement (Camac, 2018). According to Ahmed et al. (2022), the teacher-centered approach has a positive effect on students' learning, and students' attitudes were supportive of it at the university level. Fortunately, the most efficient strategy for instructing students was to combine teacher-centered and student-centered teaching approaches (Ganyaupfu, 2013).

3.3 Difference in the Extent of Demonstration Method on Mathematics Teaching Approaches

Table 8 presents the difference in the extent of demonstration methods on mathematics teaching approaches among the students of Mindanao State University–Sulu when data are grouped according to gender. The table shows that the mean difference and probability values for each approach are not significant at alpha 0.05. This means that the extent of the demonstration method on mathematics teaching approaches has no difference on the perceptions of male and female student-respondents. This implies that the student-respondents perceive the extent of the demonstration method on mathematics teaching approaches in the same way regardless of their gender. Therefore, the hypothesis which states that “There is no significant difference in the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu when data are grouped according to gender” is accepted.

Table 8. Difference in the extent of demonstration method on mathematics teaching approaches when data are grouped according to gender

VARIABLES	GROUPING	MEAN	SD	MEAN DIFFERENCE	T	SIG.	DESCRIPTION
Subject-centered	Male	3.9678	.6111	.00278	.029	.977	Not Significant
	Female	3.9650	.7096				
Student-centered	Male	3.9502	.6387	.05725	.622	.534	Not Significant
	Female	3.8929	.6294				
Teacher-centered	Male	3.9839	.6166	.08018	.818	.414	Not Significant
	Female	3.9037	.7331				

*Significant at alpha 0.05

Regardless of gender, the demonstration method increased students' interest in and performance in mathematics (Ehiwario et al., 2019). Using the proper techniques, approaches, and media, it was essential to actively include students in the learning process (Mariyanto et al., 2023). According to studies by Samosir & Nanda (2022) and Ehiwario et al., (2019), there was no difference in the academic achievement of male and female students. Teachers could be included in learning activities to improve student learning outcomes and create an active learning

atmosphere. In Onyeka et al., study (2023) discovered that there was no discernible variation in students' memory for the application of the demonstration teaching approach based on gender.

Table 9. Difference in the extent of demonstration method on mathematics teaching approaches when data are grouped according to age

SOURCES OF VARIATION		SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.	DESCRIPTION
Subject-centered	Between Groups	.313	2	.156	.354	.702	Not Significant
	Within Groups	82.645	187	.442			
	Total	82.958	189				
Student-centered	Between Groups	.449	2	.224	.557	.574	Not Significant
	Within Groups	75.248	187	.402			
	Total	75.697	189				
Teacher-centered	Between Groups	3.176	2	1.588	3.535*	.031	Significant
	Within Groups	84.014	187	.449			
	Total	87.190	189				

Table 9 presents the difference in the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu when data are grouped according to age. The table shows that except for the teacher-centered approach, the F-values and probability values for each approach are not significant at alpha 0.05. This means that the perceptions of 16 years old and below student-respondents on the extent of demonstration method in the subject-centered and student-centered mathematics teaching approaches have no difference from those of 17 to 18 years old and 19 years old and above, or vice versa, but 16 years old and below, and 17 to 18 years old differ in teacher-centered approach, as shown in table 3.2.1. This implies that the student-respondents perceive the extent of demonstration method in the subject-centered and student-centered mathematics teaching approaches in the same way regardless of their age. However, they perceive differently when it comes to the teacher-centered approach. Therefore, the hypothesis which states that, “There is no significant difference in the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu when data are grouped according to age” is accepted.

Table 10. Multiple comparisons of demonstration methods on mathematics teaching approaches by age

DEPENDENT VARIABLE	(I) GROUPING BY AGE	(J) GROUPING AGE	MEAN DIFFERENCE (I - J)	STD. ERROR	SIG.
Teacher-centered	16 years old and below	17-18 years old	-.37811*	.14364	.025
		19 years old and above	-.26667	.17960	.301

*The mean difference is significant at the 0.05 level

A Post Hoc Analysis using Tukey test (Table 10) was conducted to identify which among groups classified according to age have different levels of mean in the extent of teacher-centered approach when data are grouped according to students-respondents' demographic profile in terms of age. It shows that 16 years old and below students-respondents obtained the mean difference of -.37811* with Standard Error of .14364 and p-value of .025 which is significant at alpha 0.05 over 19 years old and above students-respondents.

Table 11. Difference in the extent of demonstration method on mathematics teaching approaches according to grade level

VARIABLES	GROUPING	MEAN	SD	MEAN DIFFERENCE	T	SIG.	DESCRIPTION
Subject-centered	Grade 11	3.8203	.6793	-.3264	-3.47*	.001	Significant
	Grade 12	4.1467	.5973				
Student-centered	Grade 11	3.8470	.6350	-.1640	-1.79	.076	Not Significant
	Grade 12	4.0110	.6220				
Teacher-centered	Grade 11	3.8178	.6876	-.2779	-2.86*	.005	Significant
	Grade 12	4.0957	.6399				

*Significant at alpha 0.05

Table 11 presents the difference in the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu when data are grouped according to grade level. The table shows that except for student-centered approach, the mean difference and probability values for each approach are significant at alpha 0.05. This means that the extent of demonstration method in the subject-centered and teacher-centered mathematics teaching approaches has difference on the perceptions of grade 11 and grade 12 student-respondents, but they do not differ in student-centered approach. This implies that the student-respondents perceive the extent of demonstration method in the subject-centered and teacher-centered mathematics teaching approaches in different ways regardless of their grade level. However, they don't perceive

differently when it comes to the student-centered approach. Therefore, the hypothesis which states that, “There is no significant difference in the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu when data are grouped according to grade level” is rejected.

Based on research by Basheer et al., (2017), the demonstrations were a useful tool for improving students' comprehension of certain concepts as well as their motivation and enthusiasm in learning mathematics. When students were actively working to solve problems during class activities, they more effectively develop a deeper comprehension of the key concepts (Ganyaupfu, 2013). According to studies by Umoru & Haruna (2018) and Isa et al., (2022), most teaching strategies, particularly the demonstration technique, had a significant favorable impact on students' academic achievement. This approach to learning mathematics could enhance student performance at all grade levels (Mariyanto, Tembang, Betaubun, & Niatun, 2023).

Table 12. Difference in the extent of demonstration method on mathematics teaching approaches according to parents' educational attainment

SOURCES OF VARIATION		SUM OF SQUARES	DF	MEAN SQUARE	F	SIG.	DESCRIPTION
Subject-centered	Between Groups	.427	4	.107	.239	.916	Not Significant
	Within Groups	82.530	185	.446			
	Total	82.958	189				
Student-centered	Between Groups	1.574	4	.393	.982	.419	Not Significant
	Within Groups	74.123	185	.401			
	Total	75.697	189				
Teacher-centered	Between Groups	.343	4	.086	.183	.031	Not Significant
	Within Groups	86.847	185	.469			
	Total	87.190	189				

*Significant at alpha 0.05

Table 12 presents the difference in the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu when data are grouped according to age. The table shows that the F-values and probability values for each approach are not significant at alpha 0.05. This means that the perceptions of student-respondents, whose parents' educational attainment is elementary, on the extent of demonstration method in mathematics teaching approaches have no difference from those whose parents' educational attainment is high school graduate, bachelor's degree holder, master's degree holder, and Ph.D. degree holder, or vice versa. This implies that the student-respondents perceive the extent of demonstration method in mathematics teaching approaches in the same way regardless of their parents' educational attainment. Therefore, the hypothesis which states that, “There is no significant difference in the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu when data are grouped according to age” is accepted. Based on the study of Camac's (2018) that the teacher-centered approach yielded higher academic achievement for students with disabilities and with at-risk students, within all social classes and races.

3.4 Relationship Among Variables

Table 13 presents the correlation among the sub-categories subsumed under the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu. The table shows that the computed Pearson correlation Coefficients (Pearson *r*) between these variables are all significant at alpha 0.05.

Table 13. Correlation among the sub-categories subsumed under the extent of demonstration method on mathematics teaching approaches

VARIABLES		PEARSON R	SIG.	N	DESCRIPTION
Dependent	Independent				
Subject-centered	Student-centered	.841*	.000	190	Very High
	Teacher-centered	.840*	.000	190	Very High
Student-centered	Teacher-centered	.861*	.000	190	Very High

*Correlation coefficient is significant at alpha .05

The table shows that there is a very high positive degree of correlation among the sub-categories subsumed under the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University–Sulu. This means that the higher the extent of demonstration method for one teaching approach, the higher the extent of demonstration method for another teaching approach. This implies that if the subject-centered approach has a high extent of demonstration method, then the student-centered and teacher-centered approaches

also have a high extent of demonstration method. Therefore, the hypothesis which states that, “There is no significant correlation among the sub-categories subsumed under the extent of demonstration method on mathematics teaching approaches among the students of Mindanao State University-Sulu” is rejected. In the study of Azizah and Kumala's (2023) research, there was a correlation between the demonstration method used in the classroom and students' comprehension of mathematical topics. Following the use of the demonstration approach, there was an improvement in the cognitive growth of number recognition (Bahfen et al., 2020). Students who were instructed using this technique of instruction maintained it (Onyeka et al., 2023).

4.0 Conclusion

The study concludes that:

- a) Student-respondents are mostly female, aged 17-18 years old, in grade 11, and have parents with high school education. These findings suggest that the sample is representative of the typical senior high school students in the MSU-Sulu, SHS department. However, the profile also indicates that there is a lack of diversity in terms of parents' educational attainment as most of the students have parents who are high school graduates or bachelor's degree holders. This may limit the generalizability of the study to other populations with different parental educational backgrounds.
- b) Student-respondents of Mindanao State University-Sulu have a positive perception of the demonstration method in mathematics teaching approaches in different contexts. The mean scores of the three contexts (subject-centered, student-centered, and teacher-centered) rated as agreeable among the student-respondents. The standard deviations of the three contexts are also relatively low suggesting that the responses are consistent and have a low degree of variation.
- c) The demonstration method in mathematics teaching has varying effects on the perceptions of student-respondents of Mindanao State University-Sulu depending on their demographic profile. The student-respondents have consistent perceptions of the demonstration method regardless of their gender or parents' educational attainment, but they have different perceptions depending on their age or grade level. The teacher-centered approach seems to be more appealing to older students, while the subject-centered and student-centered approaches are equally preferred by all age groups. The student-respondents in grade 12 tend to have more favorable perceptions of the demonstration method than those in grade 11, except when the method is student-centered.
- d) The results of the correlation analysis indicate that the extent of the demonstration method for the subject-centered, student-centered, and teacher-centered approaches among the student-respondents of Mindanao State University-Sulu are all positively and significantly correlated with each other. This means that the students' perceptions of the demonstration method are not affected by the type of approach, but rather by how well and how efficiently the method is implemented.

This study recommends the following:

- a) School heads should support and encourage the teachers by providing them with adequate resources, training, and feedback, and also monitor and evaluate the effectiveness of the method in improving the students' academic performance and attitude towards mathematics.
- b) Mathematics teachers should use the demonstration method in mathematics teaching as it is perceived positively by the students consider the differences among their students, and adjust the pace, depth, and scope of the demonstration accordingly.
- c) Parents should not only be aware of the benefits of the demonstration method in mathematics teaching but also support their children's learning by communicating with the teachers and the school heads about their children's progress and challenges in mathematics.
- d) Students should actively participate in the demonstration method in mathematics teaching by observing, asking questions, and practicing the skills and concepts taught.
- e) Future studies may consider including more students with parents who have lower or higher educational attainment to explore the possible effects of parental education on students' academic performance and attitudes.
- f) Future researchers should also investigate the impact of the demonstration method on the students' academic performance and learning outcomes in mathematics. This would help to evaluate the effectiveness and efficiency of the demonstration method in mathematics teaching and learning.

5.0 Contributions of Authors

The author solely written this article. Thus, there are no co-authors for this study.

6.0 Funding

This research received no specific grant from any funding agency.

7.0 Conflict of Interests

The author declared that he has no conflicts of interest as far as this study is concerned.

8.0 Acknowledgment

The researcher thanks all the individuals who have helped her in the completion of this study.

9.0 References

- Abanador, J. R., Buesa, G. D., Remo, G. L., & Mañibo, J. (2014). Teaching Methods and Learning Preferences in the Engineering Department of an Asian University. *International Journal of Academic Research in Progressive Education and Development*, 3(1), 1–15. <https://doi.org/10.6007/ijarped/v3-i1/499>
- Ahmed, D., Sultan, D., Kousar, M., Basit, H., Zaid, D., & Bano, S. (2022). Effectiveness Of Teacher's Centered Approach On Student's Learning At University Level. *Journal of Positive School Psychology*, Vol. 6, No. 10, 415-428, <http://journalppw.com>. Retrieved from Journal of Positive School Psychology.
- Aisah, A. (2021, October). The Effect Of Using The Demonstration Method On Students' Skills In Practicing Wudhu. Retrieved from *Interdisciplinary Social Studies*: <https://iss.internationaljournallabs.com/index.php/iss>. <https://doi.org/10.55324/iss.v1i1.2>
- Alhassan Bigson, M., & Yussif, Z. (2022). Enhancing Students' Performance in Senior High School Mathematics through the Learner-centered Approach: A Case in T. I. Ahmadiyya Senior High School, WA, Ghana. *International Journal of Research and Innovation in Social Science (IJRISS)*, ISSN 2454-6186, 6(1), 508-523. <https://doi.org/10.47772/ijriss.2022.6129>
- Altun, M. (2023). The Ongoing Debate over Teacher Centered Education and Student Centered Education. *International Journal of Social Sciences & Educational Studies*, 10(1), 106-110. <https://doi.org/10.23918/ijsses.v10i1p106>
- Andiema, N. C. (2016). Effect of Child Centred Methods on Teaching and Learning of Science Activities in Pre-Schools in Kenya. *Journal of Education and Practice*, Vol.7, No.27, pp. 1-9.
- Angrist, N., de Barros, A., Bhula, R., Chakera, S., Cumiskey, C., DeS tefano, J., . . . Stem, J. (2021, May 3). Building back better to avert a learning catastrophe: Estimating learning loss from COVID-19 school shutdowns in Africa and facilitating short-term and long-term learning recovery. Retrieved from *International Journal of Educational Development*: <https://doi.org/10.1016/j.ijedudev.2021.102397>
- Ardington, C., Wills, G., & Kotze, J. (2021, August 6). COVID-19 learning losses: Early grade reading in South Africa. Retrieved from *International Journal of Educational Development*: <https://doi.org/10.1016/j.ijedudev.2021.102480>
- Astuti, R., & Katoningsih, S. (2021). Implementation Of Demonstration Methods In Early Children's Akhlak Education. *Early Childhood Research Journal (ECRJ)*, 4(2), 38-45, <http://journals.ums.ac.id/index.php/ecrj>. <https://doi.org/10.23917/ecrj.v4i2.12105>
- Ayuwanti, L., Marsigit, & Siswoyo, D. (2021). Teacher-student interaction in mathematics learning. *International Journal of Evaluation and Research in Education (IJERE)*, 10(2), 660–667, ISSN: 2252-8822, DOI: 10.11591/ijere.v10i2.21184. <https://doi.org/10.11591/ijere.v10i2.21184>
- Azizah, A., & Kumala, F. (2023). The Influence of the Demonstration Method with the Help of Geogebra Software on the Ability to Understand Mathematical Concepts. *AlphaMath: Journal of Mathematics Education*, 9(1), 77-87, <http://jurnal.nasional.ump.ac.id/index.php/alphamath/>.
- Bahfen, M., Khaerunnisa, Hadi, M., Madyawati, L., & Sulistyaningtyas, R. (2020). Improving Number Ability Through Demonstration Method in Children Aged 4-5 Years. *Advances in Social Science, Education and Humanities Research*, volume 436, 1099-1101, <http://creativecommons.org/licenses/by-nc/4.0/>. <https://doi.org/10.2991/assehr.k.200529.230>
- Basheer, A., Hugerat, M., Kortam, N., & Hofstein, A. (2017). The Effectiveness of Teachers' Use of Demonstrations for Enhancing Students' Understanding of and Attitudes to Learning the Oxidation-Reduction Concept. *ResearchGate: EURASIA Journal of Mathematics Science and Technology Education*, 13(3), 555-570, DOI 10.12973/eurasia.2017.00632a.
- Bature, I. (2020). The Mathematics Teachers Shift from the Traditional Teacher-Centred Classroom to a More Constructivist Student-Centred Epistemology. *Open Access Library Journal*, 7: e6389, <https://doi.org/10.4236/oalib.1106389>.
- Bennett, B. (2023). How to tackle unfinished learning in math instruction in your district. *Khan Academy*. <https://blog.khanacademy.org/unfinished-learning-math-instruction-kad/>
- Butawan, J. S., Egenias, R. N., & Sebastian, J. D. (2021). Instruction on Philippine History Class in developing Higher Order Thinking Skills (HOTS). *Interdisciplinary Journal of Applied and Basic Subjects*, 1(2), 69-75.
- Camac, K. (2018). Student-Centered Approach Vs. Teacher-Centered Approach: Which Is More Effective. (Doctoral dissertation). Retrieved from <https://scholarcommons.sc.edu/etd/4834>
- Cherry, K. (2023, March 12). B.F. Skinner's Life, Theories, and Influence on Psychology. Retrieved from verywell mind: <https://www.verywellmind.com/b-f-skinner-biography-1904-1904-1990-2795543#:~:text=Skinner's%20Theory%20of%20Learning%3A%20Operant,environment%20and%20leads%20to%20consequences>.
- Daluba, N. E. (2013). Effect of Demonstration Method of Teaching on Students' Achievement in Agricultural Science. *World Journal of Education*, ISSN 1925-0746 E-ISSN 1925-0754, 3(6), www.sciedu.ca/wje. <https://doi.org/10.5430/wje.v3n6p1>
- Dr. Alam, M. (2023). From Teacher-Centered To Student-Centered Learning: The Role Of Constructivism And Connectivism In Pedagogical Transformation. *Conflux: Journal Of Education*, 11(2), <https://cjoe.nasublishers.com>.
- Dr Hill, R. (1998). WHAT SAMPLE SIZE IS "ENOUGH" in INTERNET SURVEY RESEARCH? *Interpersonal Computing and Technology: An Electronic Journal for the 21st Century. (IPCT: AECT)*, vol. 6, No. 3-4
- Dr. Isa, S. G., Dr. Mammam, M. A., Badar, Y., & Bala, T. (2020). The Impact Of Teaching Methods On Academic Performance Of Secondary School Students In Nigeria. *International Journal of Development Research*, 10(7), 37382-37385, <https://doi.org/10.37118/ijdr.18223.07.2020>.
- Dr. Khan, S. (2020, February 5). Demonstration method. Retrieved from Education: Education Awareness and Research: <https://research-education-edu.blogspot.com/2020/02/demonstration-method.html?m=1>
- Dr. Kumar Shah, R. (2020). Similarities and Difference between LCT and TCT. *International Journal of Creative Research Thoughts (IJCRT)*, 8(7), 5694-5719.
- Dr. Kurt, S. (2021, February 21). Constructivist Learning Theory. Retrieved from Educational Technology: <https://educationaltechnology.net/constructivist-learning-theory/>
- Dr. Sebulen, M. T., & MALIT, L. S. (2023). Unlocking Academic Excellence- Evaluating the Impact of Learner-Centered Teaching on BSED GEN SCI Students of Baguio Central University. *Iconic Research And Engineering Journals*, 6(12), 545-549.
- Ehiwario, J., Aghamie, S., & Azagbaekwue, A. (2019). The Effect Of Demonstration Method On The Teaching And Learning Of Mathematics In Secondary Schools In Ika South Local Govt. pp. 37- 49. <https://www.man-nigeria.org.ng/issues/ABA-EDU-2019-6.pdf>
- Emanet, E., & Kezer, F. (2021, April 1). The effects of student-centered teaching methods used in mathematics courses on mathematics achievement, attitude, and anxiety: a meta-analysis study. Retrieved from *Participatory Educational Research (PER)*: Vol. 8(2), pp. 240-259, <http://dx.doi.org/10.17275/per.21.38.8.2>. <https://doi.org/10.17275/per.21.38.8.2>
- Ganyaupfu, E. (2013). Teaching Methods and Students' Academic Performance. *International Journal of Humanities and Social Science Invention*, 2(9), 29-35. https://www.researchgate.net/publication/264124430_Teaching_Methods_and_Students'_Academic_Performance
- Garcia, R., Dr. Tan, R., Dr. Florendo, J., & Dr. Santos, N. (2020). Student-Centered Learning In General Education In A Private University In Manila: An Analysis. *Globus An International Journal of Art & Higher Education*, 9(2), 16-21.
- Hamidi, A., Jumadi, J., Nurohman, S., & Febrian, A. (2023). Teacher and Parent Perceptions of Student's Learning Loss in Post-Pandemic Science Learning. Retrieved from *Jurnal Penelitian Pendidikan IPA*: 9(8), 6439-6444. <https://doi.org/10.29303/jppipa.v9i8.3603>
- Hamzah, F. (2014). Effectiveness of Student Centered Approach to Improve Mathematics Achievement among Primary 4 Students. https://www.academia.edu/32400377/Effectiveness_of_Student_Centered_Approach_to_Improve_Mathematics_Achievement_among_Primary_4_Students_Melor_at_Fatihah_binti_Hamzah
- Haque, M., & Sudhan Rao, M. (2018). Implications for Curriculum, Materials, Teaching and Testing Strategies in a Saudi Arabian University. *The Turkish Online Journal of Educational Technology (TOJET)*, volume 17, issue 3, pp. 54-64.
- Haser, C., Dogan, O., & Erhan, G. (2021, December 7). Tracing students' mathematics learning loss during school closures in teachers' self-reported practices. Retrieved from *International Journal of Educational Development*: <https://doi.org/10.1016/j.ijedudev.2021.102536>
- Hassan, M. U., & Akbar, R. A. (2020). Tracing the Effects of Teachers' Centered Teaching Methods on Students' Achievement Scores: Secondary Level Study. *Bulletin of Education and Research*, Vol. 42, No. 1 pp. 29-43.

- Isa, S. G., Mammam, M. A., Bala, Y. A., & Badar, Y. (2022). The Impact of Teaching Methods on Academic Performance of Secondary School Students in Nigeria. ResearchGate. DOI:10.37118/ijdr.18223.07.2020. <https://doi.org/10.37118/ijdr.18223.07.2020>
- Jones, E. (2021). A Guide To Descriptive Research Design: Definition & Types. Retrieved from My Assignment Help: <https://myassignmenthelp.com/blog/descriptive-research/>
- Kassem, H. M. (2019). The Impact of Student-Centered Instruction on EFL Learners' Affect and Achievement. *English Language Teaching*, Vol. 12, No. 1, pp. 134-153. <https://doi.org/10.5539/elt.v12n1p134>
- Katz, D. A. (2022). The Art Of Effective Demonstrations. Retrieved from <http://www.chymist.com/THE%20ART%20OF%20EFFECTIVE%20DEMONSTRATIONS.pdf>
- Khadka, J., Joshi, D., Adhikari, K., & Khanal, B. (2022). Learner-Centered Instruction: Teachers' Practice in Online Class of Mathematics During Covid-19 Pandemic in Nepal. *International Journal of Instruction*, 15(3), 831-852. <https://doi.org/10.29333/iji.2022.15345a>
- Khalil, I. A. (2022, August 06). How is learning loss treated in mathematics classrooms at the intermediate stage? A mixed methods study. Retrieved from *Education 3-13 International Journal of Primary, Elementary and Early Years Education*: <https://doi.org/10.1080/03004279.2022.2108873>
- Kim, S. (2018). Technological, Pedagogical, and Content Knowledge (TPACK) and Beliefs of Preservice Secondary Mathematics Teachers: Examining the Relationships. *EURASIA Journal of Mathematics, Science and Technology Education*, 14(10), em1590. <https://doi.org/10.29333/ejmste/93179>
- Labarosa, J.-v. (2013, November 26). Approaches teaching mathematics. Retrieved from slideshare: a Scribd company: <https://www.slideshare.net/janvylabarosa/approaches-in-teaching-mathematics>
- Lathan, J. (2023). Complete Guide to Student-Centered vs. Teacher-Centered Learning. Retrieved from University of San Diego. <https://onlinedegrees.sandiego.edu/teacher-centered-vs-student-centered-learning/>
- Lessani, A. (2017). Comparison Of New Mathematics Teaching Methods With Traditional Method. *PEOPLE: International Journal of Social Sciences*, ISSN 2454-5899, 3(2), 1285-1297. <https://dx.doi.org/10.20319/pijss.2017.32.12851297>
- Lessani, A., Md. Yunus, A., Abu Bakar, K., & Khameneh, A. (2016). Comparison of Learning Theories in Mathematics Teaching Methods. Fourth 21st CAF Conference in Harvard, ISSN: 2330-1236, Vol. 9(1), 165-174.
- Loiser, P., & Endne, W. (2022). Effect of demonstration method on learning success. Retrieved from *International Journal of Curriculum Development, Teaching and Learning Innovation*: <https://trigin.pelrus.ac.id/index.php/Curriculum/index>. <https://doi.org/10.35335/curriculum.v1i1.51>
- Main, P. (2022, October 24). Social Learning Theory-Bandura. Retrieved from *Structural Learning*: [https://www.structural-learning.com/post/social-learning-theory-bandura#:~:text=Albert%20Bandura%20\(1901%E2%80%931994\),process%20is%20called%20observational%20learning](https://www.structural-learning.com/post/social-learning-theory-bandura#:~:text=Albert%20Bandura%20(1901%E2%80%931994),process%20is%20called%20observational%20learning)
- Main, P. (2023, March 28). Skinner's Theories. Retrieved from *Structural Learning*: <https://www.structural-learning.com/post/skinners-theories#:~:text=The%20Behavioral%20Psychologist%20B.%20F.%20Skinner's,to%20the%20human%20behavior%20conditioning>
- Makiyah, S. (2021). Increasing Teaching Ability Teachers With Demonstration Method In Class 3 Students of Elementary School. Workshop Penguatan Kompetensi Guru 2021, SHIES: Conference Series 4 (5), 335- 344. <https://doi.org/10.20961/shes.v4i5.66020>
- Mariyanto, W., Tembang, Y., Betaubun, M., & Niatun, A. (2023). Demonstration Method: An Effective Alternative in Improving Student Mathematics Learning Outcomes in Elementary School. *Edumaspul - Jurnal Pendidikan*, 7(1), 1413-1424. <https://doi.org/10.33487/edumaspul.v7i1.6096>
- McLain, M. (2022). Developing perspectives on 'the demonstration' as a signature pedagogy in design and technology education. Retrieved from *International Journal of Technology and Design Education*: <https://doi.org/10.1007/s10798-019-09545-1>
- Molato-Gayares, R., Park, A., Raitzer, D., Suryadarma, D., Thomas, M., & Vandenberg, P. (2022, July). How to Recover Learning Losses from COVID-19 School Closures in Asia and the Pacific. Retrieved from *ABD BRIEFS*. <https://doi.org/10.22617/brief220301-2>
- Morrison-Saunders, A., & Hobson, J. (2013). Being subject-centred: A philosophy of teaching and implications for higher education. *Issues in Educational Research*, 23(2), 212-226. <https://www.iier.org.au/iier23/morrison-saunders.pdf>
- Oko, J. (2022). Teaching methods that influence Grade 12 students' mathematics results in Port Moresby, Papua New Guinea. *Journal of Applied Learning & Teaching*, ISSN : 2591-801X, 5(2), 132-142. <http://journals.sfu.ca/jalt/index.php/jalt/index>. <https://doi.org/10.37074/jalt.2022.5.2.9>
- Okotubu, J. (2020). Effect of Demonstration Teaching Method on Students' Academic Achievement and Retention in Auto Mechanics Trade in Technical Colleges in Delta State. *International Journal of Education and Evaluation*, 6(5), www.iiardpub.org.
- Onyeka, E. C., & Okoye, G. N. (2023). Effectiveness Of Demonstration Teaching Method On Students' Academic Achievement In Mathematics In Rivers State Nigeria. ResearchGate: *African Journal of Educational Management, Teaching and Entrepreneurship Studies (AJEMATES)*, 8 (2), 32-42. <https://ajemates.org>
- Onyeka, E. C., Dr. Eze, F. B., & K., O. O. (2023). Upgrading Students' Academic Retention In Mathematics Using Demonstration Teaching Method In Rivers State Nigeria. *Advance Journal of Education and Social Sciences*, ISSN: 2237 - 1470, 8(3), <https://aspjournals.org/ajess>.
- Pulungan, S. (2021). Application Of Demonstration Method To Improve Mathematics Learning Achievement Of Class 1 Students SD 0511 Batang Tegal JAS T.P 2020/2021. *Indonesian Journal of Basic Education*, 4(2), 247 - 254.
- Samosir, A., & Nanda, F. (2022). The Influence of Demonstration Methods with Media on Mathematics Learning Outcomes SDN 091546 Unong Manik, Simalungun Regency. *International Journal of Educational Research Excellence (IJERE)*, e-ISSN: 2830-7933, 1(2), 245-247. <https://ejournal.ipinternasional.com/index.php/ijere>. <https://doi.org/10.55299/ijere.v1i2.342>
- Samuelsson, J. (2010). The Impact of Teaching Approaches on Students' Mathematical Proficiency in Sweden. *International Electronic Journal of Mathematics Education - IJME*, Vol.5, No.2, pp. 61-78. <https://doi.org/10.29333/iejme/250>
- Schreurs, J., & Dumbaveanu, R. (2014). A Shift From Teacher Centered To Learner Centered Approach. *ijEP - Volume 4, Issue 3, 2014*, 4(3), 36-41. <http://dx.doi.org/10.3991/ijep.v4i3.3395>
- Serin, H. (2018). A Comparison of Teacher-Centered and Student-Centered Approaches in Educational Settings. ResearchGate: *International Journal of Social Sciences & Educational Studies*, ISSN 2520-0968 (Online), ISSN 2409-1294 (Print), 5(1), 164-167. <https://www.researchgate.net/publication/328429101>. <https://doi.org/10.23918/ijsses.v5i1p164>
- Sirisilla, S. (2023, February 20). Bridging the Gap: Overcome these 7 laws in descriptive research design. Retrieved from <https://www.enago.com/academy/descriptive-research-design/#:~:text=Descriptive%20research%20design%20is%20a,a%20particular%20population%20or%20subject>
- Soe, M., & Nyunt, S. (2018). A Study Of The Effectiveness Of Demonstration Method On Grade Nine Students' Achievement In Physics. *J. Myanmar Acad. Arts Sci.* 2018 Vol. XVI. No.9A, Vol. 16(9A), 361-383.
- Storey, N., & Zhang, Q. (2021). A Meta-analysis of COVID Learning Loss. DOI:10.35542/osf.io/qekw2. https://www.researchgate.net/publication/354515783_A_Meta-analysis_of_COVID_Learning_Loss
- Suhulah, G., Ibrahim, M., Tabroni, I., Nurhadi, S., & Suhartini. (2022). Demonstration Method: Concrete Innovation Increases Student Learning Motivation. *International Journal of Integrative Sciences (IJIS)*, Vol.1(1), 33-44.
- Sunsuma, G., & Luneta, K. (2023). Zimbabwean mathematics pre-service teachers' implementation of the learner-centered curriculum during teaching practice. *EURASIA Journal of Mathematics, Science and Technology Education*, 19(5), em2258. <https://doi.org/10.29333/ejmste/13131>
- Tang, K. (2023). Student-centered Approach in Teaching and Learning: What Does It Really Mean? *Acta Pedagogica Asiana*, 2(2), 72-83. <https://doi.org/10.53623/apga.v2i2.218>
- Thahir, A., Mawarni, A., & Palupi, R. (2019). The Effectiveness of Demonstration Methods Assisting Multiplication Board Tools for Understanding Mathematical Concept in Bandar Lampung. *Journal for the Education of Gifted Young Scientists*, 7(2), 353-362. <https://doi.org/10.17478/jegys.512260>
- Thomas, M. (2013). Teachers' Beliefs about Classroom Teaching - Teachers' Knowledge and Teaching Approaches. *Procedia - Social and Behavioral Sciences*, 31 - 39. <https://doi.org/10.1016/j.sbspro.2013.08.805>
- Toker, T. (2022). Detecting Possible Learning Losses due to COVID-19 Pandemic: An Application of Curriculum-Based Assessment. *International Journal of Contemporary Educational Research*, Volume 9, Number 1, Page 78-86. <https://doi.org/10.33200/ijer.985992>
- Wahyudi, A. (2021). Learning Loss During Covid-19 Pandemic In Indonesia And The Strategies To Minimize It. *Journal Of English Education And Linguistics*, pp. 18-25. <https://doi.org/10.56874/jeel.v2i2.579>
- Zhao, N., Valcke, M., Desoete, A., Sang, G., & Zhu, C. (2014). Does teacher-centered teaching contribute to students' performance in primary school? A video analysis in Mainland China. ResearchGate: *International Journal of Research Studies in Education*, DOI: 10.5861/ijrse.2014.729. <https://doi.org/10.5861/ijrse.2014.729>
- Zulkifli, Z., Kristiawan, M., & Sasongko, R. (2022). Improving Students' Active Learning Through Demonstration Method. *Al-Ishlah: Jurnal Pendidikan*, 14(4), 6539-6550, ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v14i4.2313. <https://doi.org/10.35445/alishlah.v14i4.2313>