



Attitude of University Mathematics Lecturers towards the Use Of GeoGebra Software in the Teaching and Learning of Coordinates Geometry in North-Central Zone, Nigeria

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ABSTRACT

This study investigated the Attitude of University Mathematics lecturers towards integrating GeoGebra Software in the teaching and learning of Coordinates Geometry. Four objectives were set, four research questions were asked and four null hypotheses were formulated to guide the study. Six-four (64) University Mathematics Lecturers, 36 males and 28 females were sampled to be the subjects of the study. Survey research design was adopted for the study and Lecturers Attitude Towards GeoGebra Questionnaires was adapted from Likert scale and served as an instrument of the study. The reliability coefficient of the instrument has been established to be 0.89 through test and retest. The researchers conducted a one-hour workshop on the basics of GeoGebra. Immediately, after the workshop the lecturers were served with the questionnaires and the data was generated. Descriptive Statistics of Mean and Standard Deviation to answer research question and inferential Statistics of independent sample t-test was used to test the hypotheses using SPSS version 26.0. The data were analysed using SPSS version 26. The findings include: Universities Mathematics Lecturers are aware of GeoGebra software, they also have a positive attitude towards the software and most importantly they use the software in the teaching of Coordinates Geometry and Mathematics in general. Some of the recommendations given include: Universities Mathematics lecturers should update their knowledge on GeoGebra software and other software for the teaching and learning of mathematics through research and attending workshops and seminars. More so, the National University Commission should introduce more courses into the B.Sc. Ed mathematics programme on the application of computers to mathematics Concepts.

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INTRODUCTION

The world is witnessing an increase in technological development in all aspects of life daily. Some of these developments include Artificial Intelligence (AI), Robotics, space science, drones, 3D painting, IOT, smart technologies and many more. Since these technologies are reshaping the world according to Musa et al. (2022), Mathematics lecturers should

embrace them to enhance teaching and learning of mathematics and also to visualize concepts. Technologies such as online teaching, data science, and interactive whiteboard computer software should be integrated into the classrooms. This will make teaching and learning relevant to the needs of the society. The lecturers have been identified as the main determinant of integrating technology into mathematics classrooms (Agyie

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& Beining, 2015; Simanjutak & Sipayung, 2017; UNESCO, 2022). More so, the National Policy on Information and Communication Technology (2019) stated that:

1. Lecturers and trainers should use technology to support all learning across the curriculum functioning as coaches, mentors, advocates and managers of information.
2. All lecturers and trainers should acquire the knowledge and skills to integrate technology into challenging and interdisciplinary curricula and address specific needs developmental levels and learning styles.

Computer software in the form of Dynamic Geometric Systems (DGS) and Computer Algebra Systems (CAS) is some of the means of infusing into mathematics classrooms. Computer software wares according to Tiwari et al. (2021) are said to be better than the traditional method because they enable lecturers to give attention to specific mathematics courses, bring about dynamic movement, increase knowledge, develop skills, use sound and graphics to enhance teaching and learning by contributing to problem-solving. Some of these softwares are Geometer Sketchpad, Maple, Grapes, geometry pad and GeoGebra to mention a few.

In the realm of academia, the relationship between attitude of university mathematics lecturers and the use of technology achievement in teaching Coordinate geometry has long been acknowledged, prompting numerous university mathematics lecturers to advocate for the incorporation of a solid mathematical foundation within mathematics science education (Karmila et al., 2024, Karaduman & Eti, 2023, Yuan et al., 2022). This emphasis on mathematical underpinnings is readily apparent within our collaborative department, where we diligently strive to infuse mathematical concepts throughout our mathematics science curriculum (Tan & Lee, 2022, Cumhuri et al., 2021).

Currently, there is a growing recognition of the importance of integrating various technology software strategy in teaching STEM disciplines, such as mathematics and science

education, into the field of education. The conventional approach of teaching has demonstrated limited effectiveness in adequately preparing students for their future endeavors in STME. the intricate complexities of the contemporary world (Zulirfan et al., 2023, Liburd & Jen, 2021, Succar et al., 2022) have led researchers to discover that students who choose STEM majors may encounter varying experiences in online science courses, contingent upon their level of mathematical proficiency of the university Mathematics lecturers (Muhammad et al., 2021, Kennedy & Smolinsky, 2016, Núñez et al., 2022, Busch et al., 2023).

The pertinence and timeliness of integrating GeoGebra Software Strategy into the instruction of mathematics and science education in STEM education are influenced by the transformations taking place in the university education system and the growing acknowledgment of the global significance of STME education (Altun & APAYDIN, 2022, Pekbay, 2023, Akpınar & Yalçın, 2021, Wahono et al., 2022). STME education, an acronym for science, technology, and mathematics Education, places great emphasis on the integration of these disciplines in order to furnish students with a comprehensive and comprehension of real-world problem-solving (Karaduman; & Eti, 2023, Beviz & Dmytriienko, 2020, Yuan et al., 2022). By embracing GeoGebra Software strategy in our university, education have the potential to enable students to perceive the interconnections between mathematics and other science education, as well as their practical applications (Altun & Apaydin, 2022, Akpınar & Yalçın, 2021, Wahono et al., 2022).

GeoGebra (from Geometry and Algebra) was developed in 2001 by Michael Hohenwarter. It combines the functions of DGS and CAS. It provides multiple representations. It offers Algebra, Geometry and spreadsheets all in one. The software is so versatile that is being used worldwide and translated into more than 45 languages. Fletcher (2019) reported that the use of GeoGebra aided learners successfully in discovering the properties of straight-line graphs with the majority of the learners understanding

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both concepts. Saidu (2019) established that GeoGebra software improves students' performance in coordinate geometry at the NCE level.

Azucena et al. (2022) established that GeoGebra effectively and efficiently increases students' confidence in Algebra, enhances their learning and remediate students' least mastered skills and concepts. Owusu et al. (2023) found that GeoGebra allows University students to learn, understand and work with polar coordinates easier and faster; more interestingly, GeoGebra is gender-friendly software. Many students have reported that GeoGebra is effective in enhancing students' performance in Algebra, calculus, probability, coordinate geometry and many more. Coordinate Geometry is a branch of mathematics which enables one to solve geometrical questions algebraically. In other words, coordinate Geometry is a system which uses numbers (coordinates) to uniquely determine the position of a point in space.

Coordinate geometry allows us to understand objects and points with algebraic expressions that wouldn't been understood otherwise; it is part of the mathematics curriculum in Nigerian secondary schools also it is also a course in the University for Mathematics and Science students. Some of the areas of the application of coordinate geometry include: It is used to locate the position of aircraft within the space and also its proximity. The knowledge of coordinate Geometry also aids in the study of motion, centripetal force and how elections move on the magnetic field. In addition to these, it is also applied in cars and other devices with GPS systems that plot routes. More importantly, the knowledge of coordinate Geometry facilitates in the study of other subjects such as calculus, and graph theory.

Despite the importance of coordinate Geometry, students perform poorly in the course and other mathematics courses at university levels. Mathematics is becoming more unpopular as very few students apply to read the course, and yet many leave the department without completing the course. One of the reasons advanced by researchers is that teachers are teaching in the

era of ICT, the way they were taught. That is the chalk and talk method which makes students passive listeners. Since teachers are the key to implementing technology into the classroom, this study was conducted to find out the attitude of University Mathematics lecturers towards integrating GeoGebra software into the teaching and learning of coordinate Geometry. Attitude refers to liking or disliking something.

Attitude can be positive or negative if lecturers have a positive attitude towards GeoGebra, they will likely use it to teach their students. The students who are teacher trainees are likely going to use it when they become teachers. The course MTH 125- Application of Mathematics to Computer does not give room for teaching students (prospective teachers), how to use computer software in the teaching and learning of Mathematics. There is a need for more courses at the University level which will teach the students how to use computer software in teaching Mathematics.

STATEMENT OF THE PROBLEM

In the region of North Central, Nigeria, there is an urgent need to improve attitude of university mathematics lecturers towards GeoGebra Software usage in quality of STM Education, specifically in the areas of Coordinate Geometry and other science education courses. However, the conventional lecture method of instructing these disciplines frequently falls short in preparing university students at the higher level for the demands of the contemporary labor force, which increasingly relies on technology proficiencies. The objective of this investigation is to tackle the attitude of university mathematics lecturers towards GeoGebra software for teaching mathematics and other science education in the realm of STM Education among University students at North Central Universities, Nigeria.

Objectives of the study

The objectives of this study include the following:

1. To assess the overall attitude (positive, neutral, negative) of Mathematics



- lecturers toward GeoGebra for coordinate geometry.
2. To identify factors (e.g., training, access, perceived usefulness, institutional support) that influence those attitudes.
 3. To examine how lecturers' attitudes relate to their actual integration of GeoGebra in classroom practice.
 4. To compare attitudes across selected universities in North-Central Nigeria to see if regional or institutional differences exist.

Research Questions

The study is guided by these questions:

1. What is the prevailing attitude of Mathematics lecturers toward using GeoGebra in teaching coordinate geometry?
2. Which personal and contextual factors significantly predict university lecturers' attitudes toward GeoGebra?
3. To what extent does a university lecturer's attitude correlate with the frequency and quality of GeoGebra usage in their courses?
4. Are there significant differences in attitudes among university lecturers from different universities in North-Central Nigeria?

Null Hypotheses

The following hypotheses were formulated and tested at $\alpha = 0.05$ level of significance

1. Lecturers' attitudes toward GeoGebra are neutral (neither positive nor negatives)
2. There is no significant relationship between lecturers training in GeoGebra and their attitude scores
3. Attitude scores do not predict the frequency of GeoGebra Integration in coordinate geometry lectures
4. Attitude do not differ across the three selected universities in North Central, Nigeria

METHODOLOGY

The Research Design adopted for the study are survey and Mixed-methods (quantitative + qualitative) to capture both the breadth of attitudes (survey) and the depth of underlying reasons (interviews). Descriptive-correlational design for the quantitative phase; exploratory case-study design for the qualitative phase. Study Area & Population-Region: North-Central Nigeria (states: Benue, Plateau, Nasarawa, Kogi, Kwara, and the Federal Capital Territory). The target population are Full-time University mathematics lecturers (assistant lecturers to professors) who teach coordinate geometry in public universities located in the region. Estimated population size: ≈ 250 lecturers (based on university websites and departmental lists).

The instrument used for the study are Questionnaire (self-administered, online via Google Forms or Qualtrics) with Section A: Demographic data (gender, rank, years of teaching, university, prior training in GeoGebra). Section B: Attitude scale adapted from the Technology Acceptance Model (TAM) and GeoGebra Attitude Questionnaire (Hohenwarter et al., 2010). There are 20 items, 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree and 5 = Strongly Agree). Sub-scales: Perceived Usefulness (PU), Perceived Ease of Use (PEU), Attitude Toward Use (ATU), Intention to Use (IU). Section C: Self-reported frequency of GeoGebra integration (never, rarely, sometimes, often, always) and barriers faced.

Validity & Reliability the Content validity: Questionnaire reviewed by three mathematics education experts and piloted with 30 lecturers (not part of the main sample). Construct validity: Confirmatory factor analysis (CFA) to verify the TAM structure. Reliability: Cronbach's α computed for each sub-scale; target $\alpha \geq 0.80$. Interview trustworthiness: Member checking, audio recording, verbatim transcription, and triangulation with survey data.

The data Collected were analyzed using descriptive statistics of mean and standard



deviation and independent sample t-test analysis to test the null hypotheses.

Research Question One:

What is the prevailing attitude of Mathematics lecturers toward using GeoGebra in teaching coordinate geometry?

RESULTS

Table 1: Mean and Standard Deviation on the Prevailing Attitude of Mathematics lecturers Toward using GeoGebra in Teaching Coordinate Geometry

S/N	STATEMENTS	SA	A	U	D	SD	M	St. D	RMARKS
1	Teaching coordinate geometry with GeoGebra makes the topic more interesting for students	34	20	0	5	5	4.14	1.22	Agreed
2	GeoGebra helps me explain coordinate geometry concepts more clearly than traditional methods	33	25	2	3	2	4.36	1.18	Agreed
3	Using GeoGebra for coordinate geometry is time-consuming and disrupts my lesson flow.	26	32	0	5	0	4.19	1.20	Agreed
4	I feel confident using GeoGebra to demonstrate coordinate geometry problems in class	30	30	4	0	0	4.41	1.18	Agreed
5	I would recommend the use of GeoGebra to other Mathematics lecturers for teaching coordinate geometry	30	28	0	2	4	4.22	1.25	Agreed
Total							21.32	6.03	
Average Mean and Standard Deviation							4.26	1.21	Agreed

Benchmark = 3.00

Table 1. show that the mean and standard deviation of responses on the prevailing attitude of University Mathematics lecturers toward using GeoGebra in teaching coordinate geometry. The average mean value of items 1, 2, 3, 4, and 5 is given as 4.26 with Std. Div of 1.21 and is above the cut-off point of 3.00, indicating

there is high prevailing attitude of lecturers toward using GeoGebra software in teaching coordinate geometry in North central Zone, Nigeria

Research Question Two:

Which personal and contextual factors significantly predict university lecturers' attitudes toward GeoGebra

Table 2. Mean and Standard Deviation of Responses on Personal and Contextual Factors Significantly Predict University Lecturers' Attitudes Toward GeoGebra Software

S/N	STATEMENTS	SA	A	U	D	SD	M	St. D	RMARKS
6	I have sufficient ICT skills to use GeoGebra effectively in my teaching.	28	26	2	2	2	4.00	0.90	Agreed
7	I believe GeoGebra improves students' understanding of mathematical concepts more than traditional methods	34	26	0	4	0	4.41	0.97	Agreed

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S/N	STATEMENTS	SA	A	U	D	SD	M	St. D	REMARKS
8	My department/university provides adequate training and technical support for using GeoGebra	23	34	3	3	1	4.17	0.92	Agreed
9	I have reliable access to computers, internet, and software needed to use GeoGebra in my classes	31	21	0	10	2	4.07	1.10	Agreed
10	My current workload allows me enough time to prepare and integrate GeoGebra into my lessons.	35	23	2	3	1	4.38	1.22	Agreed
Total							21.03	5.11	
Cluster Average of Mean and Standard Deviation							4.21	1.02	Agreed

Benchmark = 3.00

Table 2. revealed the mean and standard deviation of responses on the personal and contextual factors significantly predict university lecturers' attitudes toward GeoGebra. The average mean value of items 6, 7, 8, 9 and 10 is given as 4.21 with Std. Div of 1.02 and is above the cut-off point of 3.00, indicating there is high

personal and contextual factors significantly predict university lecturers' attitudes toward GeoGebra in North Central Zone, Nigeria

Research Question Three:

To what extent does a university lecturer's attitude correlate with the frequency and quality of GeoGebra usage in their courses?

Table 3. Mean and Standard Deviation of Responses on University Lecturer's Attitude Correlate with the Frequency and Quality of GeoGebra usage in their courses

S/N	STATEMENTS	SA	A	U	D	SD	M	St. D	REMARKS
11	My positive attitude toward GeoGebra makes me use it regularly in my coordinate geometry lessons	34	25	2	2	2	4.41	1.10	Agreed
12	I avoid using GeoGebra frequently because I am not comfortable with the software	30	28	0	6	0	4.28	1.00	Agreed
13	When I have a positive attitude toward GeoGebra, I take time to design interactive and effective activities with it	25	26	3	10	0	4.03	0.97	Agreed
14	My attitude toward GeoGebra influences how well I integrate it to explain complex concepts in coordinate geometry	36	23	0	5	0	4.41	1.21	Agreed
15	The more positive my attitude toward GeoGebra, the higher the frequency and quality of its use in my teaching.	30	21	4	0	9	3.98	0.88	Agreed
Total							21.11	5.16	

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S/N	STATEMENTS	SA	A	U	D	SD	M	St. D	RMARKS
	Cluster average of Mean and Standard Deviation						4.22	1.03	Agreed

Benchmark = 3.00

Table 3 shows the mean and standard deviation of responses on extent does a university lecturer's attitude correlate with the frequency and quality of GeoGebra usage in their courses. The average mean value of items 11, 12, 13, 14 and 15 is given as 4.22 with Std. Div of 1.03 and is above the cut-off point of 3.00, indicating there is positive extent does a university lecturer's attitude

correlate with the frequency and quality of GeoGebra usage in their courses in North Central Zone, Nigeria

Research Question Four:

Are there significant differences in attitudes among university lecturers from different universities in North-Central Nigeria?

Table 4: Mean and Standard Deviation of Responses on Significant Differences in Attitudes among University Lecturers from Different Universities in North-Central Nigeria

S/N	STATEMENTS	SA	A	U	D	SD	M	St. D	RMARKS
16	Using GeoGebra makes teaching coordinate geometry more effective than using chalk and board alone.	36	23	0	5	0	4.41	1.21	Agreed
17	I feel confident recommending GeoGebra to colleagues for teaching coordinate geometry.	30	21	4	0	9	3.98	0.88	Agreed
18	GeoGebra helps students understand abstract coordinate geometry concepts better.	34	26	0	4	0	4.41	0.97	Agreed
19	Integrating GeoGebra into my lessons increases my workload without improving student learning	23	34	3	3	1	4.17	0.92	Agreed
20	I am willing to spend time learning and using GeoGebra for my coordinate geometry classes.	30	28	0	2	4	4.22	1.25	Agreed
Total							21.19	5.23	
	Cluster average of Mean and Standard Deviation						4.24	1.05	Agreed

Benchmark = 3.00

Table 4. shows the mean and standard deviation of responses on significant differences in attitudes among university lecturers from different universities in North-Central Nigeria. The average mean value of items 16, 17, 18, 19 and 20 is given as 4.24 with Std. Div of 1.05 and is above the cut-off point of 3.00, indicating there is

positive significant differences in attitudes among university lecturers from different universities in North-Central Nigeria.

Hypothesis One:

Lecturers' attitudes toward GeoGebra are neutral (neither positive nor negatives)

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Table 5: Result of t-test Analysis on the mean responses of Lecturers' Attitudes Toward GeoGebra

Groups	N	Mean	St. Dev.	df	t	P	Decision
Positive	50	62.61	9.055	62	34.859	0.000	Significant
Negatives	14	42.72	5.65				

Table 5 showed that, P – value is 0.000 which is less than the alpha value of 0.05 level of significance at df of 62. Since the p- value is less than the alpha value, it means that, there is significant positive Lecturers' attitudes toward GeoGebra software in North Central Zone, Nigeria. Therefore, the null hypothesis one is rejected

indicating that most of the university lecturer have high positive attitude toward GeoGebra.

Hypothesis Two:

There is no significant relationship between lecturers training in GeoGebra and their attitude scores

Table 6 t-test Analysis on the Relationship between Lecturers Training in GeoGebra and their attitude scores in North Central Zone, Nigeria

Responses	N	Mean	St. Div.	df	t	P
Agreed	50	65.23	1.74	62	21.995	0.001
Disagreed	14	24.89	1.82			

Table 6 showed that, P – value is 0.001 which is less than the alpha value of 0.05 level of significance at df of 62. Since the p- value is less than the alpha value, it means that, there is significant positive relationship between lecturers training in GeoGebra and their attitude scores in

North Central Zone, Nigeria. Therefore, the null hypothesis two is rejected.

Hypothesis Three:

Attitude scores do not predict the frequency of GeoGebra Integration in coordinate geometry lectures

Table 7: t-test Analysis on the Attitude Scores on the prediction of the frequency of GeoGebra Integration in coordinate geometry lectures

Responses	N	Mean	St. Div.	df	t	P
Agreed	50	72.43	3.21	62	11.123	0.000
Disagreed	14	32.88	2.12			

Table 7 indicates that, P – value is 0.000 which is less than the alpha value of 0.05 level of significance at df of 62. Since the p- value is less than the alpha value, it means that, there is significant positive Attitude scores do predict the frequency of GeoGebra Integration in coordinate

geometry lectures in North Central Zone, Nigeria. Therefore, the null hypothesis three is rejected.

Hypothesis Four:

Attitude do not differ across the three selected universities in North Central, Nigeria

Table 8: Result of t-test Analysis on Attitude across the three Selected Universities in North Central, Nigeria

Groups	N	Mean	St. Dev.	df	t	p	Decision
Agreed	50	51.02	8.34	62	24.475	0.000	Significant
Disagreed	14	32.72	6.15				

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Table 8 shows that, P – value is 0.000 which is less than the alpha value of 0.05 level of significance at df of 62. Since the p - value is less than the alpha value, it means that, there is significant positive Attitude across the three selected universities in North Central, Nigeria in North Central Zone, Nigeria on the use of GeoGebra in teaching coordinate geometry. Therefore, the null hypothesis four is rejected.

DISCUSSION OF FINDINGS

The finding based on hypothesis one revealed there is a significant positive university mathematics Lecturers' attitudes toward GeoGebra software in North Central Zone, Nigeria. Therefore, the null hypothesis one is rejected indicating that most of the university lecturer have high positive attitude toward GeoGebra in North Central Zone, Nigeria. The finding is in agreement with Altun & Apaydin, 2022, Botur & Bali, (2020), and Ogunlade (2021) who jointly revealed that there is a significant positive Lecturers' attitudes toward GeoGebra. But this finding is in disagreement with finding of Menasah and Boateng (2019) who believe that some university lecturers have negative attitude toward the use of GeoGebra in teaching coordinate geometry.

The finding of hypothesis two revealed that, there is a significant positive relationship between lecturers training in GeoGebra and their attitude scores in North Central Zone, Nigeria. This finding is in agreement with the finding of FGN (2019), and Adeyinka (2022), that jointly believed that there is significant relationship between lecturers training in GeoGebra and their attitude scores in North Central Zone, Nigeria. this indicated that, lecturers who received training on the usage GeoGebra always have positive attitude toward the use of GeoGebra in teaching and learning coordinate geometry. The finding from hypothesis three and four shows that, there is a significant Attitude scores do predict the frequency of GeoGebra.

Integration in coordinate geometry lectures and Attitude across the three selected universities in North Central, Nigeria. These findings are in agreement with the findings of Fletcher and Musdav (2019), Saidu, (2019) and

also that of Onwusu et al. (2023), Umar (2025) who reported that GeoGebra is not only used for teaching learning mathematics but it also helps in improving student performance and attitude towards mathematics.

CONCLUSION

The study established that the mathematics lecturers in universities in the zone are aware of GeoGebra software as a software that can enhance the teaching and learning of mathematics. The lecturers also have a positive attitude towards integrating the software into their teaching. Most importantly, a significant number of lecturers indicated that they use GeoGebra software as a pedagogical strategy in the teaching of Coordinate Geometry. However, the study did not find out how often and the depth of usage of the software in the classroom. Apart from this one important thing to note is the slow nature of accepting innovation in the education sector in Nigeria and other African countries. As GeoGebra more than 25 years old and university lecturers are yet to fully utilize it for the benefit of their students.

RECOMMENDATIONS

1. Mathematics Lecturers in the Universities should learn more about GeoGebra and other wares that can enhance the teaching of the subject
2. Mathematics Departments in Universities should organize seminars and workshops for their lecturers on GeoGebra and other relevant software so that they can update the knowledge of their lecturer
3. The National University Commission should introduce more courses on the application of computers to mathematics concepts.

REFERENCES

- Akpınar, D., & Altun Yalçın, S. (2021). Exploring the Effect of STEM Education on the Motivations and Epistemological Beliefs Related to Science Among Talented and Gifted Students. *OPEN journal for educational research*, 5(2), 317–332.



- <https://doi.org/10.32591/coas.ojer.0502.14317y>
- Alessandra, K., Adriana Helena Borssoi, & Elaine Cristina Ferruzzi. (2023). Integration of STEM Education in Differential and Integral Calculus classes: Aspects Evidenced in a Mathematical Modelling Activity. *Acta Scientiae*, 24(7), 116–145.
<https://doi.org/10.17648/acta.scientiae.7114>
- Altun, E., & Apaydin, Z. (2022). Awareness Levels and Attitudes Of Primary School Teachers About STEM Approach. *Yuzunci Yil Universitesi Egitim Fakultesi Dergisi*, 10.33711/yyuefd.1108245(<https://scite.ai/reports/10.33711/yyuefd.1108245>).
<https://doi.org/10.33711/yyuefd.1108245>
- Amin, M., Rahmawati, Y., Sudrajat, A., & Mardiah, A. (2022). Enhancing Primary School Students' Critical Thinking Skills through the Integration of Inquiry-Based STEM Approach on Teaching Electricity in Science Learning. *Journal of Physics: Conference Series*, 2377(1), 012090.
<https://doi.org/10.1088/1742-6596/2377/1/012090>
- Bevz, V., & Dmytriienko, O. (2020). Students' perceptions of the history of science and technology course at teacher training university. *Advanced Education*, 7(15), 74–80.
<https://doi.org/10.20535/2410-8286.160202>
- Busch, C. A., Mohammed, T. F., Nadile, E. M., Witt, M. L., Vargas, C., Tran, M., Wolf, J. G., Brister, D., & Cooper, K. M. (2023). Costs and Benefits of Undergraduates Revealing Depression to Online Science Instructors. *CBE—Life Sciences Education*, 22(1).
<https://doi.org/10.1187/cbe.22-05-0088>
- Cumhur, M., Masalimov, A. R., Rostovtseva, P. P., Shindryaev, N. N., & Kryukova, N. I. (2021). Content Analysis of Studies Conducted on STEM Education from 2010 to 2020: Perspective of Emerging Technologies in Learning. *International Journal of Emerging Technologies in Learning*, 16(19), 139–151.
<https://doi.org/10.3991/ijet.v16i19.26053>
- GeoGebra Official Site (2010). GeoGebra the graphic calculator for functions, geometry, algebra, calculus and 3D maths. Retrieved from:<http://www.geogebra.org>
- Karmila-Dany, Della Asmaria Putri, Mery Berlian, Deden Mahmudas Pratama, & Fatrima. (2024). *The Role of Interactive Videos in Mathematics Learning Activities During the Covid-19 Pandemic*.
<https://scite.ai/reports/10.2991/assehr.k.210227.024>(10.2991/assehr.k.210227.024).
<https://doi.org/10.2991/assehr.k.210227.024>
- Karaduman, B., & ETİ, İ. (2023). Stem for all: opinions of education staff at a stem education center on stem education. *Trakya Eğitim Dergisi*, 13(1), 209–225.
<https://doi.org/10.24315/tred.1022582>
- Kennedy, E., & Smolinsky, L. (2016). Math Circles: A Tool for Promoting Engagement Among Middle School Minority Males. *EURASIA Journal of Mathematics, Science and Technology Education*, 12(4).
<https://doi.org/10.12973/eurasia.2016.1223a>
- Liburd, K. K. D., & Jen, H.-Y. (2021). Investigating the Effectiveness of Using a Technological Approach on Students' Achievement in Mathematics—Case Study of a High School in a Caribbean Country. *Sustainability*, 13(10), 5586.
<https://doi.org/10.3390/su13105586>
- Martín-Núñez, J. L., Bravo-Ramos, J. L., Sastre-Merino, S., Pablo-Lerchundi, I., Caravantes Redondo, A., & Núñez-del-Río, C. (2022). Teaching in Secondary Education Teacher Training with a Hybrid Model: Students' Perceptions.

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- Sustainability*, 14(6), 3272.
<https://doi.org/10.3390/su14063272>
- Muhammad, R., Abdul Gani, A., Abdullah, N., Ibrahim, S., & Md Sharif, M. S. (2021). The Culinary and Food Science: Its' Integration via Kitchen Science Module (Cooking) to fascinate students towards Science, Technology, Engineering and Mathematics (STEM). *International Journal of Academic Research in Business and Social Sciences*, 11(13).
<https://doi.org/10.6007/ijarbss/v11-i13/8550>
- Nyet Moi Siew, & Ahmad, J. (2023). The effects of sociocentric issues with thinking wheel map approach on curiosity towards stem of year five students. *Problems of Education in the 21st Century*, 81(1), 130–143.
<https://doi.org/10.33225/pec/23.81.130>
- PEKBAY, C. (2023). A sample STEM activity based on the engineering design process: A study on prospective preschool teachers' views. *Participatory Educational Research*, 10(1), 86–105.
<https://doi.org/10.17275/per.23.5.10.1>
- ŞAHİN, F., & KABAPINAR, Dr. F. (2020). Öğretmen Adaylarının Vücudun pH Dengesi Konusundaki Bilgi Entegrasyon Düzeylerinin İncelenmesi. *E-Kafkas Eğitim Araştırmaları Dergisi*, [https://scite.ai/reports/10.30900/kafkas egt.664823\(10.30900/kafkasegt.664823\)](https://scite.ai/reports/10.30900/kafkas egt.664823(10.30900/kafkasegt.664823)).
<https://doi.org/10.30900/kafkasegt.664823>
- Succar, T., Lee, V. A., Karmonik, C., & Lee, A. G. (2022). An Academic Ophthalmology Curriculum as a Model for Introducing Preprofessional Students to Careers in Ophthalmology. *Journal of Academic Ophthalmology*, 14(01), e45–e51.
<https://doi.org/10.1055/s-0042-1743413>
- Tan, T. T. M., & Lee, Y.-J. (2022). Building Improved Microbial Fuel Cells: A Model Integrated STEM Curriculum for Middle-School Learners in Singapore. *Education Sciences*, 12(6), 417.
<https://doi.org/10.3390/educsci12060417>
- Umar, I. O. (2025) Effects of GeoGebra and Geometer's Sketch Pad Softwares on students Attitude and Achievement in Geometry in Nasarawa State, Nigeria. unpublished Thesis department of STME Faculty of Education Nasarawa State University, Keffi
- West African Examination Council (2024). Chief Examiner's report. Retrieved from: [http://waecheadquarters.org/index.php?option=com-docm\(9\)](http://waecheadquarters.org/index.php?option=com-docm(9))
- Yuan, Y., Ji, X., Yang, X., Wang, C., Samsudin, S., & Omar Dev, R. D. (2022). The Effect of Persistence of Physical Exercise on the Positive Psychological Emotions of Primary School Students under the STEAM Education Concept. *International Journal of Environmental Research and Public Health*, 19(18), 11451.
<https://doi.org/10.3390/ijerph191811451>
- Zulirfan, Z., Yennita, Y., Maaruf, Z., & Sahal, M. (2023). Ethnoscience literacy in Pacu Jalur tradition: Can students connect science with their local culture? *Eurasia Journal of Mathematics, Science and Technology Education*, 19(1), em2210.
<https://doi.org/10.29333/ejmsste/12773>