



Analysis of the Implementation of Quipper Learning in Facilitating the Understanding of Derivatives of Trigonometric Functions in High School

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ABSTRACT

The use of Quipper media in teaching trigonometric function derivatives strengthens learning outcomes compared to conventional methods. The analysis shows that Quipper produces higher posttest scores and N-Gain values, reflecting better conceptual mastery and optimal learning engagement. The findings confirm that Quipper is a digital learning medium that is more effective, especially for abstract and complex mathematical material. Future studies can utilize Quipper for different mathematical concepts or integrate it with technology-based learning models to further improve learning performance and motivation.

Keywords: digital learning media; learning outcomes; mathematics education; Quipper

INTRODUCTION

Mathematics learning is a structured interactive process between teachers and students aimed at helping students understand, construct, and communicate the knowledge they have acquired (Hidayat et al., 2021; Lestari et al., 2021). To achieve an effective process, learning media capable of increasing students' interest and motivation to learn are required (Wulandari et al., 2022; Putri & Rahmawati, 2021). Media relevant to students' characteristics can facilitate the understanding of concepts and skills through meaningful learning experiences (Pratama & Kuswandi, 2022; Lestari et al., 2021). In line with the demands of the 21st century, the integration of Information and Communication Technology (ICT) into learning has become a necessity because it can create a flexible, interactive, and student-centered learning environment (Sari et al., 2023; Zhang et al., 2022). One of the digital platforms widely used in education in Indonesia is Quipper School. Since 2015, Quipper has been a key component supporting Indonesia's education ecosystem by helping to improve and ensure equitable access to quality educational services for teachers and students (Sundari & Utomo, 2020). Various studies indicate that the use of this platform can boost student engagement, motivation, and learning outcomes (Rahman et al., 2022; Nugroho & Widodo, 2021; Sari et al., 2023). The Quipper platform continues to evolve, offering a more accessible learning alternative that can be accessed anytime and anywhere. Educators can more easily monitor students' learning activities, while students can review instructional materials whenever and wherever they choose (Anuli, 2020). Research by Sari and Wulandari (2020) indicates that this platform plays a role in supporting the improvement of national education quality.

Recent national and international studies indicate that Quipper-based learning systems are effective in improving students' mathematics achievement. For example, the

integration of Quipper into blended learning models significantly improves student learning outcomes (Hidayati & Sari, 2024; Faslan et al., 2024). Furthermore, Quipper has been shown to support conceptual understanding and increase student engagement through interactive features and immediate feedback (Sidabutar, 2023; Pratistha et al., 2023). These findings confirm that digital learning platforms have strong potential to support effective mathematics instruction. However, while many studies have tested Quipper's effectiveness, most focus on general mathematics topics or overall learning outcomes. Research specifically investigating the use of Quipper in studying complex and abstract topics such as derivatives of trigonometric functions remains limited. This topic is considered difficult because it requires strong prerequisite knowledge, including concepts of limits and trigonometry, and involves abstract reasoning processes (Clark & Mayer, 2016; Nzaramyimana et al., 2021).

Based on preliminary observations conducted at a high school in Bekasi Regency, Quipper is primarily used as an assessment tool and has not yet been optimally integrated into the learning process. This indicates a gap between the potential of digital learning media and its actual implementation in classroom practice. Similar findings have been reported in previous studies, highlighting that the effectiveness of digital learning platforms depends not only on their availability but also on how they are integrated into learning strategies (Buntoro et al., 2020; Syahputra & Wulandari, 2022). The uniqueness of this study lies in its focus on the use of Quipper as a digital learning medium specifically designed to enhance students' understanding of trigonometric derivatives, an area that has not been extensively explored in previous research (Pratistha et al., 2023; Hidayati & Sari, 2024). The rationale for this study is to address the need for innovative, technology-based learning solutions that can improve students' conceptual understanding and learning outcomes. The integration of digital platforms such as Quipper is expected to enhance students' engagement, independence, and conceptual mastery in mathematics learning (Mardiana, 2024; Caballo et al., 2024).

Based on the background described above, the research question is formulated as follows: Is the use of Quipper more effective than conventional teaching methods in improving students' understanding of trigonometric derivatives?

Therefore, the objective of this study is to analyze the effectiveness of Quipper in facilitating students' understanding of trigonometric derivatives compared to conventional teaching methods.

RESEARCH METHOD

The study used a quantitative approach utilizing a quasi-experiment. The research design chosen was a non-equivalent pretest-posttest group design, which involves two groups that are not randomly selected. This design was chosen based on the condition that the research subjects were pre-formed classes (whole classes). The research population included all 12th grade students at the research location school in Bekasi Regency. Cluster random sampling was used as the sampling technique, with units randomly selected in the form of groups or classes, rather than individuals (Burke & Christensen, 2014). Using this technique, two classes were selected as the research sample, namely class XII MIPA 1 with

41 students as the control group and class XII MIPA 2 with 41 students as the experimental group.

The research instruments used were pretest and posttest with equivalent item characteristics, which were given to students before and after learning the material being studied. The test format was multiple choice and had undergone expert judgment by competent lecturers. After that, the instruments were empirically tested through validity, reliability, discriminating power, and difficulty level analyses to ensure that the tests were suitable for use as research measurement tools. The procedure for testing the quality of these instruments is consistent with previous research findings which confirm that validity, reliability, difficulty level, and discriminating power are important components in the development of multiple-choice learning outcome tests (Toifur & Setyowati, 2022; Gunawan & Asria, 2024).

Data was collected by administering a test on trigonometric function derivatives to the entire sample. Each student was asked to complete the test according to the instructions listed on the instrument. The instrument used 20 multiple-choice questions that were systematically arranged to measure students' level of understanding of trigonometric function derivatives. The development and use of multiple-choice tests as a tool for measuring mathematical concept comprehension has been widely supported by previous studies, which show that objective tests can be used effectively to assess mathematical concept mastery if they meet good psychometric criteria (Usman, Wiwid, & Sulisti, 2022).

The research data were analyzed using JASP software version 0.95.3 to identify differences and improvements in student learning outcomes. The analysis process began with a normality test using Shapiro Wilk (H_0 : data is normally distributed), because this method is considered to have the best power for various distribution types and sample sizes (Ahmad & Khan, 2015). After that, a homogeneity test was conducted to ensure that the variance of the two groups, namely the experimental class and the control class, was equivalent. The next step was to conduct a two-sample t-test on the pretest data to ensure that the initial abilities of the two classes did not differ significantly before the treatment was given. The improvement in student learning outcomes was then calculated using the N-Gain index based on pretest and posttest scores, with categories of high (≥ 0.70), medium (0.30–0.70), and low (≤ 0.30). The N-Gain values are then tested using a two-sample t-test to determine whether the improvement in the class using Quipper is superior to that in the class following conventional learning. All analyses are conducted at a significance level of 0.05.

RESULTS AND DISCUSSION

The results of this study are presented through descriptive statistical analysis to address the research question regarding the effectiveness of using Quipper in improving students' understanding of trigonometric function derivatives. Before presenting the results of the descriptive analysis, the data from the ability tests obtained through pretests and posttests administered to the students were first processed. These tests were used to measure efforts to improve understanding of trigonometric function derivatives after students received instruction using the teaching materials or learning media developed for them. Pretest scores serve to describe students' initial ability before the learning process

began, while posttest scores reflect learning outcomes after the learning activities took place (Sugiyono, 2019). Subsequently, an N-Gain calculation was performed to determine the effectiveness of the learning method used. The results of the descriptive analysis of the pretest and posttest scores, as well as the N-Gain values for the trigonometric function derivatives material, were then presented in full.

Table 1. Descriptive Statistics of Pre-test Scores

<i>Group Descriptives</i>								
	Group	N	Mean	SD	SE	Coefficient of variation	Mean Rank	Sum Rank
skor-pretest	pre-ctr	41	12.24	1.827	0.285	0.149	39.51	1620
	pre-eks	41	12.46	1.832	0.286	0.147	43.49	1783

*pre-ctr: pretest for the control group

*pre-eks: pretest for the experimental group

Based on Table 1, the analysis results show that the mean pretest scores for the control class ($M = 12.24$; $SD = 1.827$) and the experimental class ($M = 12.46$; $SD = 1.832$) were relatively similar. This indicates that both groups had equivalent initial abilities before the treatment was administered. Establishing this initial equivalence is crucial in quasi-experimental research to maintain internal validity and ensure that differences in final outcomes are attributable to the treatment (Fraenkel et al., 2012).

Table 2. Descriptive Statistics of Posttest Scores

<i>Group Descriptives</i>							
	Group	N	Mean	SD	SE	Coefficient of variation	
skor-posttest	pos-ctr	41	13.49	1.872	0.292	0.139	
	pos-eks	41	16.63	1.729	0.270	0.104	

*pos-ctr: posttest for the control group

*pos-eks: posttest for the experimental group

Furthermore, based on Table 2, the posttest results indicate an improvement in both groups. However, the improvement in the experimental class ($M = 16.63$; $SD = 1.729$) was greater than that in the control class ($M = 13.49$; $SD = 1.872$). These findings indicate that students who learned using Quipper achieved better learning outcomes. This aligns with previous research stating that digital learning platforms can improve academic achievement through interactive and adaptive features (Alayacyac et al., 2024).

Table 3. Descriptive Statistics for N-Gain Scores

<i>Group Descriptives</i>								
	Group	N	Mean	SD	SE	Coefficient of variation	Mean Rank	Sum Rank
n-gain	eksperimen	41	4.171	1.465	0.229	0.351	59.23	2428.5
	kontrol	41	1.244	1.044	0.163	0.839	23.77	974.5

Based on Table 3, the N-Gain scores in the experimental class ($M = 4.171$; $SD = 1.465$) were also higher than those in the control class ($M = 1.244$; $SD = 1.044$). This indicates that the improvement in students' understanding in the experimental class was more significant. This finding reinforces the results of previous research stating that Quipper-based learning effectively improves students' understanding of mathematical concepts (Pratistha et al., 2017). The use of Quipper in the experimental class was proven to contribute positively to improvements in student learning outcomes compared to conventional teaching methods. This finding aligns with the results of a study by Clark and Mayer (2016), which showed that effectively designed e-learning, including adaptive platforms such as Quipper, can improve learning performance by 20–60%, particularly when the system provides immediate feedback and personalized learning paths.

Next, normality and homogeneity tests were conducted to analyze the pretest data using a series of statistical tests. A two-sample t-test was used as a follow-up analysis to determine whether there was a significant difference between the means of two related groups (i.e., pretest and posttest scores within the same group). If the results of the tested data do not meet the assumption of a normal distribution, then a non-parametric test must be applied as an alternative method. The entire analysis process was performed using JASP software version 0.95.

Table 4. Normality Test of Pre-test Scores

	skor-pretest	
	pre-ctr	pre-eks
Shapiro-Wilk	0.874	0.906
P-value of Shapiro-Wilk	<0.001	0.002

The results in Table 4 show that the p-value for the control group is $p < 0.001$ and for the experimental group is $p = 0.002$. Since both p-values are below the significance level of 0.05, H_0 is rejected. Thus, it can be concluded that the pretest data for both groups are not normally distributed. Therefore, the analysis continues using the non-parametric Mann–Whitney U test. The results of the Mann–Whitney U test are presented in Table 5.

Table 5. Mann Whitney Test for Pre-test Scores

<i>Independent Samples T-Test</i>			
	U	df	p
skor-pretest	759.0		.438

Note. Mann-Whitney U test.

The results in Table 5 show that the significance value of the Mann–Whitney U test is 0.438. Since the p-value is ≥ 0.05 , H_0 is not rejected. This means that there is no difference in initial ability between the experimental and control groups based on the pretest results. This finding indicates that both groups are at an equivalent level of initial ability, making them suitable as a basis for a fair comparison in experimental research. This aligns with Pallant's (2020) perspective, which emphasizes that a non-significant

Mann–Whitney U test result at the pretest stage indicates comparable initial conditions; thus, any differences emerging in subsequent phases can be more convincingly interpreted as genuine effects of the treatment, rather than the result of initial imbalance between groups. After confirming the equivalence between the two groups, the analysis can proceed to the posttest data and gain scores with the confidence that the treatment effects reflect the actual outcomes. Subsequently, the posttest data were analyzed using normality and homogeneity tests, as shown in Table 6.

Table 6. Normality Test of Post-Test Scores

<i>Descriptive Statistics</i>	skor-posttest	
	pos-ctr	pos-eks
Shapiro-Wilk	0.924	0.946
P-value of Shapiro-Wilk	.009	.050

Based on Table 6, the p-value was found to be 0.009 for the control group and 0.050 for the experimental group. If either group has a p-value < 0.05 , this indicates that the data are not normally distributed. Kim (2013) explains that when posttest data are not normally distributed, the analysis should focus on gain scores or N-Gain, which describe the change from the pretest to the posttest. Kim states that N-Gain often has a different distribution from posttest data because it corrects for baseline differences and normalizes the improvement based on the available room for improvement. Therefore, a normality test needs to be conducted again on the N-Gain data to determine the most appropriate analysis method to use in the next stage. Consequently, normality and homogeneity tests were performed on the N-Gain data, as shown in Table 7 below.

Table 7. Normality Test of N-Gain Scores

<i>Descriptive Statistics</i>	n-gain	
	eksperimen	kontrol
Shapiro-Wilk	0.921	0.856
P-value of Shapiro-Wilk	.007	$< .001$

Based on the results shown in Table 7, the p-value for the control group is $p < 0.001$, while for the experimental group it is $p = 0.007$. Since one of the groups shows a p-value < 0.05 , it can be concluded that the N-Gain data distribution does not meet the assumption of normality. Therefore, the difference in means between the two groups was tested using the non-parametric Mann–Whitney U test.

Table 8. Mann–Whitney U Test for N-Gain Scores

<i>Independent Samples T-Test</i>		
U	df	p

Independent Samples T-Test

	U	df	p
n-gain	1568		< .001

Note. Mann-Whitney U test.

The results of the Mann-Whitney U test showed a p-value of <0.001 ; since the p-value is less than 0.05, this indicates that Quipper significantly improves students' understanding of trigonometric derivatives. This finding aligns with previous research showing that Quipper-based learning significantly improves learning outcomes (Qorib et al., 2021). The use of Quipper enhances students' mastery of mathematical concepts, as explained by Hidayati and Sari (2024), who state that this platform presents learning materials in a more interactive and flexible manner, thereby encouraging student engagement and yielding more optimal learning outcomes. In line with this, research by Faslan et al. (2024) shows that the integration of Quipper School into a blended learning model significantly strengthens learning activities and the understanding of mathematical concepts. This is evident from the higher posttest scores in the experimental class compared to the class that received instruction through the lecture method. These findings are consistent with the results of the research Sidabutar (2023) reported that the use of Quipper Video has a positive impact on efforts to improve mathematical understanding and enhance the effectiveness of the learning process. This latest empirical evidence reinforces the view that the use of ICT-based digital media makes a significant contribution to improving the quality of students' conceptual understanding. Thus, the increase in scores recorded in this study indicates that the use of Quipper is effective in enhancing students' learning autonomy, increasing engagement, and deepening their understanding.

Deci & Ryan (2000) in Self-Determination Theory explain that learning technologies that provide autonomy, competence, and relatedness can enhance students' intrinsic motivation. The Quipper platform, which offers learning path options, instant feedback showing progress, and social learning features, fulfills these three basic psychological needs. Increased intrinsic motivation encourages students to improve the quality of their learning and apply more in-depth learning strategies, resulting in optimal learning outcomes compared to conventional learning methods that emphasize extrinsic motivation.

DISCUSSION

The findings of this study indicate that the use of Quipper significantly improves students' understanding of trigonometric function derivatives compared to conventional teaching methods. These results address the research question and confirm that digital learning media play a crucial role in enhancing the understanding of mathematical concepts. The greater improvement observed in the experimental class can be attributed to Quipper's features, which include interactive elements such as immediate feedback, adaptive exercises, and flexible access to learning materials. These features encourage active and self-directed learning. This aligns with multimedia learning theory, which states

that well-designed digital-based learning can improve learning outcomes through the integration of visuals and interactivity (Clark & Mayer, 2016). Furthermore, the results of this study are consistent with previous research showing that Quipper can improve students' learning outcomes and conceptual understanding (Pratistha et al., 2017; Qorib et al., 2021). However, this study offers a new contribution as it specifically examines the topic of derivatives of trigonometric functions, which is known to be abstract and complex material.

The significant difference in N-Gain scores indicates that Quipper not only improves learning outcomes but also enhances the quality of the learning process. This is linked to increased student engagement and motivation. The improvement in learning outcomes in the experimental class is not only attributed to the use of Quipper but is also driven by students' active participation during learning activities. This platform facilitates student interaction with learning materials through features such as interactive videos, automated quizzes, and immediate feedback. Consequently, students can identify errors in their conceptual understanding and correct them promptly. According to Mardiana (2024), the process of rapid feedback is one of the key factors enhancing the effectiveness of digital learning, as it allows students to improve their understanding independently without waiting for direct guidance from the teacher. Additionally, the implementation of Quipper in the teaching of trigonometric function derivatives facilitates the visualization of abstract derivative concepts. This finding aligns with Nugroho, Hidayat, and Raharjo (2023), who state that digital visualization can strengthen students' conceptual connections in mathematics learning while helping them link theory to practical application.

Digital learning environments such as Quipper have been shown to enhance students' motivation and creativity in mathematics learning (Sipin & Paglinawan, 2024). This is also supported by Self-Determination Theory, which states that learning environments that foster autonomy, competence, and relatedness will increase students' intrinsic motivation (Deci & Ryan, 2000). Nevertheless, this study has several limitations. First, the study was conducted at only one school, so the generalizability of the results remains limited. Second, the effectiveness of Quipper is highly dependent on the availability of technological infrastructure and internet access. Previous research has also shown that technological limitations can be a barrier to the implementation of e-learning (Mangarin et al., 2024). Practically, the results of this study provide assurance that teachers are advised to integrate digital learning platforms such as Quipper into mathematics instruction, particularly for abstract concepts. Theoretically, this study strengthens the evidence that technology-based learning can improve students' conceptual understanding and learning outcomes.

Overall, there is a clear connection between the research problem, the results of the analysis, and the interpretation of the findings. The results of the study indicate that Quipper is an effective digital learning tool for improving students' understanding of trigonometric function derivatives and can serve as a more innovative alternative to conventional teaching methods.

CONCLUSION

The results of this study indicate that the use of Quipper has a significant impact on improving learning outcomes in the topic of derivatives of trigonometric functions. Statistical findings reveal that both the posttest scores and N-Gain scores of students using Quipper were higher than those of students who followed conventional instruction, indicating improved conceptual understanding and greater engagement in learning. Therefore, Quipper should be considered an effective digital learning tool for mathematics topics with a high level of abstraction. Future research is recommended to test the use of Quipper on other mathematics topics or to combine it with technology-based learning approaches to improve the quality and motivation of student learning more broadly.

REFERENCES

- Ahmad, F., & Khan, R. A. (2015). A power comparison of various normality tests. *Pakistan Journal of Statistics and Operation Research*, 11(3), 331-345. <https://doi.org/10.18187/pjsor.v11i3.845>
- Amza, A., Kristiawan, M., & Fitria, H. (2020). Pembelajaran Matematika dengan Media Quipper School. *Jurnal Pendidikan Matematika RAFA*, 6(2), 123-133.
- Arianti, N. M., Wiarta, I. W., & Darsana, I. W. (2019). Pengaruh model pembelajaran problem posing berbantuan media semi konkret terhadap kompetensi pengetahuan matematika. *Jurnal Ilmiah Sekolah Dasar*, 3(4), 385-393.
- Arsyad, A. (2014). *Media Pembelajaran*. Jakarta: RajaGrafindo Persada
- Bali, M. M. E. I., Musthofa, B., Sulistiani, I. R., Dewi, M. S., Baharun, H., & Abdullah, D. (2021, May). The Effect of Quipper School Assisted Blended Learning (QSBL) on Student Motivation and Interest in Learning. In *Journal of Physics: Conference Series* (Vol. 1899, No. 1, p. 012154). IOP Publishing.
- Buntoro, G. A., Ariyadi, D., & Astuti, I. P. (2018). Pemanfaatan e-learning quipper school oleh guru dan siswa untuk optimalisasi pembelajaran di MAN 1 Ponorogo. *Jurnal Pengabdian Kepada Masyarakat (Indonesian Journal of Community Engagement)*, 1(2), 157-167.
- Buntoro, GA, Ariyadi, D., & Astuti, IP (2020). Pemanfaatan E-Learning Quipper School oleh Guru dan Siswa untuk Optimalisasi Pembelajaran di MAN 1 Ponorogo. *Jurnal Pendidikan Islam Indonesia* , 5(1), 15–28.
- Burke, J. R., & Christensen, L. B. (2014). *Educational research: Quantitative, qualitative, and mixed approaches*. Sage publications.
- Clark, R. C., & Mayer, R. E. (2016). *e-Learning and the science of instruction: Proven guidelines for consumers and designers of multimedia learning* (4th ed.). John Wiley & Sons.
- Deci, E. L., & Ryan, R. M., 2000. The "what" and "why" of goal pursuits: Human needs and the self-determination of behavior. *Psychological Inquiry*, 11(4), 227-268).
- Fitria, A., & Suryani, E. (2020). Pengaruh penggunaan media Quipper terhadap hasil belajar siswa pada mata pelajaran matematika di SMP Negeri 1 Kota Padang. *Jurnal Pendidikan Matematika*, 8(2), 50-58.
- Faslan, Z., Suhardiman, S., & Amir, A. (2024). Pengaruh model blended learning melalui aplikasi Quipper School terhadap hasil belajar siswa matematika kelas XI IPA . *Jurnal Review Pendidikan dan Pengajaran* , 7 (4). DOI: 10.31004/jrpp.v7i4.39571
- Gunawan, G., & Asria, L. (2024). Analisis Butir Soal Penilaian Semester Tengah (PTS) Matematika Kelas XI Berdasarkan Teori Klasik. *LOKUS MATEMATIKA* , 4(1). DOI: <https://doi.org/10.31002/mathlocus.v4i1.3177>

- Harini, L. P. I., Widiartha, I. M., & Sanjaya ER, N. A. (2016). Peningkatan Kualitas Pembelajaran Geometri dengan Media Pembelajaran Bebas TIK. *Jurnal Udayana Mengabdikan*, 15(2), 193–199.
- Hidayat, M. L. (2018). The Modification of LMS Quipper school to Improve Senior High School Students' Concept Mastery of Biology Subject, Topic: Human Reproduction Health. *Journal of Educational Science and Technology (EST)*, 4(1), 32–38. <https://doi.org/10.26858/est.v4i1.5215>
- Hidayati, A., & Sari, AA (2024). Pengaruh model pembelajaran blended learning menggunakan Quipper School terhadap hasil belajar matematika peserta didik kelas XI MA Nurul Jadid . *Bilangan: Jurnal Ilmiah Matematika* , 2 (4). DOI: 10.62383/bilangan.v2i4.193
- Hidayat, T., Wahyudin, D., & Rochman, C. (2021). Efektivitas e-learning dalam meningkatkan motivasi dan hasil belajar siswa dalam matematika. *Jurnal Fisika: Seri Konferensi* , 1806(1), 012045. <https://doi.org/10.1088/1742-6596/1806/1/012045>
- Hasni, H., Sida, S. C. N., & Firdaus, F. (2022). Pengaruh aplikasi Quipper School terhadap minat belajar siswa SMK Negeri 8 Sidrap. *Jurnal Kependidikan Media*, 11(2), ... DOI: 10.26618/jkm.v11i2.8975
- Kim, H. Y., 2013. Statistical notes for clinical researchers: Assessing normal distribution (2) using skewness and kurtosis. *Restorative Dentistry & Endodontics*, 38(1), 52–54).
- Karmila, N., & Anggereni, S. (tahun). Pengaruh penggunaan media pembelajaran Quipper School terhadap minat belajar fisika siswa . *Jurnal Pendidikan Fisika* , 5 (2). DOI: 10.24252/jpf.v5i2.3561
- Lestari, I., Suryadi, D., & Sabandar, J. (2021). Peran media pembelajaran dalam meningkatkan pemahaman matematika siswa. *Jurnal Pendidikan Matematika* , 12(2), 155–168. <https://doi.org/10.22342/jme.12.2.2021.155-168>
- Maulana, A. R., & Mutianingsih, N. (2021). The Influence of Quipper School LMS on Learning Results of Arithmetic Sequences and Series in SMA Dr. Soetomo in the Maulana, AR, & Mutianingsih, N. (2021). Pengaruh LMS Quipper School terhadap Hasil Belajar Deret dan Deret Aritmatika di Sekolah Menengah Atas. *Eduma: Pendidikan Matematika, Pembelajaran dan Pengajaran* , 10(2), 121–13
- Mardiana, T. (2024). Efektivitas Teknologi Pendidikan dalam Pembelajaran Matematika. *Jurnal Edutic: Pendidikan dan Teknologi Informasi* , 11(1), 45–55.
- TIME of the Covid-19 Pandemic. *Matematika dan Pembelajaran*, 9(1), 24–3.
- Nzaramyimana, E., Mukandayambaje, E., Iyamuremye, L., Hakizumuremyi, V., & Ukobizaba, F. (2021). Effectiveness of GeoGebra towards students' active learning, performance and interest to learn mathematics. *International Journal of Mathematics and Computer Research*, 9(10), 2423–2430.
- Nurhasanah, S., & Sobandi, A. (2016). Minat belajar sebagai determinan hasil belajar siswa. *Jurnal Pendidikan Manajemen Perkantoran*, 1(1), 128. <https://doi.org/10.17509/jpm.v1i1.3264>
- Nugroho, IR, Hidayat, T., & Raharjo, W. (2023). Tren Riset Mobile Learning di Indonesia: Tinjauan Sistematis. *Jurnal Ilmiah Pendidikan dan Pembelajaran* , 7(2), 89–102
- Qorib, A. F., Susilaningtyas, T., & Al Ayubi, S. (2021). The Application of E-Learning Model with Quipper School Media to Improve Learning Outcomes. *Jurnal Axioma : Jurnal Matematika Dan Pembelajaran*, 6(1), 38–44. <https://doi.org/10.36835/axi.v6i1.816>

- Nugroho, A., & Widodo, SA (2021). Efektivitas Quipper School dalam meningkatkan hasil belajar siswa. *Jurnal Pendidikan Matematika* , 15(2), 89–102. <https://doi.org/10.22342/jpm.15.2.2021.89-102>
- Ramly, RA, & Ilham, I. (2022). Penggunaan Quipper School terhadap hasil belajar siswa SMP Negeri 2 Campalagian . *Jurnal Kependidikan Media* , 11 (2). DOI: 10.26618/jkm.v11i2.
- Rahman, F., Hidayat, A., & Setiawan, B. (2022). Pemanfaatan Quipper School sebagai platform pembelajaran online dalam meningkatkan motivasi siswa. *Jurnal Pendidikan* , 7(1), 33–41. <https://doi.org/10.26740/jp.v7n1.p33-41>
- Sundari, H. D., & Utomo, P. (2020, May). Five e-learning for education in Indonesia. In *International Conference on Online and Blended Learning 2019 (ICOBL 2019)* (pp. 48-52). Atlantis Press.
- Sidabutar, R. (2023). Peningkatan Kualitas Belajar Matematika Siswa SMA Padamu Negeri Melalui Quipper Video. *Jurnal Guru Kita*, 7(3), 577-585.
- Suardana, I. G., Lasmawan, I. W., & Sriartha, I. P. (2020). Pengembangan perangkat pembelajaran blended-scientific learning berbantuan Quipper School untuk meningkatkan aktivitas dan hasil belajar ekonomi peserta didik. *Jurnal Pendidikan IPS Indonesia*, 4(2), ... DOI: 10.23887/pips.v4i2.3419
- Sugiyono. (2019). *Metode Penelitian Pendidikan: Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabeta.
- Syahputra, M., & Wulandari, F. (2022). Pengaruh Implementasi Blended Learning terhadap Hasil Belajar Matematika Siswa SMA. *Jurnal Pendidikan Matematika Raflesia* , 7(1), 33–42.
- Sari, NP, Mulyono, B., & Anwar, K. (2023). Pemanfaatan Quipper School dalam meningkatkan motivasi dan hasil belajar siswa. *Jurnal Pendidikan Matematika* , 17(1), 45–56. <https://doi.org/10.22342/jpm.17.1.2023.45-56>
- Toifur, I., & Setyowati, E. (2022). Analisis Butir Soal Simulasi Ujian Sekolah Mata Pelajaran Matematika. *LOKUS MATEMATIKA: Jurnal Riset dan Inovasi Pendidikan Matematika* , 3(1), 27–38. DOI: <https://doi.org/10.31002/mathlocus.v3i1.2341>
- Usman, U., Wiwid, W., & Sulisti, H. (2022). Analisis Butir Soal Ulangan Matematika Semester Genap Kelas XI SMA. *Al-'Adad: Jurnal Tadris Matematika* , 1(2), 34–43. DOI: <https://doi.org/10.24260/add.v1i2.1133>
- Pallant, J., 2020. *SPSS survival manual: A step by step guide to data analysis using IBM SPSS* (7th ed.). Routledge.
- Pratistha, IGNY, Suweken, G., & Hartawan, IGNY (2023). Efektivitas media pembelajaran e-learning berbasis Quipper School terhadap pemahaman konsep matematika siswa kelas X. *Jurnal Pendidikan Matematika Undiksha* , 8 (2). DOI: 10.23887/jppm
- Pratama, RA, & Kuswandi, D. (2022). Dampak platform pembelajaran digital terhadap keterlibatan dan prestasi siswa. *Jurnal Instruksi Internasional* , 15(2), 123–138. <https://doi.org/10.29333/iji.2022.1527a>
- Putri, NA, & Rahmawati, I. (2021). Integrasi TIK dalam pembelajaran untuk meningkatkan pembelajaran yang berpusat pada siswa. *Jurnal Teknologi Pendidikan* , 23(1), 45–56. <https://doi.org/10.21009/jtp.v23i1.2021.v8i2.13087>
- Wulandari, R., Fitriani, N., & Amalia, S. (2022). Media pembelajaran dan motivasi siswa dalam pembelajaran matematika. *Jurnal Pendidikan Matematika Indonesia* , 7(2), 101–110. <https://doi.org/10.26737/jpmi.v7i2.2022>

Zhang, L., Wang, Y., & Chen, X. (2022). Integrasi teknologi digital dalam pendidikan: Sebuah studi meta-analisis. *Pendidikan dan Teknologi Informasi* , 27(5), 6789–6805. <https://doi.org/10.1007/s10639-022-10945-3>