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The Effectiveness of Using Android-Based Mobile Chemistry Learning Media to Increase Students' Interest in Learning Chemistry

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Abstract

Chemistry is a subject that students tend to dislike. Student learning outcomes are still low due to the lack of student interest in learning which is caused by the lack of media used for learning both at home and at school. To overcome this deficiency, interesting learning media is needed as a complement to learning resources that students can use anywhere and anytime, one of which is Android-based mobile learning media. The aim of this research is to determine the effectiveness of using Android-based mobile learning chemistry learning media to increase students' interest in learning chemistry on the topic of buffer solutions. This type of research is Quasi Experimental Design in the form of Nonequivalent Control Group Design. The subjects of this research were students of class XI MIPA 1 and XI MIPA 2 at SMAN 3 Mataram, totaling 58 students. Data collection techniques include interviews and questionnaires. The data analysis used was N-gain score analysis as well as normality, homogeneity and t-tests. The research results showed that the N-gain for the experimental class was 0.618 with medium criteria (effective) while the control class obtained 0.299 with low criteria (not effective). Normality and homogeneity tests showed that the N-gain data was normally and homogeneously distributed. The results of the t-test at the 5% significance level were obtained a significance value showing 0,000 < 0,05. These results indicate that the use of mobile learning media is effective in increasing students' interest in learning chemistry on the topic of buffer solutions.

Keywords: Android-based mobile chemistry learning media; Chemistry; Effectiveness; Students' interest

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INTRODUCTION

Chemistry is a part of natural science (science) which is often considered an abstract subject and tends to be disliked by students. The reason why chemistry lessons are not liked is because the chemistry material itself is difficult for students to understand (Junaidi et al, 2021). Students experience difficulties in learning chemistry due to students' lack of interest and attention to the learning process (Marlina, 2023). Meanwhile, according to Prayunisa (2022) and Ramlawati et al., (2023), the factor that causes students to have difficulty learning chemistry is that teachers do not use learning media and do not implement innovative learning that requires students to be active. Nita et al (2022) stated that the media that most teachers use in teaching in schools is only one-way, for example LKS. Learning resources that are less interesting make students bored and have less interest in chemistry lessons, which will have an impact on a passive class atmosphere.

The lack of student learning resources causes the learning process to be less effective because most of the chemistry material requires the help of appropriate media to increase learning interest and make learning more interesting (Dewi & Sumarni, 2020). The use of

learning media based on Information and Communication Technology (ICT) has been proven to increase interest in learning and critical thinking skills in the field of chemistry (Hadisaputra et al, 2019; Muntari et al, 2023). Therefore, providing varied and ICT-based learning resources is very important in chemistry learning. By utilizing technology, students can more easily understand abstract concepts and increase their learning motivation (Ghavifekr & Rosdy, 2015; Derkach, 2022).

Buffer solutions are one of the subjects covered in SMA and MA chemistry classes. Buffer solution material contains many concepts, explanations of calculations, practice questions and is closely related to the benefits of buffer solutions in the bodies of living creatures (Repi, 2019). In addition, buffer solutions involve abstract and difficult to visualize concepts, such as chemical equilibrium and ionization reactions (Fitriza et al., 2021). The reality in many schools shows that students still have difficulty understanding buffer solution material. This can be caused by a lack of emphasis on basic concepts that encourage buffer solution material as well as a lack of strategies and learning media used, thereby reducing student interest and attention which results in students having difficulty understanding concepts when following the learning process (Yustiqvar et al, 2019; Sariati et al, 2020). Meanwhile, according to Iswara et al (2020), students have difficulty understanding buffer solution material because the media used by teachers in delivering the material cannot visualize the concept of buffer solutions properly.

A similar problem was found at SMAN 3 Mataram. Based on the results of an interview with a chemistry teacher, students consider chemistry to be a difficult subject because chemistry is a complex subject, chemistry is related to other scientific disciplines such as mathematics, biology and physics so that to study chemistry students need to understand this field of science. Difficulties in studying chemistry material cause students to lack interest in learning. The chemistry teacher at SMAN 3 Mataram said that only 25% of students were serious about following the learning process. Students are less interested in buffer solution material because the material contains many concepts and calculations which make students feel that the material is difficult to learn. Students are more enthusiastic in participating in the learning process if the teacher provides media, while students lack media for learning, both at school and at home. At SMAN 3 Mataram there is no learning media that utilizes smartphones. Media in the form of Android applications can help students in learning activities, especially chemistry learning.

Students need to be given media for learning so they can learn the material, the textbooks used as learning resources do not meet students' learning needs, so other sources are needed as support (Daroini & Alfiana, 2022). The use of media is in line with the current rapid development of science and technology, which requires education to involve the use of technology as a form of learning innovation and improving the quality of education (Salsabila et al, 2021). An educator is required to carry out reforms by utilizing technology in learning (Munawarah et al, 2021). One alternative for utilizing technology is by creating learning media that utilizes cell phone technology, which is called mobile learning (Ardiansyah & Nana, 2020). Mobile learning gives students the flexibility to study content they haven't mastered at any time or place, complementing traditional classroom instruction. This may offer students an alternative educational experience (Ardiansyah & Nana, 2020). This kind of learning media can transcend temporal and spatial constraints, effectively enhancing the subject matter and raising students' academic achievement (Dewi & Sumarni, 2020).

Previous research, such as those conducted by Ramdani et al (2020), shows that students' interest in learning can be increased by applying online learning media that can attract students' attention. Other research conducted by Restyayuklita et al (2023) stated that Android-based mobile learning media is effectively used in the learning process and can increase students' understanding and interest in learning chemistry. Thus, teachers are required to update their

knowledge and technological literacy so they can use innovative and creative media to increase the effectiveness of learning in the classroom (Budiana, 2021).

The Android-based mobile learning materials that were previously generated were the ones whose efficacy was examined in this study. Expert testing of Android-based mobile learning resources has resulted in a score of 89% for reliability and 0.85 for very validity. Additionally, the Android-based mobile learning materials have undergone field testing and have received quite favorable evaluations, with class XI MIPA 2 SMAN 3 Mataram pupils and teachers rating them at 90% and 87%, respectively, based on extremely practical criteria (Restyayulita et al., 2023). Based on the background information and other studies mentioned above, this research focuses on finding out the effectiveness of using Android-based mobile learning chemistry media to increase students' interest in learning chemistry on the topic of buffer solutions.

METHOD

Research Type

This research employs a quantitative approach with a quasi-experimental design, specifically the Nonequivalent Control Group Design. In this design, the subjects were not randomly assigned to groups; instead, existing classes were selected as the experimental group (XI MIPA 2) and the control group (XI MIPA 1) at SMAN 3 Mataram. The experimental group received treatment in the form of Android-based mobile learning chemistry media on buffer solution topics, while the control group followed conventional learning without the media. Both groups were given a pretest and posttest to measure students' interest in learning chemistry. The pretest was administered before the treatment to establish baseline equivalence, and the posttest was given after the treatment to assess changes. This design was chosen to evaluate the effectiveness of the mobile learning media in a natural classroom setting without disrupting regular school routines.

This research uses a quantitative approach with a Quasi Experimental Design type of research in the form of Nonequivalent Control Group Design (Creswell & Creswell, 2017; Fraenkel & Wallen, 2012). In this design, subjects are randomly assigned to classes, either for the experimental class or the control class. The research design can be seen in Figure 1.

E	O_1	X	O_2
K	O_3	–	O_4

Figure 1. Research design

Description:

O_1 = pre-test experimental class
O_2 = post-test experimental class
O_3 = pre-test control class
O_4 = post-test control class
X = treatment with android-based mobile learning media in experimental class
– = regular/conventional treatment

Participant, Sample, or Subject

The subjects of this study were students of class XI MIPA 1 and XI MIPA 2 at SMAN 3 Mataram, totaling 58 students. The sampling technique used was purposive sampling, where subjects were selected based on specific considerations tailored to the research objectives. Class XI MIPA 2 was assigned as the experimental class, consisting of 29 students who received treatment using Android-based mobile learning chemistry media on buffer solution topics. Class XI MIPA 1 served as the control class, also consisting of 29 students, who followed conventional learning without the mobile learning media. The selection of these two classes was based on the recommendation of the chemistry teacher, considering that both

classes had similar academic abilities and were taught by the same teacher with the same curriculum, thereby minimizing potential confounding variables in the study.

The technique for selecting research subjects is purposive sampling technique (Robinson, 2024). These subjects were selected based on considerations tailored to the research objectives. This research used control (XI MIPA 1) and experimental (XI MIPA 2) classes at SMAN 3 Mataram. The effectiveness test was carried out to measure the effectiveness of using Android-based mobile learning media in increasing students' interest in learning chemistry on the topic of buffer solutions.

Instrument and Procedure

The instruments used in this study consisted of two types: interview sheets and questionnaires. The interview sheet was employed during the preliminary stage to gather initial data and information regarding the learning process, students' difficulties in understanding buffer solution material, and the availability of learning media at SMAN 3 Mataram. The questionnaire sheet was used as the main instrument to measure students' interest in learning chemistry. The interest questionnaire was structured based on indicators of learning interest, including feelings of enjoyment, attention, engagement, and willingness to learn the material. The questionnaire was administered twice to each class: as a pretest (before treatment) and as a posttest (after treatment). Before use, the questionnaire was validated by experts to ensure its content validity and reliability.

Data Analysis

Data analysis in this study was conducted quantitatively to determine the effectiveness of using Android-based mobile learning chemistry media on students' interest in learning chemistry on buffer solution topics. The analysis procedures included several statistical tests. First, the N-gain (normalized gain) score analysis was performed to calculate the increase in students' learning interest from pretest to posttest in both the experimental and control classes. The N-gain formula used was the difference between the posttest and pretest scores divided by the maximum possible score minus the pretest score. The obtained N-gain values were then interpreted using the following criteria: $g > 0.7$ (high/effective), $0.3 \leq g \leq 0.7$ (medium/effective), and $g < 0.3$ (low/ineffective). Second, a normality test was conducted using the Shapiro-Wilk test to determine whether the N-gain data from both classes were normally distributed.

This test was performed using SPSS version 25, with a significance level set at $\alpha = 0.05$. Data were considered normally distributed if the p-value (Sig.) was greater than 0.05. Third, a homogeneity test was carried out using Levene's test (F-test) to assess whether the variances of the N-gain data from the experimental and control classes were equal. A significance value greater than 0.05 indicated homogeneous variances. Fourth, after the assumptions of normality and homogeneity were met, hypothesis testing was performed using an independent sample t-test (Pooled Variance t-test) to compare the mean N-gain scores between the experimental and control classes. The t-test was conducted at a 5% significance level ($\alpha = 0.05$). The null hypothesis (Ho) stated that there was no significant difference in the increase of learning interest between students who used Android-based mobile learning media and those who did not. Conversely, the alternative hypothesis (Ha) stated that there was a significant difference. All statistical analyses were performed using IBM SPSS Statistics version 25 to ensure accuracy and reliability of the results.

RESULTS AND DISCUSSION

N-Gain Test Result

The effectiveness test to analyzes the effectiveness of using Android-based mobile learning media in increasing students' interest in learning chemistry on the topic of buffer solutions. The mobile learning media that was employed have been deemed legitimate and useful (Restyayulita et al., 2023). Students' learning interests can be used to measure how

effective Android-based mobile learning media are. A number of tests, such as normally distributed, homogeneous, and t-tested ones, must be conducted in order to assess the increased learning interest. Pretests and posttests were used to gather information on the learning interests of students in the experimental and control classes. Standard gain is used to analyze students' learning interests. Table 1 displays the results of applying conventional gain to compute the pretest and posttest scores for student interest in learning.

Table 1. Standard Gain Results

N-gain	Experimental	Control
Average	0,618	0,299
Percentage	61,8%	29,9%
Criteria	Medium (Effective)	Low (Ineffective)

Based on Table 1, it shows that the N-gain value of the experimental class which was given mobile learning media was higher, namely 0.618 with a percentage of 61.8% in the medium (effective) criteria compared to the control class which was not given mobile learning media which was 0.299 with a percentage of 29.9% in low criteria (ineffective). These results show that Android-based mobile learning media is effective in increasing students' interest in learning chemistry on the topic of buffer solutions. Mobile learning, or m-learning, leverages the ubiquity of smartphones to provide flexible and interactive educational content, which appears to align well with current student learning preferences for subjects like chemistry (Rifaan et al, 2022). This approach can make abstract chemical concepts more accessible and relevant through interactive elements and visualizations.

Normality Test

The data normality test is used to determine whether the data obtained is normal or not, which is a requirement for continuing with statistical analysis. This test used the Shapiro-Wilk test assisted by IBM SPSS Statistics 25. The results of the Shapiro-Wilk test used in the normality analysis are shown in Table 2.

Table 2. Tests of Normality

Parameter	Class	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
N-Gain	Experimental	.110	29	.200*	.932	29	.062
	Control	.140	29	.151	.949	29	.167

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on Table 2 above, the Shapiro-Wilk test results for the N-gain data on students' chemistry learning interest were above the 0.05 significance level (>0.05), indicating that the data for the experimental and control groups were normally distributed. This statement is consistent with common statistical practices for interpreting normality test results (Aisyah et al, 2025; Enterprise, 2018; Sari et al, 2017).

Homogeneity Test

The homogeneity test was applied to the N-gain data from the experimental and control classes. The homogeneity test is crucial in any data processing because if homogeneity is not met, the variance obtained will be inconsistent (Sari et al, 2017; Zhou et al., 2023). Homogeneity analysis using Fisher exact Levene's statistical test by comparing the variance of standardized gain data from each class, as shown in Table 3.

Table 3. Test of Homogeneity of Variances

Parameter		Levene Statistic	df1	df2	Sig.
N-Gain	Based on Mean	.107	1	56	.745
	Based on Median	.094	1	56	.760

Parameter		Levene Statistic	df1	df2	Sig.
	Based on Median and with adjusted df	.094	1	54.664	.760
	Based on trimmed mean	.080	1	56	.778

Based on Table 3, containing the results of the N-gain data on students' chemistry learning interest homogeneity tests for the experimental and control classes, the test results for both classes obtained N-gain significance value of 0,745. Thus, it can be concluded that the N-gain data on students' chemistry learning interest for both classes have homogeneous variance. Hasil analisis homogenitas data ini selaras dengan temuan yang serupa oleh Aisyah et al (2025).

Hypothesis Testing Results

After conducting normality and homogeneity tests, the data were found to be normally distributed and homogeneous. The next step was to test the hypothesis using the t-test. A t-test was used to determine the effect of using Android-based mobile learning media on students' chemistry learning interest on the material of buffer solutions. The test used was an Independent sample t-test assisted by IBM SPSS 25. The data from this study can be seen in Table 4.

Table 4. Independent Samples Test

Parameter		t-test for Equality of Means				
		t	df	Sig. (2-tailed)	Mean Diff.	Std. Err. Diff.
N-Gain	Equal variances assumed	13.250	56	.000	.31897	.02407
	Equal variances not assumed	13.250	55.442	.000	.31897	.02407

Based on the results of the Independent sample t-test analysis in Table 4, it is known that the significance value is 0,000. A significance value showing 0,000 < 0,05, then Ho was rejected. This means that there was a significane effect of using Android-based mobile learning media on students' chemistry learning interest on the material of buffer solutions.

The results of the analysis prove that Android-based mobile learning chemistry learning media is effectively used to increase students' chemistry learning interest on the material of buffer solutions. The results obtained from this study are in line with the opinion of Zulkifli et al. (2022), that the use of Android-based learning media will make learning more effective and efficient. Similar findings were reported by Rifaan et al. (2022), who found that the use of Android-based media in chemistry learning can improve student motivation, cognitive learning outcomes, problem-solving skills, critical thinking, scientific literacy, and student activity. Another finding was reported by Sari & Iswendi (2023), that the use of Android-based chemical ludo game media for material reduction and oxidation reactions was effective in increasing learning outcomes significantly in the cognitive domain of high school students.

Therefore, Android-based mobile learning media is crucial in the increasingly technologically integrated world of education. This is because mobile learning media is more efficient in conveying information students acquire during the learning process, thus optimizing learning. (Setyaningsih, 2020). The implications of this study support the use of IT-based learning media, especially mobile learning, as an effective alternative in chemistry learning (Cahyana et al., 2019). Schools and teachers need to support the development and implementation of mobile learning as part of a broader learning strategy (Ghavifekr & Rosdy, 2015; Wiliyanti et al., 2023).

Android-based mobile learning media is present as an innovative learning source that is more interactive and interesting. This media contains material from various sources equipped with pictures, videos and illustrations that can help students understand the material. Examples of questions listed in the media are also accompanied by solution steps that make it easier for

students to understand the material, especially calculation questions. Apart from that, there are also quizzes which are equipped with answer keys, discussions and scores obtained by students so that students know the extent of their ability to master the material. Android-based mobile learning media also allows students to learn independently anywhere and anytime (Pangalo, 2020). This provides flexibility in the learning process and allows students to access learning materials outside the classroom. Thus, it can be concluded that the use of Android mobile learning media is effective in increasing students' chemistry learning interest on the material of buffer solutions.

CONCLUSION

The use of Android-based mobile chemistry learning media was effective in increasing students' interest in learning chemistry, particularly on the topic of buffer solutions. This finding is supported by the N-gain score of the experimental class, which reached 0.618 or 61.8% and was categorized as medium or effective, while the control class obtained an N-gain score of 0.299 or 29.9%, which was categorized as low or ineffective. These results indicate that students who learned using Android-based mobile learning media experienced a higher increase in learning interest than students who received conventional instruction.

The statistical analysis also strengthened this finding. The N-gain data were normally distributed and homogeneous, allowing the hypothesis test to be conducted using an independent sample t-test. The significance value of 0.000, which was lower than 0.05, showed that there was a significant difference between the experimental and control classes. Therefore, Android-based mobile chemistry learning media can be considered an effective learning resource because it provides interactive materials, visual support, practice questions, quizzes, and flexible access that help students learn buffer solution concepts more independently and with greater interest.

RECOMMENDATION

Chemistry teachers are encouraged to use Android-based mobile learning media as a complementary learning resource, especially for abstract and calculation-based topics such as buffer solutions. However, its use should not replace teacher guidance entirely, because students still need conceptual explanation, discussion, and feedback during the learning process. Schools should support the implementation of this media by ensuring adequate access to smartphones, internet facilities, and teacher readiness in integrating mobile learning into classroom activities. Further research is also recommended with broader samples, different schools, and other chemistry topics to examine whether the same level of effectiveness can be achieved in different learning contexts.

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AUTHOR CONTRIBUTIONS STATEMENT

Name of Author	C	M	So	Va	Fo	I	R	D	O	E	Vi	Su	P	Fu
Muntari	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓		✓	
Baiq Fara Dwirani Sofia	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
I Nyoman Loka	✓	✓		✓			✓	✓		✓		✓	✓	✓
Restyayulita	✓	✓		✓			✓	✓		✓		✓	✓	✓
Ramlawati					✓		✓			✓		✓		✓

CONFLICT OF INTEREST STATEMENT
Authors state no conflict of interest.

INFORMED CONSENT
The authors confirm that informed consent was obtained from all adult participants in this study, including consent to participate and consent for publication.

ETHICAL APPROVAL
The researchers meticulously followed ethical protocols throughout the research process, adhering to the principles outlined in the Declaration of Helsinki.

REFERENCES

Aisyah, S. N., Sihaloho, M., Tangio, J. S., Lukum, A., Munandar, A., Thayban, & Kurniawati, E. (2025). The effect of using the PBL (problem-based learning) learning model assisted by ChatGPT on student learning outcomes in the reaction rate material. *Jambura Journal of Educational Chemistry, 7*(2), 94–102. https://doi.org/10.37905/jjec.v7i2.33888

Ardiansyah, A. A., & Nana. (2020). Peran mobile learning sebagai inovasi dalam meningkatkan hasil belajar siswa pada pembelajaran di sekolah. *Indonesian Journal of Educational Research and Review, 3*(1), 47–56. https://doi.org/10.23887/ijerr.v3i1.24245

Budiana, I. (2021). Menjadi guru profesional di era digital. *Journal of Islamic Education: Basic and Applied Research, 2*(2), 144–161. https://doi.org/10.33853/jiebar.v2i2.234.g139

Cahyana, U., Yusmaniar, Y., & Zahari, P. A. (2019). Development of mobile learning on acid and base to improve student performance. *Journal of Physics: Conference Series, 1402*(5), Article 055062.

Creswell, J. W., & Creswell, J. D. (2017). *Research design: Qualitative, quantitative, and mixed methods approaches*. Sage.

Daroini, A. F., & Alfiana, H. (2022). Kesulitan pembelajaran matematika di masa pandemi: Kebutuhan akan modul untuk belajar mandiri. *Jurnal Nasional Pendidikan Matematika, 6*(1), 1–19. http://dx.doi.org/10.33603/jnpm.v6i1.4604

Derkach, T. M. (2022). ICT-based assessment of cognitive load in chemistry learning. *Journal of Physics: Conference Series, 2288*(1), Article 012016. https://doi.org/10.1088/1742-6596/2288/1/012016

Dewi, B. E. K., & Sumarni, W. (2020). Efektivitas penggunaan media e-learning berbasis website terhadap hasil belajar kognitif peserta didik. *Journal of Chemistry in Education, 9*(2), 1–6. https://journal.unnes.ac.id/sju/index.php/chemined/article/view/40008

Enterprise, J. (2018). *Lancar menggunakan SPSS untuk pemula*. PT Elex Media Komputindo.

Fitriza, Z., Aini, F. Q., & Handayani, P. (2021). Cross-sectional approach for diagnosing student's learning progression in relation to pre-requisite knowledge of buffer solution. *Journal of Physics: Conference Series, 1788*(1), Article 012025. https://doi.org/10.1088/1742-6596/1788/1/012025

Fraenkel, J. R., & Wallen, N. E. (2012). *How to design and evaluate research in education*. McGraw-Hill.

Ghavifekr, S., & Rosdy, W. A. W. (2015). Teaching and learning with technology: Effectiveness of ICT integration in schools. *International Journal of Research in Education and Science, 1*(2), 175–191.

Hadisaputra, S., Gunawan, G., & Yustiqvar, M. (2019). Effects of green chemistry based interactive multimedia on the students' learning outcomes and scientific literacy. *Journal of Advanced Research in Dynamical and Control Systems, 11*(7), 664–674. http://eprints.unram.ac.id/24638/

Iswara, G. P. S., Kuswandi, D., & Husna, A. (2020). Pengembangan multimedia interaktif dilengkapi dengan simulasi untuk memvisualisasikan reaksi kimia pada materi larutan

penyangga SMA kelas XI. *Jurnal Inovasi Teknologi Pembelajaran, 6*(2), 58–68. https://doi.org/10.17977/um031v6i22020p058

Junaidi, E., Hakim, A., Hadisaputra, S., Anwar, Y. A. S., & Sofia, B. F. D. (2021). Meningkatkan motivasi belajar kimia melalui implementasi konsep kimia dalam bentuk permainan sederhana di SMAN 4 Praya. *Jurnal Pengabdian Masyarakat Sains Indonesia, 3*(2), 240–245. https://doi.org/10.29303/jpmsi.v3i2.134

Marlina, L. (2023). Analisis kesulitan belajar kimia pada materi larutan penyangga di SMA Negeri 1 Kapuas Murung Kabupaten Kapuas. *Jurnal Ilmu-Ilmu Sosial dan Pendidikan, 9*(2), 106–115. https://ojs.uvayabjm.ac.id/index.php/institute/article/view/651

Munawarah, Z., Burhanuddin, Sofia, B. F. D., & Hakim, A. (2021). Pengembangan multimedia interaktif berbantuan aplikasi Articulate Storyline dalam pembelajaran kimia kelas XI MIPA SMAN 1 Utan. *Jurnal Ilmiah Profesi Pendidikan, 6*(4), 768–775. https://doi.org/10.29303/jipp.v6i4.295

Muntari, Purwoko, A. A., Siahaan, J., Haris, M., & Supriadi. (2023). Optimization of blended learning using ICT-based media for improving learning interest, critical thinking ability, and chemistry learning outcomes. *AIP Conference Proceedings, 2619*(1), Article 080009. https://doi.org/10.1063/5.0130559

Nita, P. N. T., Fauziah, A. M., Maharani, A. C., Hayati, E. M., Hafid, R. N. F., & Mulyanti, S. (2022). Trend pembelajaran kimia pada materi elektrokimia: Study literatur tahun 2018–2022 [Conference presentation]. *Seminar Nasional OPPSI, Sains dan Teknologi*, Semarang, Indonesia.

Pangalo, E. G. (2020). Pembelajaran mobile learning untuk siswa SMA. *Jurnal Teknologi Pendidikan: Jurnal Penelitian dan Pengembangan Pembelajaran, 5*(1), 38–56.

Prayunisa, F. (2022). Analisa kesulitan siswa kelas XI dalam pembelajaran kimia di SMAN 1 Masbagik. *Journal of Classroom Action Research, 4*(3), 147–151. https://doi.org/10.29303/jcar.v4i3.2095

Ramdani, A., Jufri, A. W., & Jamaluddin. (2020). Pengembangan media pembelajaran berbasis Android pada masa pandemi Covid-19 untuk meningkatkan literasi sains peserta didik. *Jurnal Kependidikan: Jurnal Hasil Penelitian dan Kajian Kepustakaan di Bidang Pendidikan, Pengajaran dan Pembelajaran, 6*(3), 433–440. https://doi.org/10.33394/jk.v6i3.2924

Ramlawati, R., Attahira, N., & Samputri, S. (2023). Pengaruh media audio visual terhadap hasil belajar peserta didik kelas VII SMP YPS Singkole Sorowako. *Jurnal IPA Terpadu, 7*(1), 118–127. https://doi.org/10.35580/ipaterpadu.v7i1.22240

Repi, E. V., Suriani, N. W., & Waworuntu, F. (2019). Pengaruh model pembelajaran Learning Cycle 7E pada materi larutan penyangga terhadap hasil belajar siswa kelas XI SMAN 2 Langowan. *Jurnal Oxygenius, 1*(2), 99–106. https://indochembull.com/index.php/oxygenius/article/download/118/68/

Restyayulita, Muntari, Sofia, B. F. D., & Loka, I. N. (2023). Pengembangan media pembelajaran kimia mobile learning berbasis Android pada materi pokok larutan penyangga. *Jurnal Ilmiah Profesi Pendidikan, 8*(4), 1981–1989. https://doi.org/10.29303/jipp.v8i4.1441

Rifaan, N., Prasetya, A. T., Susilogati, S., Sumarni, W., & Mahatmanthi, W. (2022). Student responses and effectiveness of Android media as chemistry learning media during the Covid-19 pandemic. *Jurnal Pendidikan Kimia Indonesia, 6*(2), 154–161.

Robinson, R. S. (2024). Purposive sampling. In *Encyclopedia of quality of life and well-being research* (pp. 5645–5647). Springer International Publishing.

Salsabila, U. H., Saputri, R. M., Nursusanti, D. N., Setianto, E., & Sabhara, H. (2021). Kedudukan teknologi pendidikan di era globalisasi. *Jurnal Pendidikan dan Ilmu Sosial, 3*(3), 402–416.

Sari, A. Q., Sukestiyarno, Y. L., & Agoestanto, A. (2017). Batasan prasyarat uji normalitas dan uji homogenitas pada model regresi linear. *Unnes Journal of Mathematics, 6*(2), 168–177. https://doi.org/10.15294/ujm.v6i2.11887

Sari, I., & Iswendi, I. (2023). The effectiveness of using Android based chemical ludo game media reduction and oxidation reaction material on students learning outcomes. *Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA, 11*(2), 267–280. https://doi.org/10.33394/j-ps.v11i2.7474

Sariati, N. K., Suardana, I. N., & Wiranti, N. M. (2020). Analisis kesulitan belajar kimia siswa kelas XI pada materi larutan penyangga. *Jurnal Ilmiah Pendidikan dan Pembelajaran, 4*(1), 86–97. https://doi.org/10.23887/jipp.v4i1.15469

Setyaningsih, S., Rusijono, & Wahyudi, A. (2020). Pengaruh penggunaan media pembelajaran interaktif berbasis Articulate Storyline terhadap motivasi belajar dan hasil belajar siswa pada materi kerajaan Hindu Budha di Indonesia. *Jurnal Pendidikan dan Ilmu Pengetahuan, 20*(2), 144–156. https://doi.org/10.30651/didaktis.v20i2.4772

Wiliyanti, V., Latifah, S., Syarlisjiswan, M. R., & Kurnia, A. E. (2023). Pengembangan media pembelajaran fisika berbasis mobile learning berbantuan Smart Apps Creator pada materi fluida dinamis. *Seminar Nasional Pembelajaran Matematika, Sains dan Teknologi, 3*(1), 129–137.

Yustiqvar, M., Hadisaputra, S., & Gunawan, G. (2019). Analisis penguasaan konsep siswa yang belajar kimia menggunakan multimedia interaktif berbasis green chemistry. *Jurnal Pijar Mipa, 14*(3), 135–140. https://doi.org/10.29303/jpm.v14i2.1299

Zhou, Y., Zhu, Y., & Wong, W. K. (2023). Statistical tests for homogeneity of variance for clinical trials and recommendations. *Contemporary Clinical Trials Communications, 33*, Article 101119. https://doi.org/10.1016/j.conctc.2023.101119

Zulkifli, Hidayat, F., Hajar, A., Nurpratiwi, S., Afnanda, M., Handayani, R., Yahya, A. M., Firmansyah, Hariyadi, Hairidah, & Fayola, A. D. (2022). *Media pembelajaran pendidikan agama Islam*. PT Global Eksekutif Teknologi.