International Journal of Multicultural and Multireligious Understanding

http://ijmmu.com
editor@ijmmu.com
ISSN 2364-5369
Volume 12, Issue 11
November, 2025
Pages: 71-80

The Development of Augmented Reality-Based E-Modules on Basic Thermochemistry Material to Increase Student Interest in Learning Chemistry

Siti Nurul Yaqutu Burhani; Jaslin Ikhsan

Chemistry Education, Yogyakarta State University, Indonesia

http://dx.doi.org/10.18415/ijmmu.v12i11.7133

Abstract

This study aims to develop an augmented reality-based e-module on basic thermochemistry material to increase students' interest in learning chemistry. The research method used is Research and Development (R&D) using the Four-D Model (4D Model). The subjects in this study were 11th-grade students at a high school in East Lombok. These research and development results are e-modules developed based on Augmented Reality, which have characteristics in the form of e-modules in APK files that provide 3D representations using markerless technology and activity content presented in the e-modules related to everyday life. The developed e-module was also deemed feasible by experts, teachers, and students regarding readability. The trial results showed that the e-module increased learning interest by 0.3, which is moderate. These results indicate that the developed e-module is effective in increasing students' interest in learning.

Keywords: *Augmented Reality; E-Module; Interest in Learning*

Introduction

The quality of student learning is influenced by their level of interest in learning. Based on the results of research by Aulia et al. (2023), it is known that there is a positive relationship between interest in learning and student learning outcomes. This is because students with a high interest in learning tend to be active in learning; they will be more focused and enthusiastic in asking questions, analyzing, and exploring information more deeply. These activities support students in understanding the material better and facilitate the achievement of learning objectives (Sinaga et al., 2024). However, in reality, the quality of student learning, especially in chemistry, remains a significant problem that needs to be solved. One factor influencing this is students' perception that chemistry is one of the most difficult and uninteresting subjects. This can be seen from students' low chemistry learning outcomes (Astafani et al., 2024). The factors causing difficulties in learning chemistry are divided into internal and external factors. Internal factors are within the self, including low interest in learning and low motivation to learn. Meanwhile, external factors originate from the environment, including the application of teaching models and methods by teachers, the influence of peers, and ineffective learning time (Priliyanti et al., 2021). Therefore, it is crucial to increase motivation and interest in learning in order to improve the quality and results of student learning. Afrilia & Piawi (2024) state that motivation is crucial in shaping students' interest in learning. This aligns with a study by Saragih et al. (2024), which also states that students with high motivational factors tend to perform all their learning tasks well. This motivation comes from within themselves because of their interest and personal needs, which effective increases their interest in learning.

As one of the fields of science that follows the principles of 21st-century learning, through the independent curriculum, chemistry learning is designed to be student-centered so that students can play an active role in discovering and constructing their knowledge. Building understanding and knowledge in chemistry learning includes three levels of representation: macroscopic, submicroscopic, and symbolic. According to the results of research by Herawati et al. (2013), chemistry learning currently only focuses on two levels of representation, namely macroscopic and symbolic, so that students tend to memorize abstract concepts. This often occurs when studying chemistry concepts, resulting in students being unable to understand the processes at the particulate level in chemical reactions. This causes chemistry to be considered a complex subject to understand and often leads to misconceptions in learning chemistry (Rokhim et al., 2023).

Advances in technology and information have significantly impacted on innovation in education, from teaching materials and evaluation to learning media (Tanjung, 2023). One effective method of accommodating the need for teaching materials that support submicroscopic aspects is to present three-dimensional visualizations with the help of Augmented Reality (AR) technology (Lima et al., 2022). AR media is a form of educational innovation that utilizes technology and information to improve spatial understanding by enabling the visualization and manipulation of complex chemical structures in 3D form. The use of AR has previously been widely described in molecular structure visualization applications (Eriksen et al., 2020). Based on research conducted by Whatoni & Sutrisno (2022), the chemical bonding learning module developed with Augmented Reality support is very suitable for use in chemistry learning, especially in chemical bonding material. The results differences in students’ interest and learning motivation, both classically and individually. The chemical bonding learning module with Augmented Reality support effectively contributes 18.8% to students’ interest and learning motivation simultaneously, 17.2% to students’ learning interest, and 9.7% to learning motivation. Another study conducted by Rofi'i et al. (2023) states that using AR media in learning can create a more interactive, engaging, and memorable learning experience for students. This proves that using Augmented Reality in learning positively affects on students' motivation, interest in learning, and literacy skills.

Based on the above explanation, using Augmented Reality as a learning tool is very suitable for students. Augmented reality technology has been widely used, especially in medicine, gaming, and image processing, but it is still rarely used in education (Muchlisin, 2023). One of the reasons for this is that some schools are unfamiliar with using confusing technology in learning (Mufidah et al., 2024), so many teachers still experience obstacles in utilizing technological developments to develop teaching materials and learning media that can facilitate student learning (Dari & Sudatha, 2022). Based on observations and interviews conducted at a high school in East Lombok, it was found that the use of technology has been attempted in schools, but its implementation has not been optimal. Learning is still oriented towards textbooks or worksheets in the form of short questions given by teachers and occasionally accompanied by YouTube links as additional learning resources. This is also one of the consequences of students' lack of interest and motivation to learn.

However, with the development of the Society 5.0 era, teachers and students must become familiar with and accustomed to the latest technological developments. In this era, teachers are expected to be able to create teaching materials that facilitate optimal learning for students. One way to improve the quality of learning is to provide quality teaching materials, in this case, as learning modules (Maharcika et al., 2021). With the development of existing technology, learning modules that were originally in printed form have begun to be converted into electronic modules or e-modules as an innovation in the development of teaching materials. Electronic modules contain learning materials systematically designed within a specific time frame and displayed using electronic devices, such as computers and smartphones (Asmianto et al., 2022). Electronic modules are considered very practical because they make it easy for students to access all materials in their hands (smartphones) (Kurniawan & Kuswadi, 2021). Electronic modules can facilitate students in independent learning activities and allow them to repeat material they have not yet mastered (Logan et al., 2020). Electronic modules can also attract students' interest in learning, illustrate abstract material (with the help of images, videos, and animations), and be easily accessed anytime and anywhere by students (Aziz & Noer, 2022). In addition, the use of e-modules also has many positive impacts on learning, such as increasing learning effectiveness, learning independence (Syahroni et al., 2016), self-efficacy, motivation, and learning outcomes (Delita et al., 2022; Idayanti & Suleman, 2024). This is why e-modules are very important to develop. Therefore, this research is important to conduct, not only to provide new experiences for teachers and students but also to determine the extent of the benefits of Augmented Reality-based e-modules for students in chemistry learning, particularly in basic thermochemistry material.

Method

This type of research is research and development using the 4D Model developed by Thiagarajan. In the define stage, initial and final analyses, learner analyses, task analyses, concept analyses, and learning objective formulations are carried out. The results of this stage are used as a reference when designing the basis of the e-module being developed. The design stage consists of preparing criterion-referenced tests, selecting media, selecting formats, and preparing initial drafts. The results at this stage are the designs of the e-modules being developed. The development stage consists of expert validation and development trials. Validation is carried out by two subject matter and media experts. At the same time, the development trial consists of a usability test conducted by five teachers and a readability response test conducted by 85 students. The results are in the form of an assessment of the e-module being developed, as well as suggestions and input for improvements to the e-module. The final stage, dissemination, consists of an effectiveness test, final packaging, and diffusion.

The data collection techniques used were non-test techniques, namely questionnaires, interviews, observations, and literature studies. The data collection instruments included a student needs analysis questionnaire, a product feasibility validation sheet (subject matter experts and media experts), a teacher usability questionnaire, a student readability response questionnaire, and a learning interest questionnaire. The adapted learning interest questionnaire grid can be seen in Table 1 below.

Table 1. Learning Interest Questionnaire Guidelines

Aspect of Learning Interest	Indicators	Item Number		Number of Item
		Positive	Negative	
Feeling of Pleasure	Students did not feel bored in participating in the learning process from start to finish.	1,3,5	2,4	5
Attention	Students paid attention to the teacher's explanation of the material and the use of e-modules.	6,8,9	7	4
	Students took notes on the material and responded well to it.			
Interest	Students are enthusiastic about learning using e-modules.	10, 11 13, 14,	12, 15	6
	Students try to find answers to the problems given in the e-modules.			
Involvement	Students actively participate in discussions using e-modules.	16, 17, 19, 20	18	5
	Students actively ask and answer questions from the teacher regarding the use of e-modules.			
Number				20

This study was conducted at a public high school in East Lombok in the odd semester of 2024/2025. The research subjects for the effectiveness test were 33 students. The validity was in the form of theoretical validity and empirical validity. Theoretical validity was conducted qualitatively and quantitatively by media experts and subject matter experts. The qualitative assessment contained suggestions and input from expert judgment related to the developed e-module. In contrast, the quantitative assessment was carried out by processing Likert scale data by calculating the percentage based on the results divided by the maximum score obtained. The data obtained was then interpreted based on the feasibility category (Astuti et al., 2025).

Table 2. Eligibility Category

Eligiblity	**Category**
81-100	Very Eligiblity
61-80	Eligiblity
41-60	Enough Eligiblity
21-40	Less Eligiblity
0-20	Not Eligibility

Meanwhile, empirical validity is an assessment of the instruments used to measure the dependent variables. The empirical validity of the learning interest questionnaire was analyzed using the Winstep application. Items were declared valid if they met at least two of the following Rasch Model analysis criteria (Boone et al., 2014).

Table 3. Criteria for Item Suitability

Criteria	**Description**
0,5 < *MNSQ* < 1,5	Accepted *MNSQ* value
-2,0 < *ZSTD* < +2,0	Accepted *ZSTD* value
0,4 < *Pt Measure Corr* < 0,85	Accepted *Pt Measure Corr* value

Data analysis techniques for development trials use comparisons of average scores with ideal validation categories. Average scores are obtained by processing the Likert scale using the following formula:

$$\bar{X} = \frac{\sum X}{n}$$

Description:

$\bar{X}$ = Average score

$\sum X$ = *Total score*

n = *Number of assessors*

The average scores were then compared with the ideal validation categories presented in Table 4 (Azwar, 2012) below:

Table 4. Ideal validation categories

No	**Score range**	**Categories**
1	$\bar{X}$ > Mi + 1.5 SBi	Exellent
2	Mi + 0.5 SBi < $\bar{X}$ ≤ Mi + 1.5 SBi	Good
3	Mi – 0.5 SBi < $\bar{X}$ ≤ Mi + 0.5 SBi	Enough
4	Mi – 1.5 SBi < $\bar{X}$ ≤ Mi – 0.5 SBi	Poor
5	$\bar{X}$ ≤ Mi – 1.5 SBi	Very Poor

Description:

$\bar{X}$ = Average score

Mi = Ideal average = $\frac{1}{2}$ (ideal highest score + ideal lowest score)

SBi = Ideal standard deviation = $\frac{1}{6}$ (ideal highest score - ideal lowest score

An augmented reality-based e-module on basic thermochemistry material can be considered feasible if the actual score obtained from the validation sheet is at least in the good category.

Results and Discussion

Product development results

The define stage consists of initial and final analysis, student analysis, task analysis, concept analysis, and formulation of learning objectives. The initial analysis was based on literature studies, observations, and teacher interviews. It was previously known that digital learning had been known and used since the COVID-19 pandemic and is still in use today (Atsani, 2020). This also applies to the school where the research was conducted, where platforms other than face-to-face learning are also used, such as WhatsApp groups and Google Classroom. As for learning resources, they still use worksheets from teachers, textbooks in the library, and YouTube links for independent learning. This shows that the school has tried to use digital devices in its learning, but not to the fullest extent. This is evident because most students and teachers are still unfamiliar with more advanced learning technologies such as Artificial Intelligence, Augmented Reality, Virtual Reality, and the like. Based on the analysis of the students, it is known that students feel bored and have difficulty learning chemistry material through the methods and media used by teachers. Students also hope basic thermochemistry material will be presented using learning media such as Augmented Reality-based e-modules. This shows that students are interested in learning if the learning is packaged with models and media that align with current technological developments. Based on the task analysis results, if we want to develop media in the form of e-modules, we must be up-to-date with current technological developments, and their content must present chemistry material in accordance with the Learning Outcomes in phase F of the independent curriculum related to thermochemistry, with each concept linked to chemistry problems in everyday life. This is intended to increase students' interest in learning chemistry if the material presented is closely related to their surroundings. It is also recommended that the formulation of learning objectives accommodate aspects of learning interest to achieve the learning objectives as expected.

The design stage consisted of developing criterion-referenced tests, selecting media, selecting formats, and developing initial drafts. The results of the criterion-referenced test development included 20 items of a learning interest questionnaire, which were then validated theoretically by two expert judgments and empirically by 85 students. As a result, 18 of the 20 developed items were declared valid and reliable based on Rasch Model analysis. The media selected to develop the PBL-STEM-integrated Augmented Reality-based e-module was Augmented Reality, which resulted in an application called *ThermoXplorer*. The initial design of the e-module consists of several essential components, such as a cover and menu consisting of an introduction, instructions, materials, activities, evaluation, and developer profiles.

The development stage consists of expert validation and development trials. Expert validation provides assessments, suggestions, and input related to the product being developed based on material and media aspects. The result of expert validation is that the developed product is suitable for use with several revisions to the content. Meanwhile, development testing consists of teacher usability and student readability response testing.

The dissemination stage consists of effectiveness testing, final packaging, and diffusion. This effectiveness test uses a pre-post one-group design and a random sampling technique. The final packaging of the product is an e-module in the form of an APK file that can be accessed via an Android smartphone or tablet. Finally, diffusion is carried out by disseminating the results in accredited national journals and distributing them directly to teachers and students who were part of the research sample.

Characteristics of E-Module

The Augmented Reality (AR)-based e-module is an e-module in the form of an APK file, designed using the Canva application for the layout and the Blender application for AR animation, which is then converted into fbx. The layout and animation are then combined using the Unity Hub application to create the final e-module in the form of an APK file that can be accessed using an Android smartphone/tablet. This e-module has main components such as a cover, general information, introduction, instructions for use, materials, activities (containing case studies and sample questions), evaluation, developer profiles, and references. The case studies used in the developed e-module are based on problems related to the basics of thermochemistry in everyday life.

Feasibility of E-Module

The feasibility of e-modules is assessed based on expert validation of material and media, usability testing, and readability response. The feasibility of e-modules developed based on material is assessed by expert lecturers regarding material feasibility and accuracy, material presentation, relevance of facts to thermochemical concepts, and language. Meanwhile, the feasibility of e-modules developed based on media is assessed by expert lecturers regarding e-module features, instructional quality, software engineering, and audio and visual display. Qualitatively, here are some suggestions and input from expert lecturers for improving the developed product:

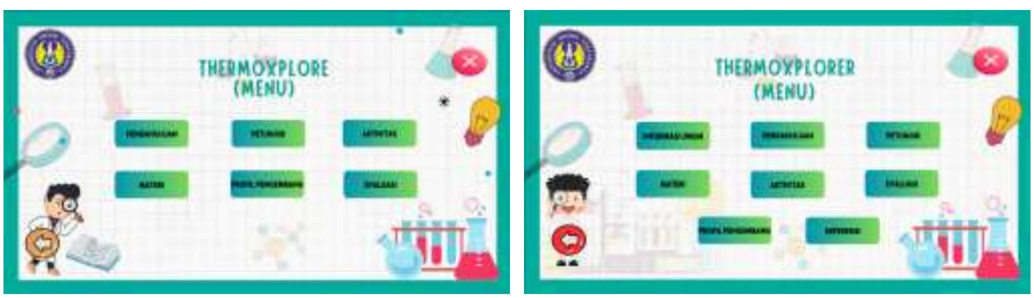

Figure 1. Main menu before and after repair

Figure 2. Menu section introduction before and after repair

Quantitatively, the average expert validation score for the material was 80.2, which falls into the acceptable category when interpreted using the acceptability category table in Table 2. The highest average scores were for the material's presentation, acceptability, and accuracy. This is because the material is in line with the basic concepts of thermochemistry that are relevant to everyday life. The material presented is also equipped with relevant animations/AR objects so that it is easier for students to understand.

As for media experts, the average validation result is 86.9, which is classified as very feasible. The highest average is in the aspects of instructional quality and software engineering. This is because the developed e-module already accommodates clear usage instructions. The e-module is also easy to operate anytime and anywhere, encouraging students' interest in learning. The e-module format was chosen to enable more efficient learning that can be done independently anytime and anywhere (Logan et al., 2020).

Meanwhile, a comparison of average scores with the ideal validation category was used for the development test (teacher usability test and student readability response test). Based on the teacher usability test results, the average total score for all aspects was 160.2 (X>139.8), with the highest average score in the Language and Media aspect. This proves that the developed e-module is easy to operate, and the 3D objects presented can support learning well. Based on the ideal assessment score range in Table 4, the average score obtained can be interpreted as the Augmented Reality-based e-module obtaining an excellent category.

Meanwhile, the student readability response test results obtained an average total score for all aspects of 73.44 (X>67.95), with the highest average score in the aspects of material and language. This shows that the material presented in the e-module is easy to understand. In addition, the activities presented in the e-module case studies on basic thermochemistry material related to everyday life, made students more interested in learning it. Based on the ideal score range in Table 4 for the readability response results, the Augmented Reality-based e-module obtained an excellent category.

Effectiveness Test Results

The effectiveness test was conducted on 33 students by looking at the results of the learning interest questionnaire before and after using the Augmented Reality-based e-module on basic thermochemistry material. Based on the data obtained, the average learning interest score before using the Augmented Reality-based e-module was 65, with the lowest score of 44 and the highest score of 82. Meanwhile, the average learning interest score after using the Augmented Reality-based e-module was 73, with the lowest score of 61 and the highest score of 88, indicating an increase. The increase of 8 is classified as moderate when converted using the N-Gain test with a result of 0.30.

Based on the average N-Gain results for each indicator, the results were 0.30 for feelings of happiness, 0.24 for attention, 0.29 for interest, and 0.19 for involvement, all classified as moderate. The indicators of happiness and attention received the highest increase due to the media used. This is in accordance with the research by Prijambodo et al. (2024), which concluded that AR has great potential in increasing learning interest and contributing to the development of innovative education. Additionally, research conducted by Watoni and Sutrisno (2022) also states that learning with the help of Augmented Reality can increase students' interest and motivation to learn because it is interesting and not dull. Thus, selecting effective learning media and teaching methods supports an increase in students' interest in learning.

Conclusion

Based on the research and development results, it was concluded that the developed e-module was deemed suitable for use based on the assessment of subject matter and media experts, teacher usability, and student readability responses. The developed e-module can increase learning interest based on the n-Gain test results of 0.30, which are moderate. Therefore, it is highly recommended to develop it further for other chemistry subjects.

References

Afrilia, R., & Piawi, K. (2024). Faktor-faktor yang dapat membangun minat belajar siswa di era industri 4.0. *JEDCHEM (Journal Education and Chemistry), 6*(2). 62-65. https://doi.org/10.36378/jedchem.v6i2.3942.

Asmianto, H. M., Rahmadani, D., Pusawidjayanti, K., & Wahyuningsih, S. (2022). Developing android-based interactive e-modules on trigonometry to enhance the learning motivation student. *International Jurnal of Interactive Mobile Technologies, 16*(2), 159-170. https://doi.org/10.3991/ijim.v16i02.27503.

Aulia, R. P., Prihatin, J., & Siswati, B. H. (2023). Hubungan antara minat belajar dengan keberhasilan belajar siswa dengan penerapan buku ajar elektronik sistem ekskresi berbasis *brain-based learning* (BBL) dilengkapi video dan diagram *roundhouse. Bio-Lectura: Jurnal Pendidikan Biologi, 10*(1), 11-17. https://doi.org/10.31849/bl.v10i1.13435.

Astafani, A., Hakim, E., & Resmawati, R. F. (2024). Systematic review: faktor-faktor kesulitan belajar materi kimia. *Jurnal Inovasi Pendidikan Kimia, 14*(2), 81-88. https://doi.org/10.15294/qm1ym619.

Astuti, D., Wijayanti, A., & Purnamasari, V. (2025). Pengembangan media pembelajaran interaktif berbasis steam dalam pembelajaran IPAS kelas IV "Gaya di Sekitar Kita" di SDN 3 Surokonto Kulon. *Jurnal Wawasan Pendidikan, 5*(1), 302-316. https://doi.org/10.26877/jwp.v5i1.19994.

Atsani, L. G. M. Z. (2020). Transformasi media pembelajaran pada masa pandemi covid-19. *Al-Hikmah: Jurnal Studi Islam, 1*(1), 82-93. Retrieved from https://core.ac.uk/download/pdf/327208218.pdf.

Aziz, A. A., & Noer, S. H. (2022). Analisis pembelajaran berbasis kemampuan pemecahan masalah dan kebutuhan e-modul berbantuan *flipbook maker*. *JNPM, 6(*4), 788-801. http://dx.doi.org/10.33603/jnpm.v6i4.7330.

Azwar, S. (2012*). Penyusunan skala psikologi (Edisi III).* Yogyakarta: Pustaka Pelajar.

Boone, W. J., Staver, J. R., & Yale, M. S. (2014). *Rasch analysis in the human sciences*. Dordrecht: Springer. Retrieved from https://dx.doi.org/10.1007/978-94-007- 6857-4.

Dari, R. T. U., & Sudatha, I G. W. (2022). Upaya meningkatkan semangat belajar siswa melalui e-modul berorientasi *discovery learning. Jurnal Edutech Undiksha, 10*(2). 205-214. https://doi.org/10.23887/jeu.v10i1.43966.

Delıta, F., Berutu, N., & Nofrıon, N. (2022). Online learning: The effects of using emodules on self-efficacy, motivation and learning outcomes. *Turkish Online Journal of Distance Education*, *23*(4), Article 4. https://doi.org/10.17718/tojde.1182760.

Eriksen, K., Nielsen, B. E., & Pittelkow, M. (2020). Visualizing 3D molecular structures using an augmented reality app. *J. Chem. Educ, 97* (5), 1487-1490. https://doi.org/10.1021/acs.jchemed.9b01033.

Herawati, R. F., Mulyani, S., & Redjeki, T., (2013). Representasi pembelajaran berbasis kimia berganda dilihat dari kemampuan awal terhadap prestasi belajar laju reaksi peserta didik SMA Negeri 1 Karanganyar Tahun Pelajaran 2011/2012. *Jurnal Pendidikan Kimia Universitas Sebelas Maret, 2*(2). 38-43. Retrieved from https://www.neliti.com/id/publications/125894/pembelajaran-kimia-berbasis-multiple-representasi-ditinjau-dari-kemampuan-awal-t#cite.

Logan, R., Johnson, C., & Worsham, J. (2020). Development of an e-learning module to facilitate student learning and outcomes. *Teaching and Learning in Nursing*, *16*. https://doi.org/10.1016/j.teln.2020.10.007.

Lima, C. B. D., Walton, S., & Owen, T. (2022). A critical outlook at augmented reality and its adoption in education. *Computers and Education Open, 3,* 100103. https://doi.org/10.1016/j.caeo.2022.100103.

Idayanti, Z., & Suleman, M. A. (2024). E-modul sebagai bahan ajar mandiri untuk meningkatkan hasil belajar peserta didik. *Jurnal Penelitian dan Pengembangan Pendidikan, 8*(1), 127-133. https://doi.org/10.23887/jppp.v8i1.61283.

Kurniawan, C., & Kuswandi, D. (2021). *Pengembangan e-modul sebagai media literasi digital pada pembelajaran abad 21.* Lamongan: Academia Publication.

Maharcika, A. A. M., Suarni, N. K., & Gunamantha, I. M. (2021). Pengembangan modul ekejtronik (e-modul) berbasis *flipbook maker* untuk subtema pekerjaan di sekitarku kelas IV SD/MI. *PENDASi: Jurnal Pendidikan Dasai Indonesia*, *5*(2), 165-174. https://doi.org/10.23887/jurnal_pendas.v5i2.240.

Muchlisin, M. (2023). Pemanfaatan media pembelajaran berbasis aplikasi augmented reality alat uji kuat tekan beton. *Jurnal Penelitian Pendidikan Indonesia, 8*(1), 25-39. Retrieved from https://irpp.com/index.php/jpp/article/download/1422/371371890.

Mufidah, Z., Darmayanti, M., & Hendriani, A. (2024). Implementasi pembelajaran Augmented Reality di sekolah dasar: A systematic literature review and bibliometric analysis. *Jurnal Belantika Pendidikan, 7*(1), 38-45. https://doi.org/10.47213/bp.v7i1.265.

Priliyanti, A., Muderawan, I. W., & Maryam, S. (2021). Analisis kesulitan belajar siswa dalam mempelajari kimia kelas XI. *Jurnal Pendidikan Kimia Undiksha*, *5*(1), 11-18. https://doi.org/10.23887/jjpk.v5i1.32402.

Prijambodo, R. F. N., Handayani, N. F., Wajnah., Meylani, Y., Hikmah, N., & Situngkir, F. L. (2024). Teknologi Augmented Reality: Apakah memiliki pengaruh terhadap peningkatan minat belajar peserta didik dalam menyajikan materi pembelajaran?. *Journal on Education, 6*(3), 17664-17671. https://doi.org/10.31004/joe.v6i3.5697.

Rokhim, D. A., Rahayu, S., & Dasna, I W. (2023). Analisis miskonsepsi kimia dan instrument diagnosisnya: Literatur review. *Jurnal Inovasi Pendidikan Kimia, 17*(1), 23-34. https://doi.org/10.15294/jipk.v17i1.34245

Rofi'i, A., Saputra, D. S., Yonanda, D. A., & Febriyanto, B. (2023). Implementasi media pembelajaran augmented reality (AR) dalam meningkatkan kemampuan literasi peserta didik. *Jurnal Elementaria Edukasia, 6*(1), 344-350. https://doi.org/10.31949/jee.v6i1.4754.

Saragih, D. I., Simarmata, R., Naibaho, S. G., Imelayana, C., Saragih, M., & Mailani, E. (2024). Analisis faktor-faktor yang mempengaruhi minat belajar siswa sekolah dasar di era digital. *Jurnal Pendidikan Ilmiah Transformatif, 8*(12), 77-82. Retrieved from https://edu.ojs.co.id/index.php/jpit/issue/view/34.

Sinaga, D. Y., Yunilisa, R., Simangunsong., Simajuntak, A., Sinaga, F., Sinaga, Y. P., Hutagalung, W., Simbolon, U. G., Sitindaon, L. M., & Maharani, N. (2024). Mengembangkan minat belajar peserta didik untuk meningkatkan pembelajaran matematika SD Kelas Tinggi. *Edu Cendikia: Jurnal Ilmiah Kependidikan, 4*(3), 1550-1560. https://doi.org/10.47709/educendikia.v4i03.5430.

Syahroni, M. W., Dewi, N. R., & Kasmui, K. (2016). The effect of using digimon (science digital module) with scientific approach at the visualization of students' independence and learning results. *Jurnal Pendidikan IPA Indonesia*, *5*(1), Article 1. https://doi.org/10.15294/jpii.v5i1.5800.

Tanjung, N. A. (2023). Peran inovasi pada pembelajaran berbasis teknologi. *Seminar Nasional Unigha Tahun 2023*, 157-167. Retrieved from https://journal.unigha.ac.id/index.php/SemNas.

Whatoni, A. S., & Sutrisno, H. (2022). Development of a learning module supported by augmented reality on chemical bonding materials to improve interest and motivation of student learning for senior high school. *Jurnal Penelitian Pendidikan IPA, 8*(4), 1916-1924. https://doi.org/10.29303/jppipa.v8i4.2057.

Copyrights