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DEVELOPMENT OF A CHEMISTRY E-MODULE BASED ON EXPERIENTIAL LEARNING ON REACTION-RATE MATERI

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Abstract: *This research aims to develop chemistry e-modules based on Experiential Learning (EL) model on reaction rate material and test its validity, practicality, and effectiveness. The method used is the ADDIE development model. The research subjects were 30 students of class XI MIPA 2 at SMA Swasta PAB 8 Saentis. The results of the validity of the e-module by material and media experts showed a percentage of content feasibility of 83%, presentation of 84%, EL aspects of 80%, graphics of 81%, and language of 87%, with an average of 83% which is included in the "very feasible" category. Practicality of e-modules from learner responses obtained an average percentage of 82% in the "very practical" category. The effectiveness test through N-Gain shows an increase in learning outcomes from a pretest score of 43.83 to a posttest of 85.17, with an N-Gain score of 73.54% which is classified as "quite effective". From the overall results, the EL-based chemistry e-module on reaction rate material is declared valid, practical, and effective enough to be used as teaching material in the chemistry learning process.*

Keywords: *E-Modules, Experiential Learning, Reaction Rate, ADDIE*

Abstrak: Penelitian ini bertujuan untuk mengembangkan e-modul kimia berbasis model Experiential Learning (EL) pada materi laju reaksi serta menguji validitas, praktikalitas, dan efektivitasnya. Metode yang digunakan adalah model pengembangan ADDIE *(Analysis, Design, Development, Implementation, Evaluation)*. Subjek penelitian adalah 30 peserta didik kelas XI MIPA 2 di SMA Swasta PAB 8 Saentis. Hasil validitas e-modul oleh ahli materi dan media menunjukkan persentase kelayakan isi sebesar 83%, penyajian 84%, aspek EL 80%, kegrafikan 81%, dan bahasa 87%, dengan rata-rata 83% yang termasuk kategori "sangat layak". Praktikalitas e-modul dari respon peserta didik memperoleh persentase rata-rata 82% dengan kategori sangat praktis. Uji efektivitas melalui N-Gain menunjukkan peningkatan hasil belajar dari nilai pretest sebesar 43,83 menjadi posttest 85,17, dengan skor N-Gain sebesar 73,54% yang tergolong cukup efektif. Dari keseluruhan hasil, e-modul kimia berbasis EL pada materi laju reaksi dinyatakan valid, praktis, dan cukup efektif sehingga layak digunakan sebagai bahan ajar dalam proses pembelajaran kimia.

Kata kunci: E-Modul, Experiential Learning, Laju Reaksi, ADDIE

INTRODUCTION

The rapid development of technology in the 21st century has brought significant impacts in various aspects of life, including in education. The utilization of technology and information allows easier access to learning materials through the internet and various digital platforms. This opens up opportunities for educators and learners to obtain learning resources more efficiently.

However, in reality, learning practices in schools are still dominated by the monotonous and less varied lecture method. The teacher plays a dominant role, while students tend to be passive,

only receiving the information conveyed. This condition has an impact on low student participation, activity, and motivation, so they lack confidence in asking questions, conveying ideas, or solving problems, which ultimately leads to low learning outcomes (Iftina Delfi & Hudaidah, 2021).

The same thing was also revealed by Mamang, Sunarti, & Hamid (2020) who found that 50% of students did not achieve learning completeness on reaction rate material. The reasons include the lack of adequate teaching materials and the delivery of material that is still rote.

This material actually examines concepts about the rate of a chemical reaction and the abstract rate equation, so learning media is needed that is able to visualize concepts simply in the form of text, images, videos, and animations. The results of interviews with chemistry teachers at SMA Swasta PAB 8 Saentis also show low daily test scores due to limited learning resources that only rely on textbooks. Therefore, interactive learning media is needed that is interesting, visualizes concepts simply, and encourages active student involvement (Ashari et al., 2023).

One alternative solution that can be applied is the Experiential Learning (EL) model. This model is based on the views of educational figures such as Dewey, Piaget, Kolb, and Rogers, who emphasize the importance of direct experience in the learning process (Aldian & Wahyudiati, 2023). Students will more easily understand concepts if they are directly involved and use the five senses rather than just listening to the teacher's explanation.

EL also allows students to build understanding through interaction with the physical, social, and cultural environment so that the learning process becomes more meaningful (Iftina Delfi & Hudaidah, 202). Therefore, this study aims to develop an Experiential Learning-based Chemistry E-module using the Flipbook Application on reaction rate material, as an alternative to interactive learning media which is expected to improve student learning outcomes.

METHODS

This research will be conducted at SMA Swasta PAB 8 Saentis which is located at Jl. Kali Serayu Dusun 16, Saentis, Kec. Percut Sei Tuan, Deli Serdang Regency, North Sumatra 20371. This research will be conducted in the even semester of 2024/2025 starting from March to June 2025. The population in this study were all students in class XI of PAB 8 Saentis Private High School, in the 2024/2025 school year in the even semester with an independent curriculum learning reaction rate material. The sample taken for this study was XI-IPA 2 class students as the experimental class. The sampling selection technique in this study used Purposive Sampling technique.

The type of research used is Research and Development (R&D) or what is usually called development research. The development model in this study refers to the ADDIE development model. This ADDIE development model consists of 5 stages, namely Analysis, Design, Development, Implementation, and Evaluation (Okpatrioka, 2023).

The research instruments used in this study were test and non-test instruments. Test instruments are used to measure the learning outcomes of students after learning using e-modules. Non-test instruments were used to determine the validity of the e-module and the practicality of the e-module by looking at the teacher's response to the e-module developed. The following is the research procedure used;

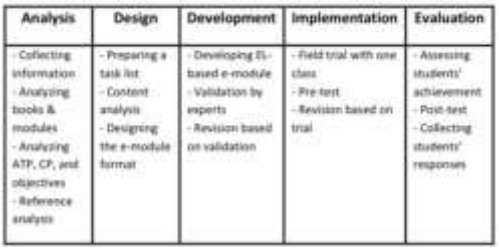

Figure 1 Research Procedures

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RESULTS AND DISCUSSION

The Experiential Learning based E-Modules on reaction rates was developing using the ADDIE development model, which includes the steps os analysis, design, development, implementation, and evaluation.

Analysis

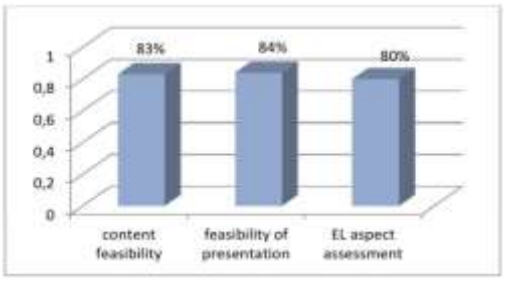
The analysis stage was conducted prior to the research to identify the need for developing an Experiential Learning (EL)-based chemistry e-module. Gap analysis through observations and interviews at SMA Swasta PAB 8 Saentis revealed that learning relied solely on textbooks, with no use of e-modules or EL models, resulting in passive student participation and low learning outcomes. Observations showed that only a few students actively engaged in lessons, while others remained passive (Wulandari et al., 2021). Teachers noted that students struggled particularly with reaction rate material due to limited conceptual understanding. Although students expressed interest in chemistry, they preferred easier topics. Source analysis of textbooks and existing e-modules revealed deficiencies, including minimal illustrations, lack of videos, poor color schemes, and overly formal language. To ensure alignment with the Merdeka Curriculum, ATP, CP, and TP were reviewed. Additional references included textbooks from two publishers and prior e-modules to support the development of a more engaging and student-centered learning resource (Žakelj et al., 2024).

Design

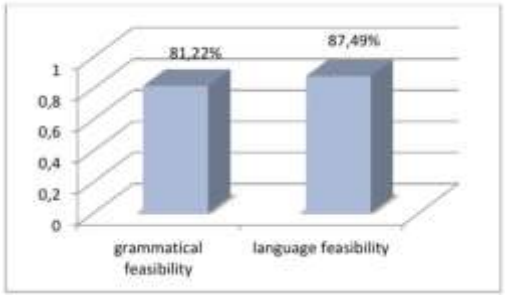
Based on the analysis results, the design stage integrated the Experiential Learning (EL) model into the e-module development. Tasks were arranged according to EL syntax, both individually and in groups. For group activities, a Learner Worksheet (LKPD) was developed in the form of a Reaction Rate Experiment, including tools and materials, objectives, procedures, observations, and conclusions. Students presented their results, which were assessed alongside the practicum process. Additionally, competency test items and interactive quizzes were created based on learning indicators across three topics (Syam et al., 2024). The e-module content followed the EL cycle concrete experience, reflective observation, abstract conceptualization, and active experimentation to promote active and meaningful learning. Visually, the e-module used an A4 format with a chemistry-themed cover, relevant illustrations, a balanced color scheme, communicative language, and embedded learning videos displayed through engaging thumbnails to enhance student motivation.

Development

The development stage produced an EL-based e-module aligned with BSNP standards, covering core topics on reaction rates with structured content, examples, formulas, and visuals. Validation was conducted in April–May 2025 by two UNIMED lecturers and one school chemistry teacher using BSNP-based criteria, assessing content, presentation, EL integration, graphics, and language. Validators also offered feedback for quality improvement.



Graph 1 Material Expert Rating



Graph 2 Media Expert Rating

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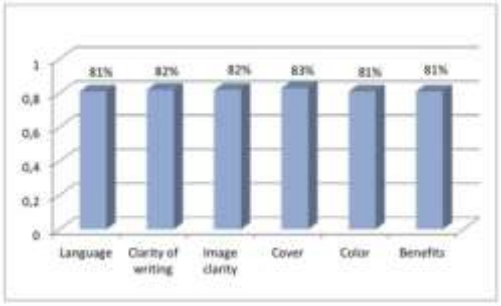
The e-module was validated by experts based on five aspects, achieving an average score of 83% (very feasible). Content, presentation, graphics, and EL aspects scored between 80–84%, with language receiving the highest at 87%. Suggestions included adding concept illustrations, refining EL implementation, and improving graphic consistency. Revisions were made accordingly, including clearer EL stages, enhanced visuals, and better color variation.

Figure 3 E-module Before Revision

Figure 4 E-module After Revision

Implementation

The validated e-module was implemented in one experimental class to evaluate its impact on student learning outcomes. The implementation began with a pre-test to assess students' initial understanding of reaction rate material as a baseline for measuring learning improvement.

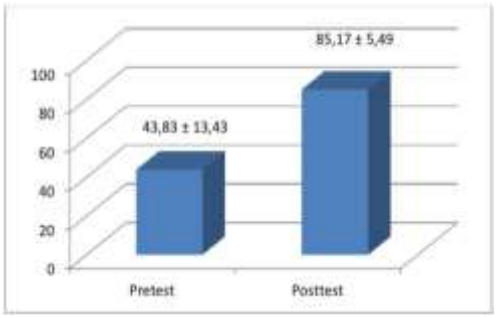


Graph 5 Student Response Rating

The practicality of the EL-based e-module was evaluated through student responses from 30 class XI MIPA 2 students. The average response score was 82%, categorized as very practical. This indicates that students found the e-module easy to use, engaging, and supportive in the learning process.

Evaluation

The implementation of the Experiential Learning (EL) model was evaluated through cognitive, psychomotor, and affective domains using tests, observation sheets, and questionnaires. In the cognitive domain, students' average scores increased from 47.33 to 85.17, indicating improved concept mastery after using the EL-based e-module. Psychomotor observations showed most students performed in the "good" to "very good" category, successfully following practicum procedures and demonstrating safe and accurate work—aligned with EL's active experimentation principle (Kolb, 1984). In the affective domain, over 80% of students responded positively, showing increased motivation, collaboration, and enthusiasm. This supports the view that emotional engagement is key to EL success (Ouellette & Rhoads, 2023). Overall, the e-module is feasible and effective for teaching reaction rate material.



Graph 6 Pretest and Posttest Results

The effectiveness of the EL-based e-module was measured using the N-Gain test. The average pretest score was 43.83 ± 13.43, while the posttest average increased to 85.17 ± 5.49, resulting in an

N-Gain score of 73.54. This indicates a significant improvement in students' understanding after using the e-module. The results confirm that the EL-based e-module is effective in enhancing students' learning outcomes on reaction rate material.

During the research, several obstacles were encountered. First, unstable internet access caused delays in loading the e-module. This was resolved by sharing hotspots from peers with stable connections. Second, some students had difficulty understanding problems, prompting frequent questions (Lebert & Vilarroya, 2024). The researcher addressed this by re-explaining the example problems provided in the e-module. Third, limited student literacy required additional clarification from the researcher. To overcome this, efforts were made to help students connect reaction rate concepts to real-life contexts through the four EL stages, thereby enhancing their understanding and engagement. This research aligns with the findings of Pramudya & Surjono (2021), who developed an EL-based e-module on the respiratory system (Lenchuk & Ahmed, 2021).

Thus, the research conducted at SMA Swasta PAB 8 Saentis supports the effectiveness of the Experiential Learning (EL) approach in e-modules, demonstrating not only improved conceptual understanding but also enhanced learning outcomes. This success stems from EL's emphasis on active student engagement through real-world experiences, reflection, conceptualization, and application. Therefore, EL-based e-modules offer an innovative alternative for chemistry instruction in schools. The developed e-module can be accessed at https://online.fliphtml5.com/uzfyy/xbaj/

However, a limitation of the current module is its reliance on internet connectivity. Future research is encouraged to explore solutions for creating offline-accessible content to increase usability in low-connectivity environments.

CONCLUSSIONS

The experiential learning (EL)-based e-module on reaction rate material was declared very feasible with a material feasibility level of 83% and media 84%. The practicality of e-modules is also in the very feasible category with a percentage of 82%, indicating that e-modules are very practical to use in learning.

The effectiveness test showed an increase in student learning outcomes, from an average pretest score of 43.83 to a posttest of 85.17 with an N-Gain of 0.74 (high category), so that this e-module was declared quite effective and feasible to use as a learning medium.

REFERENCES

Aldian, H., & Wahyudiati, D. (2023). Analisis Pengaruh Bahan Ajar Kimia Berbasis IT Terhadap Keterampilan Kolaborasi dan Komunikasi Siswa. *Jurnal Paedagogy*, *10*(1), 207. https://doi.org/10.33394/jp.v10i1.5484

Ashari, V. R., Fatirul, A. N., & Walujo, D. A. (2023). Pengembangan E-Modul Kimia Materi Asam Basa Berbasis Flip PDF Professional untuk Peserta Didik Kelas XI SMA Negeri 1 Menganti. *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, *4*(2), 1391–1398. http://jurnaledukasia.org

Iftina Delfi, & Hudaidah. (2021). Perkembangan Pendidikan Di Era Globalisasi. *Jurnal Ilmiah Wahana Pendidikan*, *7*(2).

Lebert, A., & Vilarroya, Ó. (2024). The links between experiential learning and 4E cognition. *Annals of the New York Academy of Sciences*, *1541*(1), 37–52.

Lenchuk, I., & Ahmed, A. (2021). Tapping into Bloom Taxonomy's Higher-Order Cognitive Processes: The Case for Multiple Choice Questions as a Valid Assessment

Tool in the ESP Classroom. *Arab World English Journal*, *1*, 160–171.

Okpatrioka. (2023). Research And Development(R&D)PenelitianYang Inovatif Dalam Pendidikan. *DHARMA ACARIYA NUSANTARA : Jurnal Pendidikan, Bahasa Dan Budaya*, *1*(1), 86–100.

Syam, M., Ada, W., & Riset dan Inovasi Pembelajaran, J. (2024). *Evaluation of Experiential Learning Implementation in Vocational Education Based on Student Learning Style*. *4*(2), 1270.

Wulandari, C. A., Rahmaniati, R., Nurul, D., Kartini, H., Chrismonika, O. :, & Wulandari, A. (2021). PENINGKATAN KETERAMPILAN KOLABORASI DAN HASIL BELAJAR DENGAN MENGGUNAKAN MODEL PEMBELAJARAN TEAMS GAMES TOURNAMENT. *Pedagogik Jurnal Pendidikan*, *16*(1), 1–1.

Žakelj, A., Cotič, M., & Doz, D. (2024). Evaluating the impact of active and experiential learning in mathematics: an experimental study on eighth-grade student outcomes. *Cogent Education*, *11*(1). https://doi.org/10.1080/2331186X.2024.2436698