

THE DEVELOPMENT OF ETHNO-STEM INTEGRATED E-LKPD ON REACTION RATE MATERIALS

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Abstract: This development research was conducted because the advancement of education in the 21st century is geared towards improving human potential. The shift of global society towards digitalization forces schools to adapt their teaching methods to new technological advances. This study aims to determine the analysis of students' needs, the level of feasibility, teacher practicality, and students' readability response to the Ethno-STEM integrated LKPD on reaction rate material. The method used is research and development (Research and Development) with the 4-D model, but limited to 3-D (Define, Design, and Develop). The research subjects were 3 material and media validators, 5 chemistry teachers and 90 students of SMA Negeri 1 Kisaran. The data collection techniques used were interviews and questionnaires. The data were analyzed using kappa moment. Based on the results of the study, students need Ethno-STEM integrated E-LKPD on reaction rate material, the material feasibility level is 0.84 (very feasible), the media feasibility level is 0.85 (very feasible), the practicality level is 0.95 (very practical), and the results of students' readability response are 0.90 (very good).

Keyword: E-LKPD; Ethno-STEM; Reaction Rate.

Abstrak: Penelitian pengembangan ini dilakukan karena kemajuan pendidikan di abad ke-21 diarahkan untuk meningkatkan potensi manusia. Pergeseran masyarakat global ke arah digitalisasi memaksa sekolah untuk menyesuaikan metode pengajaran mereka dengan kemajuan teknologi baru. Penelitian ini bertujuan untuk mengetahui analisis kebutuhan peserta didik, tingkat kelayakan, kepraktisan guru, dan respon keterbacaan peserta didik terhadap LKPD terintegrasi Ethno-STEM pada materi laju reaksi. Metode yang digunakan adalah penelitian dan pengembangan (Research and Development) dengan model 4-D, namun dibatasi hingga 3-D (Define, Design, dan Develop). Subjek penelitian adalah 3 orang validator materi dan media, 5 orang guru kimia dan 90 orang peserta didik SMA Negeri 1 Kisaran. Teknik pengumpulan data yang digunakan adalah wawancara dan kuesioner. Data dianalisis dengan menggunakan momen kappa. Berdasarkan hasil penelitian, peserta didik membutuhkan E-LKPD terintegrasi Ethno-STEM pada materi laju reaksi, tingkat kelayakan materi sebesar 0,84 (sangat layak), tingkat kelayakan media sebesar 0,85 (sangat layak), tingkat kepraktisan sebesar 0,95 (sangat praktis), dan hasil respon keterbacaan peserta didik sebesar 0,90 (sangat baik).

Kata kunci: E-LKPD; Etno-STEM; Laju Reaksi.

INTRODUCTION

A paradigm shift in education characterized by curriculum and media modifications. 21st century learning is essentially a result of the periodic development of society. Moreover, the shift of the global society towards

digitalization forces schools to adapt their teaching methods to new technological advancements. Technological literacy is a must for educators and learners (Rahayu et al., 2022).

According to Suncaka (2023), the quality of education in Indonesia needs

more attention. One of the causes is teachers who are less technologically literate. Technological advances are not directly proportional to the teacher's ability to adapt, so learning takes place traditionally (Kinas & Nilawati, 2024). It is also shown by Prasastisiwi (2024) that from the results of the 2022 PISA (Program for International Student Assessment) assessment, Indonesia is ranked 69th out of 80 countries.

Chemistry is one of the compulsory curriculum subjects in high school. However, this material is often seen as difficult by students because it requires strong conceptual understanding as well as application and numerical skills. Therefore, there is a need for a teaching method or methods that can explain this concept in a way that is clear, easy to understand, and in line with everyday life (Sakti et al., 2020).

Based on findings from interviews with chemistry teachers at SMA Negeri 1 Kisaran, it was found that SMA Negeri 1 Kisaran is one of the schools that implement the Merdeka Curriculum. However, in the application of the learning process, it is still teacher-centered learning and teachers who are not good at technology, so teachers only use the lecture method. Sources and teaching materials used in chemistry learning are only packaged books from the school. On the other hand, there are quite a lot of students who are less interested in learning chemistry, such as in reaction rate material which is considered difficult.

In the 21st century related to education, there is a need for the latest innovations that utilize technology, one of which is by using E-LKPD (Electronic Learner Worksheets). To fulfill the demands of 21st century learning, it is crucial to develop new E-LKPD. The use of E-LKPD explains the material, guides students to do activities, and conducts evaluations as an effort to improve learning so that students do not feel bored learning in class (Suryaningsih & Nurlita, 2021).

In addition, the industrial revolution 4.0 and the demands of the times raise concerns that culture will disappear from the minds of the next generation. The integration of STEM and ethnoscience, also called Ethno-STEM, is an attempt to keep pace with the times with education and culture (Idrus, 2022). Indonesia has tremendous cultural wealth, including traditional knowledge known as ethnoscience. Integrating ethnoscience values in learning can make students feel the activity of learning activities directly connected to the surrounding environment (Fahrozy et al., 2022). STEM-based learning (Science, Technology, Engineering, and Mathematics) is an approach that is considered effective in equipping students with critical thinking, creativity, collaboration, and problem-solving skills that are needed in the modern era (Sumartati, 2020).

Based on this background, the purpose of this development research is to determine the analysis of student needs, the level of material and media feasibility, the level of teacher practicality, and the students' readability response to the Ethno-STEM integrated E-LKPD on Reaction Rate material.

METHOD

This research was conducted at SMA Negeri 1 Kisaran which is located at Jalan Madong Lubis Street No. 5, Kisaran Timur District, Asahan Regency, North Sumatra Province. Research conducted in the 2024/2025 academic year. The subjects of this research are 3 material expert validators and media expert validators who are chemistry lecturers in the FMIPA UNIMED environment. The teacher practicality test involved 5 chemistry teachers and 3 XI classes at SMA Negeri

Kisaran consisting of 90 students. The object of this research is E-LKPD integrated with Ethno-STEM on reaction rate material. This research uses the

Research and Development (R&D) method. The development model used in the research is the 4-D model, but in this study it was limited to 3-D including: define, design, and develop.

The research instruments used in the study were in the form of interview sheets and questionnaire. Ratings using a Likert scale of 1-4 can be given is a check mark (✓) in one of the columns. The data obtained will be analyzed using the kappa cohen formula in equation 1 (Asda & Iryani, 2020).

$$momen\ kappa\ (k) = \frac{p_0 - p_e}{1 - p_e} \quad (1)$$

Description:

k = the value of the kappa moment

p_e = proportion realized

p_0 = unrealized proportion

The validity category based on the kappa moment (k) is in Table 1 as follows.

Table 1. Category of Validity Based on Kappa Moment (k)

Interval	Category
< 0.00	Not valid
0.00 – 0.20	Very low
0.21 -0.40	Low
0.41 – 0.60	Medium
0.61 - 0.80	High
0.81 – 1,00	Very high

RESULT AND DISCUSSION

Define

There are five primary phases in the defining stage. Through direct observation and interviews, the first phase, front-end analysis, is utilized to determine the issues that teachers in schools confront. The second phase is student analysis, which is carried out by researchers to determine the needs of

students in the chemistry learning process, particularly with regard to reaction rate content. The result is students agree if there is an Ethno-STEM integrated E-LKPD development on reaction rate material.

The third step is task analysis, which at this stage is carried out by determining teaching materials that refer to learning outcomes in accordance with the independent curriculum. The fourth step is concept analysis, this analysis is used to identify, compile and connect learning concepts with the subject matter. The defining of learning objectives is the fifth and last phase. The purpose of this step is to transform task and idea analysis into learning goals.

Design

This stage is carried out to produce an initial design of the product to be developed. This design stage consists of 3 steps, the first step is media selection. At this point, it is utilized to determine the appropriate medium and in line with the features of the E-LKPD learning materials and content. This E-LKPD uses Flip PDF Corporate Edition as its medium. Febrianti (2021) believes that Flip Pdf Corporate Edition is a program that converts PDF digital flipping page publications to generate interactive learning materials with a number of features.

The next step is format selection, where this format selection refers to considerations in the form of design, color, writing, layout, images and illustrations, and features. The original design is the final stage of the design process. In this case, it takes the shape of a cover, preface, table of contents, and bibliography. The initial design produced is called a prototype. Here are some preliminary designs of this development research.

The opening section consists of a front page cover, preface, and table of contents.

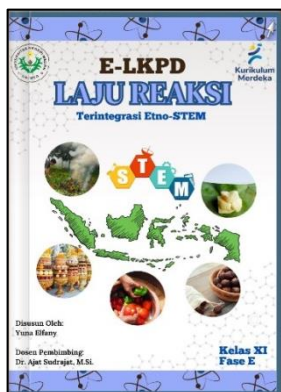


Figure 1. Front Page Cover of E-LKPD



Figure 3. Back Page Cover of E-LKPD

The content section consists of a concept map, learning outcomes, learning objectives, description, instructions for use, features, activity and answer key.



Figure 2. E-LKPD Activity

The closing section consists of a bibliography, glossary, periodic table of elements, author's biography, and back cover.

The initial design was then converted into electronic form using flip PDF corporate edition with features to make the initial design more attractive.

Develop

The final stage in this research is the development stage which consists of 2 steps, specifically developmental testing and expert evaluation. Evaluating the completed E-LKPD prototype is the first stage. Three validators who are lecturers at Medan State University's Chemistry department participate in this assessment, which is conducted by media experts and material specialists. If there are mistakes or shortcomings in the E-LKPD that was created, this evaluation is done to make improvements. Table 3 below displays the findings of the evaluation of the content by three knowledgeable validators.

Table 2. Average Material Feasibility Assessment

No	Assessed Aspect	Feasibility Assessment (Kappa Moment)			Average	Category
		V1	V2	V3		
1.	Curriculum suitability	0.84	0.67	1	0.84	Very feasible
2.	Clarity of material presentation	0.67	0.78	0.94	0.80	Feasible
3.	Ethno-STEM component	0.67	0.87	0.93	0.82	Very feasible
4.	Language use	0.67	1	1	0.89	Very feasible
Average kappa moment (k)		0.71	0.83	0.96	0.84	Very feasible

Based on Table 2, the value obtained is the average of the calculation using the kappa moment (k). On the

aspect of curriculum suitability is 0.84, then on the aspect of clarity of material presentation is 0.80. On the aspects of the

Ethno-STEM component is 0.82. And on aspects of language use is 0.89. So that the overall average feasibility of 3 material expert validators is 0.84 with a very feasible category. This value demonstrates that the E-LKPD created is in line with the learning objectives and results and is organized in line with the creation's goals and systematics, the content and questions/questions and

Ethno-STEM activities in the E-LKPD developed are appropriate, as well as the language used in accordance with scientific principles.

Then the feasibility assessment in terms of media is carried out, the results of the assessment of the media from 3 expert validators can be seen in Table 3 below.

Table 3. Average Media Feasibility Assessment

No	Assessed Aspect	Feasibility Assessment (Kappa Moment)			Average	Category
		V1	V2	V3		
1.	E-LKPD cover design	0.78	0.89	1	0.89	Very feasible
2.	Color and writing	0.67	1	1	0.89	Very feasible
3.	Layout design	0.67	0.75	1	0.81	Very feasible
4.	Pictures and illustrations	0.67	0.78	1	0.82	Very feasible
5.	Features	0.67	1	0.84	0.84	Very feasible
Average kappa moment (k)		0.69	0.88	0.97	0.85	Very feasible

Based on Table 3, the value obtained is the average of the calculation using the kappa moment (k). For the aspects of E-LKPD cover design is 0.89, aspects of color clarity and illustrations is 0.89. Furthermore, on the aspects of layout design is 0.81. Then, on aspects of images and illustrations is 0.82, and for the aspects of features is 0.84. So that the overall average feasibility of 3 media expert validators is 0.85 with a very feasible category. So that this value shows that the E-LKPD developed has a very good design, layout in terms of typeface to images and logos, its features are also attractive and have the right combination of colors, writing and language.

The assessment is acquired following revision, which is consistent with earlier research that evaluates development validity based on media and material validity to ascertain feasibility. If the evaluation results fall into the valid category with no or few changes, the product might be considered viable (Hardeli et al., 2021).

The final step in the development stage is testing. This step is intended to determine the teacher's practicality and students' readability response to the E-LKPD developed. 5 teachers participated in this study's teacher practicality test. Table 4 displays the results that were achieved.

Table 4. Average Teacher Practicality Assessment

No	Assessed Aspect	Practicality Assessment (Kappa Moment)					Average	Category
		G1	G2	G3	G4	G5		
1.	Use of E-LKPD	1	1	1	1	1	1	Very practical
2.	Content feasibility	1	0.84	1	1	0.94	0.96	Very practical

3.	Graphs	1	1	1	1	0.84	0.97	Very practical
4.	Efficiency of learning time	1	0.67	1	1	1	0.93	Very practical
5.	Benefits of E-LKPD	0.78	0.89	0.78	1	1	0.89	Very practical
Average kappa moment (k)		0.96	0.88	0.96	1	0.96	0.95	Very practical

Based on Table 4, the value obtained is the average of the calculation using the kappa moment (k). For the aspects of the use of E-LKPD is 1.0, and then the aspects of content feasibility is 0.96. Furthermore, the Graph aspect is 0.97. the aspects of time efficiency is 0.93. And for benefit aspect is 0.89. So that the overall average level of practicality of 5 chemistry subject teachers is 0.95 with a very practical

category. So that this value shows that the E-LKPD used is easily accessible and used, and the use of the Ethno-STEM approach is effective to use.

Finally, the students' readability response. This readability response was taken because the reaction rate material had been studied by students in the previous semester. The results of the students' readability response can be seen in Table 5 below.

Table 5. Average Learner Readability Response

No	Assessed Aspect	Average Learner Readability Response (Kappa Moment)	Category
1.	E-LKPD display	0.91	Very high
2.	Use of E-LKPD	0.90	Very high
3.	Presentation in E-LKPD	0.90	Very high
4.	Benefits	0.90	Very high
Average		0.90	Very high

Based on Table 5, the value obtained is the average of the calculation using the kappa moment (k). For the aspect of E-LKPD display is 0.91, on aspects of the use of E-LKPD is 0.90. Then the aspects of presentation in E-LKPD is 0.90, and the aspects of benefits is 0.90. So that the average readability response of students obtained is 0.90 with a very high category.

So that the Ethno-STEM integrated E-LKPD on reaction rate material developed can be said to be feasible, practical and interesting to use in learning. This is in accordance with the research of Gultom & Amdayani (2023) that the assessment of practicality and student responses is obtained through the kappa moment (k). If the value obtained

≥ 0.81 , it is included in the very high category. And it can be concluded that the product developed is practical for use by teachers and students, this practicality is because the product is easy to use, learning time becomes more efficient and useful for learning. So that this value shows that the use of the Ethno-STEM approach makes it interesting and the E-LKPD developed can be accessed anywhere and anytime. Thus, the readability response of students to the E-LKPD developed can be said to be good.

There are some disadvantages of using the product found, requiring an internet connection to open the E-LKPD and send answers. And the teacher has to work extra to ensure that all learners use

the E-LKPD instead of others to open the E-LKPD instead of others.

The following is a link of the Ethno-STEM Integrated E-LKPD on the reaction rate material that has been revised by material experts and media

experts, and has been tested for practicality by teachers and readability responses by students: <https://online.flipbuilder.com/doafc/mqgw/>.

CONCLUSIONS

Based on the results of the study, it is concluded that the results of the analysis of the needs of students in the study, namely teaching materials that need to be developed in chemistry subjects, precisely on reaction rate material at SMA Negeri 1 range, are teaching materials in the form of Ethno-STEM integrated E-LKPDs on reaction rate material. The feasibility level of the

E-LKPD developed for the material is 0.84 with a very feasible category and for the media is 0.85 with a very feasible category. The teacher's level of practicality of the E-LKPD developed was 0.95 which was in the very practical category. And the results of the students' readability response to the E-LKPD developed were 0.90 which was in the very good category. So that E-LKPD is ready to be used in learning.

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