

DEVELOPMENT OF ELECTRONIC STUDENTS' ACTIVITY SHEETS USING KVISOFT FLIPBOOK MAKER APPLICATION AND A STEM-BASED APPROACH ON HYDROCARBON MATERIALS

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Article info	Abstract
<p>Received: 31 August 2023 Accepted: 01 October 2023 Published: 25 October 2023</p> <hr/> <p>Keywords:</p> <p>Electronic students' activity sheets; Hydrocarbons; Kvisoft Flipbook Maker</p>	<p>Using the Kvisoft Flipbook Maker application, this study seeks to develop an Electronic Student Activity Sheet (e-LKM) based on a STEM (Science Technology Engineering and Mathematics) approach to Hydrocarbon Materials. This research is Research and Development (R and D) employing the Plomp model, which consists of Preliminary Research (introduction), Prototype Stage (development), and Evaluation. Utilizing material and media expert validation sheets, this study's data acquisition method is based on expert validation sheets. The validity of e-LKM was demonstrated by material expert validation of 0.93 and media validity of 0.92 for the appropriate category, as determined by Aiken V analysis. The percentage of material validity results is 94.8 per cent, while the percentage of media with intriguing categories is 93%. The results of user responses from lecturers and students yielded percentages of 87% and 90% for the category "interesting." e-LKM's series of activities were founded on a STEM methodology encouraging students to be active, interactive, collaborative, and independent.</p>

INTRODUCTION

Rapid technological advancement is causing profound alterations in every aspect of life. In the 21st century, also known as industrial era 4.0, we need to have developed life skills (Rawung et al., 2021). To prepare students for the workforce of the 21st century, the world of education must develop 21st-century skills, which include the ability to

communicate, collaborate, think critically when solving problems, and demonstrate creativity and innovation (Han et al., 2021).

The 21st century is the consequence of industrialization giving way to informational society. This marks the beginning of digitalization in numerous spheres of life. These changes necessitate the world of education to observe current developments in technology and information (Rahayu et al., 2022). The 21st century poses extraordinary challenges for educators. Educators are required to emphasize the four aspects of 21st-century capabilities (Salim Nahdi, 2019).

Lessons in chemistry are essential to comprehend due to the pervasiveness of chemistry in everyday life. Lessons in chemistry examine matter and the alterations that occur to it (Fauziah, 2021). Lessons in chemistry examine a substance's composition, structure, properties, changes, dynamics, and energy, which require skills and deductive reasoning. The characteristics of chemistry as attitudes, processes, and products must be emphasized in chemistry learning as a guide for educators in selecting media and student learning resources (Mufidah et al., 2021). The use of less effective learning media that does not engage students in the learning process causes students to lack comprehension of the material, including hydrocarbon material.

According to the findings of interviews with chemistry education lecturers and students at the Islamic University of Kuantan Singingi, the use of Students Activity Sheets is still uncommon. Instead, lecturers prefer to deliver material per sub-chapter in softcopy format using books or internet references. Currently, pupils must be prepared to confront the challenges of 21st century education and to compete in a technologically advanced work environment. Students frequently use laptops and Androids during the learning process; lecturers can use technology to make learning more engaging. Creating pupil activity papers in electronic format, or e-LKM is one solution to this problem. Using the Kvisoft flipbook creator application, E-LKM was created. E-LKM created with Kvisoft flipbook creator can be utilized on a laptop or desktop computer, as well as Android, for independent learning (Hidayatullah & Rakhmawati, 2016).

Educators can maximize learning facilities and media by putting forth efforts that must be made. Educators must be inventive when comparing learning models and media (Wijaya, 2020). One of the media employed consists solely of worksheets supplied by the school. Therefore, engaging learning materials are required, particularly for the chapter on hydrocarbon materials. Student handbooks and LKM (Student Worksheets) based on STEM (Science (S), Technology (T), Engineering (E), and Mathematics (M)) are common learning media (Ma'sumah & Mitarlis, 2021).

According to research by Peters-burton & Stehle (2019), STEM-based learning can support the development of 21st-century skills (Science (S), Technology (T), Engineering (E), and Mathematics (M)). STEM is an educational approach that integrates science,

technology, engineering, and mathematics with a concentration on problem-solving in ordinary life (Davidi et al., 2021). STEM in education seeks to train students to be competitive and ready to work in their preferred profession (Li et al., 2020). STEM-based education is implemented in an effort to improve multidisciplinary skills and abilities (Navy & Kaya, 2020), specifically critical thinking (Rehmat & Hartley, 2020), science (Afriana et al., 2016), and the environment, as well as creative, logical, innovative, productive, and directly related to real-world conditions (Widya & Laila Rahmi, 2019).

The STEM approach is a fascinating and trending topic in the field of education today. The incorporation of STEM into education can not only increase students' motivation and self-confidence but also their learning abilities and outcomes (LaForce et al., 2017). In addition to learning outcomes, it is anticipated that education will prepare students for the global workforce (Kelley et al., 2020). In addition to integrating science, technology, engineering, and mathematics subjects, STEM-based education also emphasizes the development of STEM skills (Eisenhart et al., 2015). Developing the skills that will emerge from the integration of these disciplines with STEM education is of equal importance. According to Widya & Laila Rahmi (2019), STEM education cultivates students who are problem solvers, innovators, inventors, independent, logical thinkers, and technologically literate.

The development of STEM-based teaching materials is important because it teaches students to solve problems in accordance with the curriculum employed and student characteristics (Wahyuni et al., 2022). LKM is not simply a sheet of paper with queries that must be answered; rather, LKM must make students active, facilitate comprehension, and integrate concepts (Zahara et al., 2020). Students' interest in learning can be stimulated by LKM that are visually appealing and contain contextual information (Nengsi et al., 2021). As a result, these LKMs are anticipated to facilitate the learning process. Using e-LKM with the application Kvisoft Flipbook Maker is one option (Zuliatin et al., 2022).

Kvisoft Flipbook Creator is an application that can be used to create e-books, e-modules, and e-papers by incorporating images, visuals, and hyperlinks. According to Tri & Yulian (2018), Flipbooks can assist students in acquiring knowledge of abstract concepts or events that cannot be presented in class. Kvisoft Flipbook Maker has a number of additional benefits, including the ability to present learning material in the form of words, sentences, and images, the ability to add colour to attract student's attention, the ease of use and low cost, the portability, and the ability to increase learning activities. Susilana & Riyana (2008) based on. In addition to having an appealing appearance, teaching materials must be developed using a learning model that matches the material's characteristics.

It is anticipated that this innovation in learning tools will make it easier for students to comprehend the material, make it easier for instructors to provide the material, and serve as a technological advancement in the field of education, which is constantly adapting to

new technologies. E-LKM based on a STEM approach and created with Kvisoft Flipbook Maker is a novel contribution to the field of education that offers numerous benefits. It is anticipated that the integration of the four fields of knowledge contained in e-LKM will make it simpler for students to solve learning-related problems in their daily lives and produce a workforce-competent generation.

Based on preliminary research and the aforementioned phenomena, researchers want to know how to develop and validate E-LKM products using Kvisoft Flipbook Maker using a STEM-based approach. Consequently, the purpose of this study is to ascertain the validity of e-LKM using Kvisoft flipbook creator and the stem approach. This study's research concerns are described as follows:

- A. How is the design e-LKM based on a STEM approach using Kvisoft flipbook maker?
- B. What is the validity of e-LKM based on a STEM approach using Kvisoft flipbook maker?

METHOD(S)

The research method employed research and development design (R&D) with the Plomp model (Plomp, 2013).

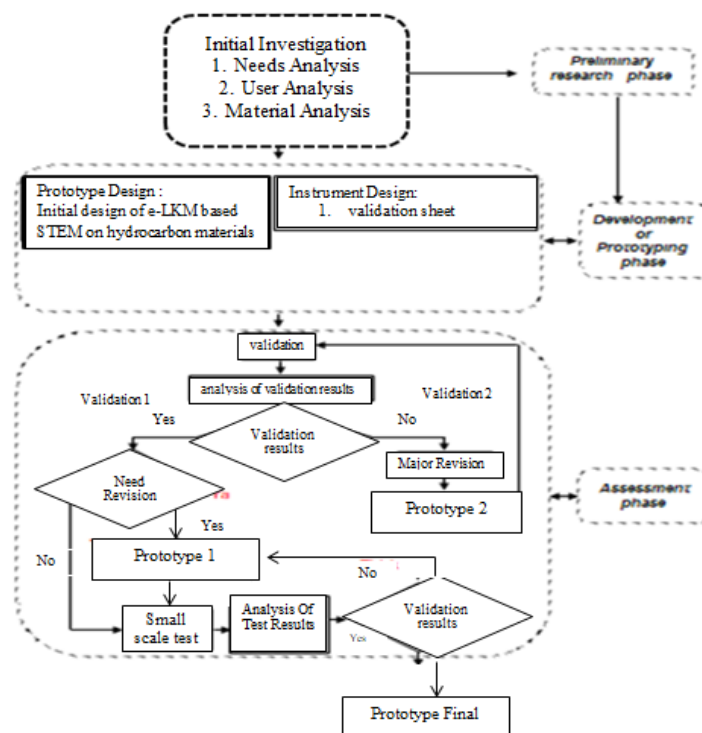


Figure 1. Research Flow Diagram producing STEM-based e-LKM modified by the Plomp model (Plomp, 2013)

A STEM-based e-LKM validation document and an attractiveness response questionnaire were employed as research instruments. The e-LKM product validation evaluation was conducted by two material specialists and two media experts using a Likert scale ranging from 1-4. In the material specifications, it was stated that the validity of STEM-based e-LKM was determined by the aspects of content appropriateness, pedagogical appropriateness, linguistic appropriateness, and graphical appropriateness of modifications (Kusumasari et al., 2022). In the material specifications, it was stated that the validity of STEM-based e-LKM can be determined by the screen design, usability, consistency, and modified graphics (Lestari et al., 2022). Validity indicators can be seen in Table 1.

Table 1. Media and material expert validation indicators

Indicators of material validity	Media validity indicator
Eligibility Aspect	Aspect Screen Design
Peadagogic Aspect	Aspect User Ease
Linguistic Aspect	AspectConsistency
Graphic Aspects	Multimedia Aspect

Testing the validity of the instrument content was also carried out using Aiken's Validity theory (Aiken's V). Aiken formulated the Aiken validation formula to calculate the content-validity coefficient which is based on the results of research by an expert panel of n people on an item in terms of the extent to which the item can represent the construct being measured. The Aiken formula used is as follows (Aiken, 1980).

$$V = \sum s / [n(c - 1)]$$

The validity value during data collection determines the level of validity of the questionnaire. The correlation coefficient categories of the questionnaire validity test can be seen in Table 2 below.

Table 2. Guidelines for scoring validation sheet questionnaires

The value of r	Interpretation
0.00 – 0.11	Not Worth Using
0.12 – 0.20	Worthy of certain considerations
0.21 – 0.35	Proper to use
0.36 – 1.00	Very Worth Using

(Soto & Egovia, 2009)

After the product is declared valid, it will continue with a lecturer response questionnaire assessment carried out by 2 lecturers and 10 chemistry education students to measure the attractiveness of using the product. This attractiveness questionnaire was adapted from (Erna et al., 2021) with the formula:

$$P = \frac{n}{N} \times 100\%$$

Information:

P: Score percentage

n: Number of scores obtained

N: Maximum number of scores

Next, the percentage results are converted into quantitative values as presented in table 3 below:

Table 3. Product Attractiveness Criteria

Percentage	Category
80%-100%	Interesting
60%-79%	Quite interesting
50%-59%	Less attractive
< 49%	Not attractive

(Sa'ud & Sriwiyana, 2010)

FINDINGS AND DISCUSSION

The process of developing STEM-based e-LKM for hydrocarbon materials generally consists of three stages, namely the preliminary stage, prototype stage, and assessment stage. The results of each stage of e-LKM preparation are described as follows:

A. Preliminary Research

The preliminary stage begins with problem analysis, curriculum, material analysis, students, and literature analysis, with the results of the analysis being:

1. Needs analysis

Based on interviews conducted with lecturers and chemistry students at Kuantan Singingi Islamic University, the use of LKM is not widely used; lecturers choose to provide material chapter by chapter in electronic form using references from books and the internet. This has an impact on students' low understanding of the lesson because explaining with documents alone is still very monotonous.

2. Material analysis

Analyzing the material based on skill requirements reveals that some chemical materials, including hydrocarbons, have a complex range and understanding. Consequently, there is a need for teaching materials that can aid students in comprehending the material.

3. Student analysis

The objective of student analysis is to identify student characteristics that inform the design and development of educational materials. From the results of the questionnaire, data on student characteristics was obtained, namely as follows.

- 1) The students are proficient with computer operation.
- 2) The average age of the students is between 18 and 22 years old. They are in the formal operations stage or can reason abstractly and solve problems.
- 3) The LKM used is not attractive for hydrocarbon materials.

B. Prototype Stage (Development) Stage

The prototype stage is the initial phase of product development, particularly for STEM-based e-LKM development. The objective of the design phase is to create an e-LKM product design based on STEM principles. This stage begins with devising a STEM-based electronic product framework or storyboard on hydrocarbon materials and designing a product validation board and user interest questionnaire document. The display of the e-LKM 1 title can be seen in Figure 2.

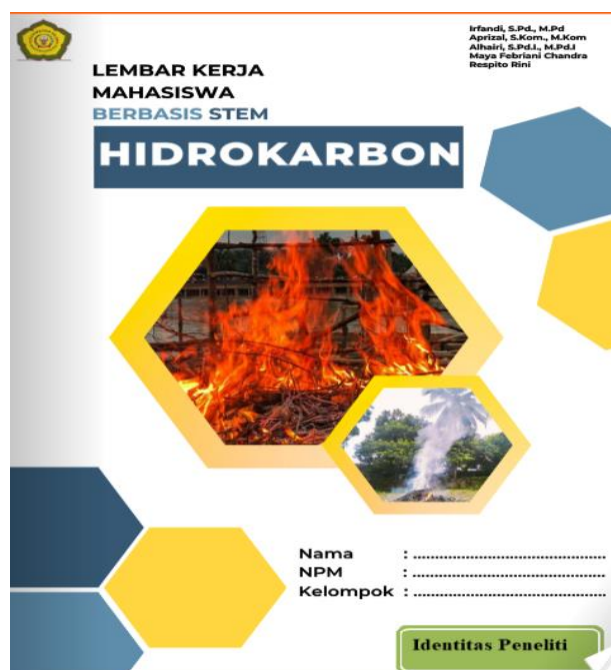


Figure 2. E-LKM cover appearance

The preparation of this e-LKM is also based on the integration of 4 STEM fields of science. The display of STEM integration in e-LKM can be seen in Figure 3.

Figure 3. STEM integration in e-LKM

Using the Kvisoft flipbook creator application, E-LKM was created. This application is used to create electronic modules and electronic documents; images, graphics, and hyperlinks can be inserted during the production process. According to (Tri & Yulian, 2018), flipbooks can help students comprehend incomprehensible abstract topics or events. In addition to the development of e-LKM, the development of a validation table was also undertaken. The validation table uses a Likert scale ranging from 1 to 4.

Expert validation is a phase of e-LKM product design feasibility testing. Validation is conducted by subject matter experts, namely material and media specialists, in accordance with Table 1's indicators. The provided recommendations are then used to enhance the product design that has been developed. The learning development products quality must satisfy the eligibility requirements. E-LKM is intended to be examined initially to identify flaws and areas requiring improvement. Additionally, the modified e-LKM's viability must be evaluated. The percentage of results from material expert validation can be seen in Figure 4.

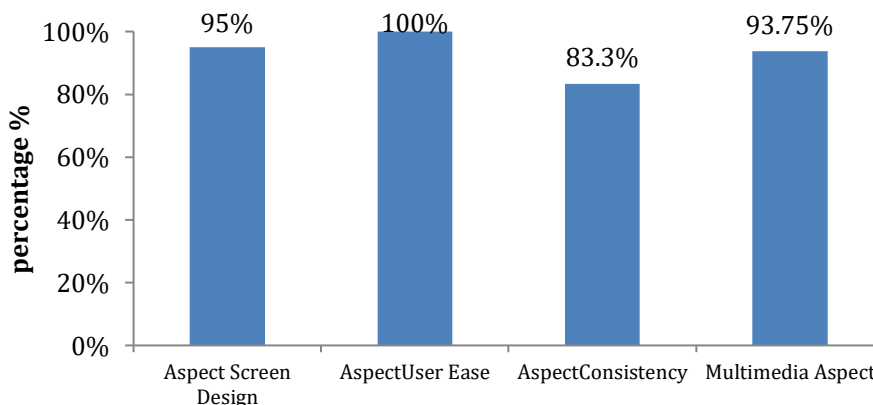


Figure 4. Percentage of Media Validation Results

Aiken V analysis was also used to ascertain the validity of STEM-approach-based e-LKM based on media aspects. The results of Aiken V's analysis of media expert validation can be seen in Table 3.

Table 3. Results of Aiken V Media Validity Analysis

Media validity indicator	Aiken V coefficient	Category
Aspect Screen Design	0.93	Worthy
Aspect User Ease	1	Worthy
Aspect Consistency	0.83	Worthy
Multimedia Aspect	0.92	Worthy
Average	0.92	Worthy

Table 3 shows that all aspects of the media suitability score are high. Validators also provide suggestions and input on the STEM-based e-LKM being developed. This feasibility was obtained because based on the expert validator's comments that the e-LKM media using the Kvisoft Flipbook Maker application had been designed taking into account all aspects of convenience for users. In the validation process, the validator also provided suggestions and input on the media being developed. Suggestions and input from validators in validating media experts can be seen in Figure 5.

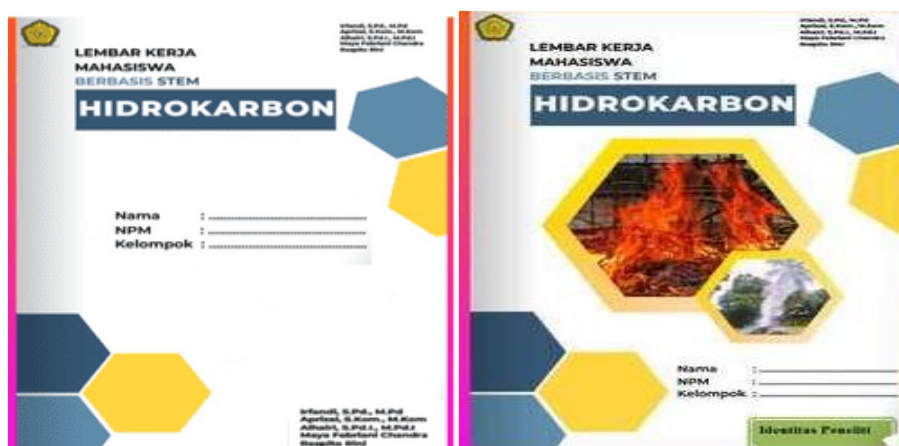


Figure 5. Before and after revision of the e-LKM cover design

Apart from media validation, material expert validation was also carried out. The results of the percentage validation of STEM-based e-LKM development materials on hydrocarbon materials can be seen in Figure 6.

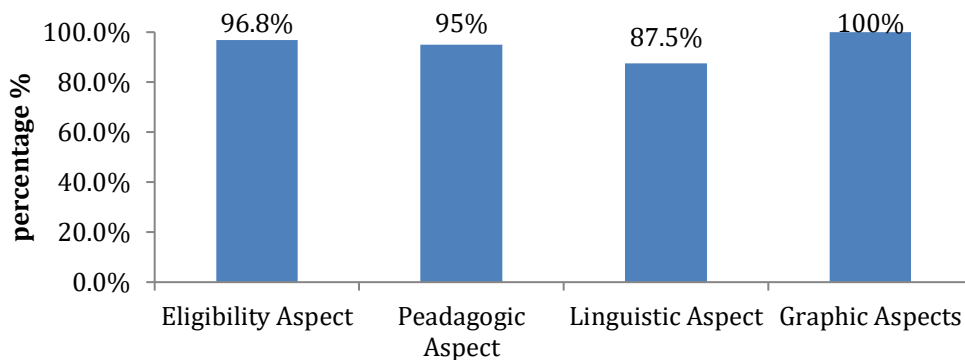


Figure 6. Percentage of Material Validation Results

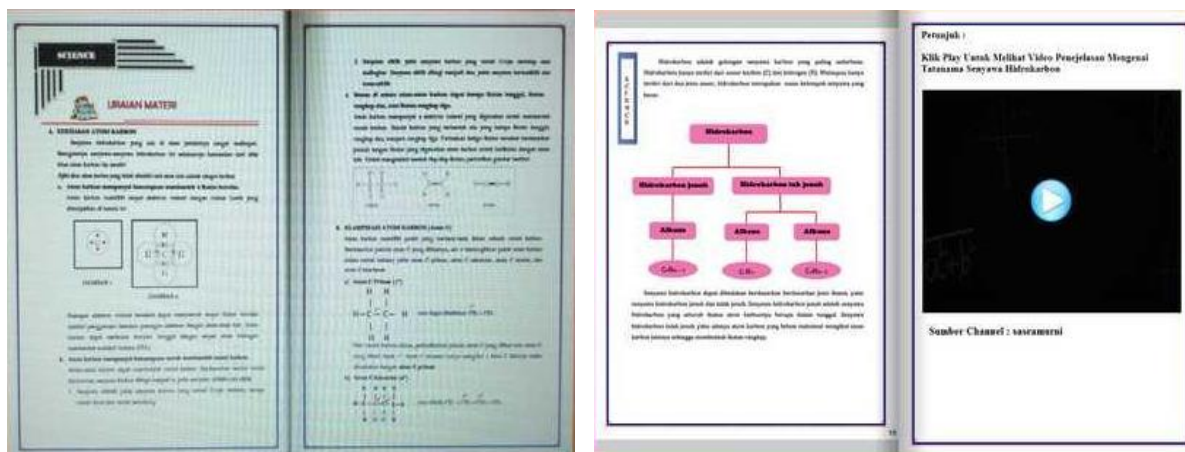
The validation results were also analyzed using Aiken V analysis to determine the validity of STEM approach-based e-LKM from the media aspects developed. The results of Aiken V's analysis of material expert validation can be seen in table 4.

Table 4. Results of Aiken V Material Validity Analysis

Media validity indicator	Aiken V coefficient	Category
Eligibility Aspect	0.96	Worthy
Pedagogic Aspect	0.93	Worthy
Linguistic Aspect	0.83	Worthy
Graphic Aspects	1	Worthy
Average	0.93	Worthy

The preparation of the material also takes into account the needs of students, where students are adults who are able to build their own knowledge and find solutions to these problems. Based on this, the validator provides input for including videos in e-LKM to make it easier for students to understand the material provided. Improvements to the validator can be seen in Figure 7.

Figure 7. Before and after revision of hydrocarbon material content



After validation was carried out by media experts and material experts, it was continued with testing the attractiveness of the product by users, namely 2 lecturers and 10 chemistry education students. The results of user responses from lecturers and students were obtained with percentage results of 87% and 90% in the interesting category. At this stage students are asked to work on the activities in the e-LKM and provide an assessment of them. Students carry out a series of activities in e-LKM according to the usage instructions that have been created. The activities carried out by students are also structured based on the STEM approach to make students have complex knowledge.

DISCUSSION

1. Preliminary Research

Preliminary analysis was a procedure for collecting information on student issues. This was used to determine whether solutions exist for student problems and to identify student requirements. Beladina & Suyitno (2013) The devised e-LKM was used to facilitate the learning process. Students constructed their own knowledge using a variety of learning resources and as an instrument for constructing student knowledge. According to research by Pertiwi et al (2017), LKM Science-based, Technology-based, and Engineering and Mathematics (STEM) effectively trains students' inventive thinking abilities. Students were taught to seek for data through problem-solving activities and detailed and systematic steps, so that they could respond in a variety of ways to various queries.

2. Prototype Stage

Several phases were completed in this development process, including material analysis activities and learning descriptions to determine indicators, lecture accomplishments, and LKM-created learning materials. The next step involved determining the structure of the LKM to be created. Using a STEM (Science, Technology, Engineering, and Mathematics) methodology, an E-LKM was created. Science as a concept, science as a process, technology as the application of science, engineering as science engineering, and mathematics as an instrument were included in LKPD's STEM curriculum. Then, the LKM was developed using a variety of components, including narratives, experiments, exercises, and essential information on hydrocarbon materials. The e-LKM design was developed based on an adaptation from (Daryanto & Dwicahyono, 2014), the designed e-LKM format consists of a title, work instructions, learning objectives and accomplishments, study materials, learning activities, supporting information, and evaluation. STEM-based e-LKM learning activities are designed on the basis of a model that supports active and independent learning, involving students in known contextual problems, distinctions in student characteristics, and social learning processes (Micari & Pazos, 2020; Puspitasari et al., 2021)

3. Assessment Stage

The Aiken V analysis data derived from an expert validator's evaluation of 0.93 indicates that the category is valid, so it can be used with minor modifications. The obtained validity results indicate that the STEM-based e-LKM development is declared valid with minor modifications from the validator. This statement is consistent with Banjarani et al (2020) research, which indicates that the development of LKM has attained an average value that is included in the valid criteria, with enhancements based on the validator's suggestions. Vennix et al (2017) explained that the validity of e-LKM can be determined by the presentation of items that incorporate teaching materials that include text, images, and videos that support learning activities. Based on validation data and the outcomes of discussions regarding STEM-based e-LKM products, researchers made a few minor modifications. According to Zahroh & Yuliani (2021), validation of e-LKM is essential for ensuring the practicability of using e-LKM in terms of presentation consisting of a design of a collection of student activities to attain learning indicators.

The incorporation of STEM-based E-LKM into the learning process can enhance student creativity. This is consistent with Ibáñez & Delgado-Kloos's (2018) finding that STEM-based worksheets are effective at nurturing student creativity and can teach students to comprehend the concepts and principles of contextualized material. Moreover, research by Zahara et al (2020) indicates that STEM-integrated instructional materials can increase students' learning motivation and creativity. This demonstrates that E-LKM makes it simpler for educators to distribute content and for students to receive and study the content (Romayanti et al., 2020). The assertion of Mas'ud et al (2021) that valid technology-based teaching materials can increase mastery of learning material supports these findings. In addition to making, it simpler to receive documents, electronic media also facilitates collaboration between parties (Irfandi et al., 2020).

According to Putri & Susanti (2021), learning aids are considered attractive and practicable if their use by educators and students does not present any obstacles or difficulties. In addition, Khamdun et al (2021) stated that a learning tool is fascinating and practical because the language used in the media is simple and communicative, thereby eliciting a positive response from the users. Apart from that, arranging the media in accordance with the allocation of learning time, several obstacles also exist in this development, including the lack of innovation and creativity in designing e-LKM. According to Irfandi & Murwindra's (2022) research, media design creativity is one of the obstacles to developing multimedia-based devices.

Student learning outcomes were enhanced when LKM was used to teach chemistry. The implementation of learning was in accordance with a series of processes contained in the LKM research results from Falloon et al (2020), who stated that STEM-based learning can enhance students' experiences because practical activities, discussions, and application of general principles from the material make students inquisitive, thereby encouraging students to interact and collaborate with one another and fostering their

creativity. Through discussion activities, practicums, and manufacturing projects, chemistry learning activities related to science, technology, engineering, and mathematics can motivate students to continue learning and enhance student learning outcomes (Yusuf, 2015).

CONCLUSIONS

Based on the findings of research and development, an e-LKM product was created using the Kvisoft flipbook creator application, which was developed using the Plomp development model, and a STEM approach to hydrocarbon materials. The validation test results indicate that the developed e-LKM based on the STEM methodology for hydrocarbon materials using the kvisoft flipbook creator application is valid and therefore applicable in terms of materials and media. The validity of e-LKM was demonstrated by material expert validation of 0.93 and media validity of 0.92 for the appropriate category, as determined by Aiken V analysis. The percentage of material validity results is 94.8 percent, and the media category is suitable for use in 93% of cases. The results of user responses from lecturers and students yielded percentages of 87% and 90% for the category "interesting." This research represents an innovation in the field of education in response to technological advancements and the challenges of learning in the twenty-first century.

On the basis of the findings of the research, developmentally appropriate instructional materials, such as e-LKM, can be created. This innovation is essential for education in the twenty-first century. Using Kvisoft flipbook producer, additional researchers are able to create e-LKM in other formats. Students can use the product resulting from this development as a study guide and a means of acquiring 21st-century skills and expanding their knowledge. In addition, this research is extremely valuable as an alternative chemistry teaching resource for educators. Apart from that, it is anticipated that the results of this research can motivate future researchers to conduct more in-depth research on the creation of chemistry learning tools, particularly in developing e-LKM.

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