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Development of Electronic Student Worksheet Based on CORE (Connecting, Organizing, Reflecting and Extending) on Hydrocarbon Materials

Hikmah Salamah Huriyah, Roza Linda*, Herdini
Faculty of Teacher Training and Education, Universitas Riau, Pekanbaru, 28293, Indonesia

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* *Corresponding author:*

E-mail: rozalinda@gmail.com

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A B S T R A C T

This study aims to produce a valid and usable CORE-based E-LKPD on hydrocarbons. This study was conducted at two schools, namely SMAN 6 Pekanbaru and SMAN 7 Pekanbaru. The study was motivated by students' difficulties in learning chemistry, particularly the hydrocarbon material, due to the teaching materials used being monotonous, poorly designed, and failing to utilize the rapidly advancing technology available today. This study includes validation and limited testing. This study used an R&D development research design with a modified 4-D model (Define, Design, Develop, Disseminate) into a 3-D model (Define, Design, Develop). The research results based on validation by content validators regarding content suitability, CORE characteristics, language, presentation, and graphics, respectively, achieved suitability scores with an average of 100%, indicating validity. Meanwhile, the validation results by media validators based on the aspects of appearance and software utilization had a feasibility score of 98.43% on average. The results of the responses from chemistry teachers and limited group trials obtained average percentages of 98.75% and 87.49%, respectively, with valid criteria. This shows that the CORE-based E-LKPD on the subject of hydrocarbons is practically used as teaching material in the learning process and students are more interested in learning hydrocarbon material.

1. Introduction

Effective learning should facilitate students' understanding of concepts. Understanding concepts can be supported by supporting components of good learning activities, one of which is teaching materials (Widiastuti, 2020). Teaching materials are components that support learning activities that are equipped with information so that students are facilitated to understand the material (Putri, 2020). An interesting learning process can foster students' curiosity about learning material. Learning materials that are easy to understand will improve student learning outcomes so that the learning objectives designed by the teacher are

achieved according to the curriculum used. To achieve this, the competence of expertise in utilizing technology must be owned by teachers in developing teaching materials (Sriwahyuni et al., 2019). The qualities of effective teaching materials, as outlined by Depdiknas (2004), include content derived from the competency standards in the curriculum, clarity for easy understanding, engaging data, and readability.

Chemistry consists of material with abstract concepts (Johnstone, 2000). Chemistry is indispensable in everyday life because of its relevance to human life. Hydrocarbon is one of the chemistry materials in class XI SMA/MA and necessitates a clear comprehension of the concept. Based on interviews conducted with chemistry teachers at SMAN 7 Pekanbaru and SMAN 6 Pekanbaru, information was obtained that difficulties were experienced by students in hydrocarbon material. This is evidenced by as many as 50% of students have not reached the completeness of the Criteria for Achievement of Learning Objectives set by the school of 75. Learning materials tend to be memorized by students rather than understanding the concept of the material and the monotonous learning process so that students are not active and bored in the learning process. Teachers have difficulty in designing interactive teaching materials such as audio and video. The design of the LKPD used is less attractive, containing only a few pictures without videos related to the material. In addition, there are no instructions for using LKPD and no learning model. Technology tends to be underutilized in learning and the material is not connected to everyday life, so that students not only have difficulty in understanding the material but also do not take advantage of the technology that is developing today. Therefore, it is necessary to develop teaching materials and innovative learning models so that the material studied can be connected to everyday life and can utilize technology.

Innovative teaching materials using technology are Electronic Learner Worksheets (E-LKPD). E-LKPD has the advantage of being flexible because it can be accessed anywhere and anytime so that students are easy to use (Yuzan & Jahro, 2022). E-LKPD can be an interesting tool because there can be video features, audio, images, links, and more varied forms of questions as well as a series of stages of learning activities for understanding the concept of learning material (Syafitri & Tressyalina, 2020). One of the learning models that can connect material with everyday life is the CORE learning model. The CORE learning model is designed with the aim that students' abilities can be built through connecting, organizing, reflecting, and extending knowledge (Wati et al., 2019). The advantages of the CORE learning model are that it provides learning experiences so that students play an active role and learning becomes meaningful (Shoimin, 2014). The use of the CORE learning model when the learning process takes place is proven in several studies to be able to improve students' learning outcomes on chemical materials (Raihana et al., 2017).

Making CORE-based E-LKPD requires a supporting software, one of which is iSpring Suite. iSpring Suite is a media that can be integrated with PowerPoint and has the ability to convert presentation formats into files in flash format. In addition, tools are provided for making questions with various types and scores can be

processed automatically (Kusuma et al., 2018). The advantages of iSpring Suite are that images, videos, audio can be added so that the resulting learning media becomes more interactive and interesting (Khotimah, 2019). Another advantage of Ispring Suite is that when working on E-LKPD, it can be done offline. Internet connection is only needed when installing iSpring suite and submitting E-LKPD answers so that it can save quota.

This study aims to produce CORE-based LKPD on hydrocarbon material that is valid and feasible to use. This research involves validation and limited trials. This research uses a Research and Development design based on the 4-D model (Define, Design, Develop, Disseminate) which is modified into 3-D (Define, Design, Develop). The validation results from material validators who assessed the feasibility of content, CORE characteristics, language, presentation, and graphics, resulted in an average feasibility score of 100%, which indicates that the material is valid. In addition, media validators assessed the appearance and use aspects of the software, resulting in an average eligibility score of 98.43%. Responses from chemistry teachers and limited group trials showed an average percentage of 98.75% and 87.49%, both of which were included in the valid criteria.

Based on relevant research conducted by Rahayu, N (2022) with the title "Development of Interactive E-LKPD Chemistry Teaching Materials with CORE-based liveworksheet on Buffer Solution Material for Class XI" obtained the overall percentage of validators of 86%. Thus interactive E-LKPD with CORE-based liveworksheet on buffer solution is included in the category of feasible to use in the learning process on buffer solution chapter material. Then the research conducted by Audreyta et al., (2024) with the title "Development of CORE-Based E-LKPD to Stimulate Students' Creative Thinking Ability on Thermochemical Material" obtained E-LKPD which is valid and feasible to use by users with a percentage of 94.19% from material experts and 100% from media experts. Teachers and students as users gave a positive response to the E-LKPD developed with a percentage of 94.44% and 83.74% respectively. Research was also conducted by Batubara et al., (2024) with the title "Development of E-LKPD Thermochemistry Based on Connecting, Organizing, Reflecting, and Extending Assisted Liveworksheet in Class XI SMA / MA Equivalent". The results showed that E-LKPDs were valid by material validators based on aspects of content feasibility assessment, CORE characteristics, language, and presentation with a percentage of 95.4% and media validators based on aspects of E-LKPD size, cover design, and content design with a percentage of 100%. E-LKPD user response obtained from the assessment of chemistry teachers and students of class XI SMA / MA equivalent shows that E-LKPD is very good and feasible based on aspects of attractiveness, effectiveness, and practicality with a percentage of 90.23%.

This research aims to produce CORE-based E-LKPD on the topic of Hydrocarbons XI for Senior High School/MA Equivalent that is valid according to subject matter experts (based on content feasibility, CORE characteristics, language, presentation, and graphics) and media experts (based on software utilization and display) as well as to determine user response to the development of CORE-based E-LKPD on the

topic of hydrocarbons XI for senior high school/equivalent levels when used in the learning process.

2. Methodology

This research was conducted at Riau University. The CORE-based E-LKPD development method was designed with the Research and Development (R&D) development method using the 4-D development model was modified to 3-D. The types of data collected are quantitative data including the number of product validation results and the number of product trial questionnaire results and qualitative data which includes data analysis results from validation tests and questionnaires. The validation sheet is used to identify the validity criteria of CORE-based E-LKPD as teaching materials in class XI chemistry learning on hydrocarbon material.

The validation sheet is used to assess E-LKPD based on aspects of content feasibility, CORE characteristics, language, presentation, graphics, appearance and software utilization. Three validators were involved in the E-LKPD assessment, consisting of two material experts and one media expert. The data that has been obtained from the validation sheet assessment is presented in the form of a Likert scale with a score of 1-4 so that there is no opportunity for the validator to be neutral. The teacher response questionnaire was addressed to 2 chemistry teachers and the student response questionnaire was addressed to 20 students to identify the criteria for user response to CORE-based E-LKPDs as teaching materials in class XI chemistry learning on hydrocarbon material. The percentage results of the validation assessment and user response that have been obtained are then converted into qualitative values as presented in Table 1 below.

Table 1. Criteria for Validation Assessment and User Response Questionnaire Assessment (Riduwan, 2012)

Percentage	Criteria
80,00-100	Valid
60,00-79,99	Valid Enough
50,00-59,99	Less Valid
0-49,99	invalid

3. Result and Discussion

The defining stage was based on the results of interviews with chemistry teachers at SMAN 6 Pekanbaru and SMAN 7 Pekanbaru, which revealed that students tend to be less active, bored and have difficulty in learning chemistry on hydrocarbon material as evidenced by 50% of students have not reached KKTP. Teachers have difficulty designing interactive teaching materials. The LKPD used only contains some pictures and questions. There are no instructions for using LKPD and no learning model. The development of increasingly sophisticated technology requires that teaching materials such as E-LKPD be utilized (Sari dkk, 2016). The

development of teaching materials is very important for educators because teaching materials greatly affect the effectiveness of the learning experience (Ramdoniati, et al., 2019).

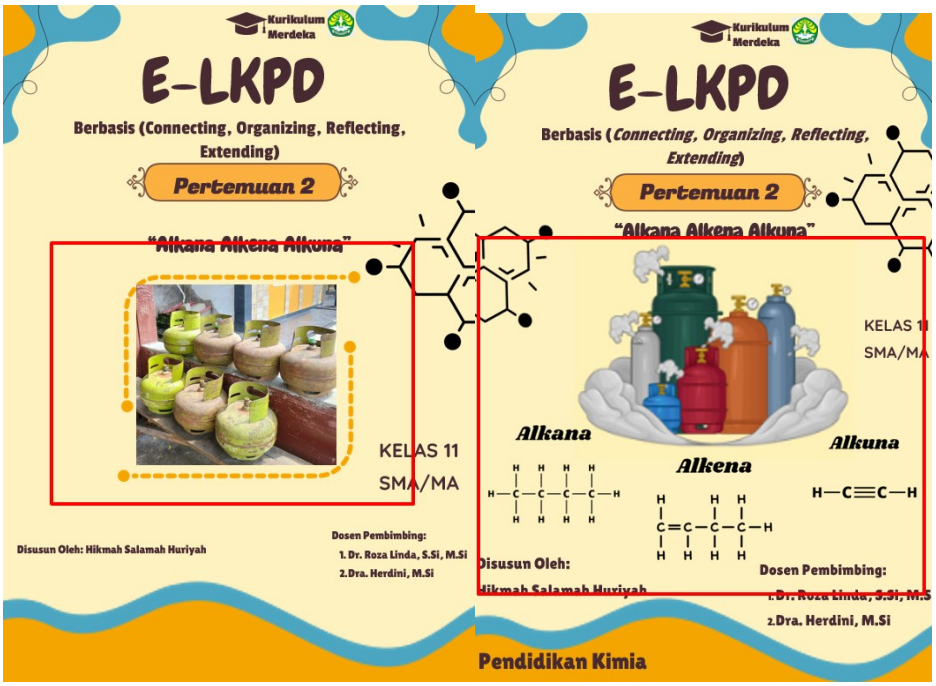
The subject matter of hydrocarbons is studied by SMA / MA students with an age range of 16-18 years. At this age, deductive hypotheses can be developed by students regarding problem solving and drawing conclusions systematically (Marinda, 2020). The defining stage also produces a task analysis, which serves as a systematic framework for determining the content in the learning unit. Task analysis includes several components, namely content structure analysis, concept analysis, procedural analysis, and goal analysis (Trianto, 2014). From the content structure analysis, the Learning Outcomes, Learning Objectives, and Indicators of Achievement of Learning Objectives are determined, all of which are in accordance with the independent curriculum syllabus from the Ministry of Education, Culture, and Research (Mendikbudristek, 2024). Effective images in LKPD are those that can convey the message or content of the image effectively to the users of the LKPD as shown in figure 1.

(a) (b)

Figure 1. Improvements Based on Validator Suggestions
(a). Before improvement
(b). After improvement

The material validator provided several suggestions to improve the E-LKPD currently being developed. The improvements shown in Figure 1 are that the validator suggested adding a brief biography of the figure who played a role in the discovery of hydrocarbons as additional information. This is in line with what Novita (2023) stated, that the addition of scientist information aims to provide information related to the learning material and contains interesting information

that is rarely known by students and broadens their knowledge. The images available in the E-LKPD align with the material, thereby aiding students in understanding the material effectively. As stated by Nurdin and Adriantoni (2016:114), in developing LKPD, certain technical requirements must be met, particularly regarding images.



(a) (b)

Figure 2. Improvements Based on Validator Suggestions
(a). Before improvement
(b). After improvement

The design stage produced initial E-LKPD designs such as E-LKPD titles, instructions for using E-LKPD, Learning Outcomes and Learning Objectives, E-LKPD materials, learner activities, practice questions and bibliography. The preparation of student worksheets based on the CORE learning model is carried out through the stages of connecting, organizing, reflecting, and expanding knowledge (Wati et al., 2019). This stage also produced validation sheets, teacher response questionnaires and student response questionnaires. The validation sheet is prepared based on the eligibility category of teaching materials according to Depdiknas (2008). The validation sheet that will be assessed by the validator is a validation sheet for material experts and media experts. The results of the development stage are CORE-based E-LKPDs using iSpring Suite 10 on the subject of hydrocarbons in class XI SMA/MA equivalent which are valid. CORE-based E-LKPD has passed the validation and limited trial stages. Validation was conducted twice by two material expert validators and one media expert validator. The numbers that have been obtained are then processed and calculated the average percentage score as shown in Table 2.

Table 2. Percentage of Validation Results by Material Validators

No	Assessment Aspect	Percentage Score of Validation I	Percentage Score of Validation II
1	Content Feasibility	79,16 %	100 %
2	Feasibility of CORE Characteristics	75 %	100 %
3	Presentation	70,83 %	100 %
4	Language	75 %	100 %
5	Graphics	56,25 %	100 %
Average Percentage Score		71,24%	100 %
Validity Category		Valid Enough	Valid

Table 2 shows the results of the average percentage of the 1st validation score of 71.24% categorized as quite valid. Some suggestions and comments have been given by the material expert validator, so that improvements are made to get a more optimal assessment in the process of improving the CORE-based E-LKPD. After the 2nd revision and validation were carried out, an average percentage score of 100% was obtained in the valid category. This proves that the E-LKPD developed is in accordance with the applicable curriculum, following the procedures of the CORE learning model. The material on the E-LKPD presented is in accordance with the learning outcomes and objectives. The sentences used in the E-LKPD are considered very clear and easy to understand, so that students do not experience multiple interpretations. This is confirmed by Sihafudin (2020) who states that the assessment of language aspects is important because the language in E-LKPD serves to connect students in interpreting the information contained in the teaching materials, and minimizes misinterpretation as shown in Table 3.

Table 3. Percentage of Validation Results by Media Validators

No	Assessment Aspect	Percentage Score of Validation I	Percentage Score of Validation II
1	feasibility of display	84,37%	96,87 %
2	software utilization	100%	100 %
Average Percentage Score		92,18%	98,43 %
Validity Category		Valid	Valid

The average percentage of the 1st validation score given by the media validator is 92.18%. However, there are some suggestions and input to improve the CORE-based E-LKPD. After revisions were made, the 2nd validation results were obtained with an average percentage score of 98.43% in the valid category. This proves that the design on the E-LKPD has been considered attractive both in terms of font type, font size, color composition, layout and layout used, thus attracting the attention of students to use the E-LKPD. According to Majid (2017: 374) the attractiveness of the E-LKPD appearance is expected to attract the attention of students, and not cause a saturated and boring impression. The use of iSpring Suite in making learning media can present an attractive and communicative media display so that it can increase students' learning motivation (Ramadani & Nana, 2020). Therefore, the CORE-based E-LKPD on the subject of hydrocarbons can be tested. The one-on-one trial was conducted to 3 students at SMAN 6 Pekanbaru with different cognitive abilities namely high, medium and low with the help of information from the chemistry teacher. The purpose of the one-on-one trial was to minimize and find

errors that appeared on the E-LKPD. Before working on E-LKPD, the researcher gave an explanation of how to use E-LKPD so that students felt directed in working on E-LKPD. Learners can work on E-LKPD well, judging from the results of the E-LKPD work assessment. Interviews were conducted by researchers to the three students after completing the E-LKPD work to find out the students' responses when using E-LKPD. Comments and suggestions from students become a reference, so that a good E-LKPD is produced and ready to be tested for chemistry teacher responses and small group trials. The results of the trial were conducted to one chemistry teacher at SMAN 6 Pekanbaru and SMAN 7 Pekanbaru. The E-LKPD that had been given was considered by the teacher and assessed in the teacher response questionnaire. The response test with the chemistry teacher was conducted directly using a smartphone as shown in Table 4.

Table 4. Chemistry Teacher Response Test Results

No	Assessment Aspect	Average Score
1	Content eligibility	100 %
2	Effectiveness	95 %
3	Practicality	100 %
4	Attractiveness	100 %
Average Total Percentage Total		98,75 %
Response Category		Valid

An average score of 98.75% was achieved from the chemistry teacher response test data, which was categorized as valid. According to the chemistry teacher, the CORE-based E-LKPD motivates students in learning, so that learning will take place well and actively and the E-LKPD is in accordance with the teaching material and the material studied can be connected to everyday life. This is emphasized by research by Wahyuni et al., (2021) which says that teaching materials that contain phenomena that occur in everyday life have good potential to build students' thinking skills. The small group test was conducted on 20 students, consisting of 10 students of SMAN 6 Pekanbaru and 10 students of SMAN 7 Pekanbaru. The response of small group test users obtained positive results in accordance with the validation results on the aspects of attractiveness, effectiveness and practicality. According to the respondents, the E-LKPD developed is very easy to use and has an attractive appearance so as to motivate students in learning chemistry, especially on hydrocarbon material as shown in Table 5.

Table 5. Recapitulation of Group Trial Response Results

No	Assessment Aspect	Average Percentage
1	Attractiveness	87, 08%
2	Effectiveness	87,91%
3	Practicality	87,5%
Average Total Percentage		87,49 %
Response Category		Valid

The overall average percentage result obtained was 87.49% with a good response category. This shows that the CORE-based E-LKPD on the subject of hydrocarbons is practically used as teaching material in the learning process and students are more interested in learning hydrocarbon material.

4. Conclusion

The results of validation by material validators based on content feasibility, CORE characteristics, language, presentation, and graphics obtained a valid validity category. Validation by media experts based on software appearance and usability aspects resulted in a score categorized as valid. Teachers' positive feedback regarding content relevance, effectiveness, practicality, and presentation appeal was categorized as valid. This is supported by students' feedback that CORE-based E-LKPD is considered good in terms of appeal, effectiveness, and practicality, categorized as valid.

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