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Pengembangan e-LKPD Materi Penurunan Titik Beku Berbasis *Chemo-Entrepreneurship* Berbantuan *Wizer.me* Berorientasi Kreativitas Siswa

(Development of a Wizer.me Assisted Chemo-Entrepreneurship Based e-Worksheet on Freezing Point Depression Oriented Toward Students Creativity)

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ABSTRACT. This study aims to find out the process of developing teaching materials, the level of conceptual feasibility based on the assessment of material experts, media experts, teacher assessments and student responses to e-LKPD of chemo-entrepreneurship-based frozen point reduction material assisted wizer.me creativity-oriented. This research is a development research using the Lee & Owens model. The instruments used in this study include interview guidelines, student needs questionnaires, expert validation sheets, teacher assessment sheets, and student response questionnaires. The analysis techniques used are qualitative and quantitative data analysis, the results are validated by material experts and media experts. The results of the study show that the e-LKPD developed has met the feasibility criteria conceptually and procedurally. The validation of material experts obtained an average score of 4.58 or 91.6% (very feasible), the validation of media experts of 4.62 or 92.4% (very feasible), and the teacher's assessment of 4.56 or 91.2% (very feasible). The product trials were carried out through small group trials, each of which obtained a response percentage of 89.4% with the very good category. Based on the results obtained, it can be concluded that the e-LKPD of chemo-entrepreneurship-assisted wizer.me creativity-oriented frozen point reduction material developed is declared feasible and very good for use in the chemistry learning process, especially frozen point reduction material. This media is able to help students understand the material contextually and the learning atmosphere is more interesting.

INTRODUCTION

Education is a process that is designed to develop individual abilities while improving the quality of human resources. However, education must also be able to adapt to the rapid development of the times, especially technological advances and the demands of globalization. This encourages the Indonesian government to carry out education reforms, one of which is through curriculum updates to be relevant to the needs of the 21st century. The curriculum is the main guideline that directs the learning process from planning to evaluation, so that educational goals can be achieved effectively [1].

In 21st century learning, students are not only required to master basic knowledge, but also need to have high-level thinking skills (Higher Order Thinking Skills/Hots) and able to integrate information and communication technologies (Information and Communication Technology/ITC) in learning carried out by the Ministry of Education and Culture in 2022. The independent curriculum emphasizes strengthening the 6C competencies, namely Critical thinking, communication, collaboration, creativity, citizenship, and character as Competencies needed to face future challenges [2]. Among these competencies, creativity is an important aspect because it is related to the ability to generate new ideas, develop solutions, and create innovative products.

The demands of modern learning are very relevant in chemistry learning that contains abstract concepts. Based on the results of observations in school, one of the materials that is considered difficult is the reduction of the freezing point, because it requires an understanding at the particle level, systematic reasoning, and the ability to connect concepts with real phenomena [3] . This condition causes learning to be meaningless if it only relies on theoretical explanations and printed books. The results of the analysis of student needs show that most students have difficulty understanding the material on freezing point reduction. In addition, the teaching materials used previously were still limited to printed books, were informative but less visually appealing and did not support the application of concepts in real-life contexts. In fact, students show a high interest in contextual and project-based

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learning, including simple ice cream making projects that are relevant to the concept of freezing point. Based on these conditions, the main problem in this study is the limitation of chemistry teaching materials that are able to explain the concept of reducing freezing points contextually, encourage active student involvement, and develop student creativity according to the demands of the independent curriculum.

21st century learning is about increasing student engagement. One of the digital teaching materials that can support this is Electronic Student Worksheet or e-LKPD. E-LKPD allows teachers to develop structured, interactive, and use digital media learning activities to improve understanding of concepts. Approach chemo-entrepreneurship It is also considered relevant in chemistry learning because it connects chemistry concepts with real products that have use value and selling value, so that learning becomes more applicable [4] [5]. In addition, the Project Based Learning (PJBL) has been proven to be able to increase student involvement through activities to design, make products, and evaluate learning outcomes [6] . In terms of technology, the platform wizer.me It is reported to be effective as a teaching material because it provides engaging, collaborative, visual features, and supports various forms of digital assessment [7]. Nonetheless, most previous research has still focused on improving understanding of concepts and learning outcomes. Development of assisted e-LKPD wizer.me integrated chemo-entrepreneurship and specifically oriented to students' creativity in the material of reducing freezing points is still limited. This gap shows the need to develop teaching materials that not only improve understanding of concepts, but also foster creativity as an important competence of the 21st century.

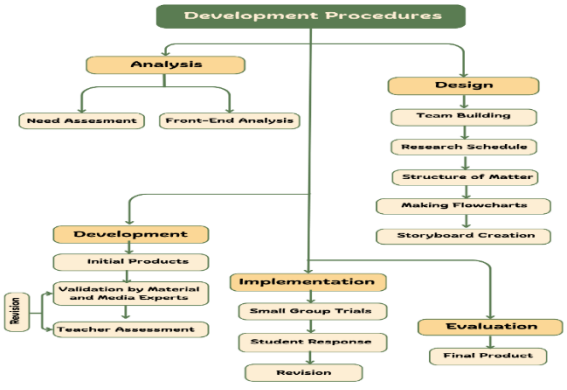
This study aims the development of e-LKPD on freeze-based de-freezing point reduction materials chemo-entrepreneurshi Help wizer.me Designed using the context of a simple ice cream making project to help students understand the concept of freezing point reduction in concrete terms through structured activities. Selection wizer.me based on its ability to provide hands-on and visual activities that can increase student engagement [8]. Chemo-entrepreneurship The e-LKPD also provides a space for students to associate chemical concepts with product making, so that learning is more meaningful and applicative.

The value of the novelty of this research lies in the integration of three main components in one digital teaching material innovation, namely: e-LKPD assisted by the wizer.me platform, a product-based chemo-entrepreneurship approach to relate chemical concepts with real contexts, and the orientation of developing students' creativity as the main learning objectives. Student creativity in this study is directed at four indicators, namely fluency, flexibility, originality, and elaboration, so that the products developed not only facilitate the understanding of the concept of freezing point reduction, but also train students' ability to generate ideas, design solutions, and develop innovative products.

Based on this description, this study aims to develop an development of a wizer.me assisted chemo-entrepreneurship based e-worksheet on freezing point depression oriented toward students creativity. Teaching materials are developed in the form of digital media with direct feedback that combines material presentation, project-based learning, and evaluation exercises to increase student engagement in learning.

RESEARCH METHODS

In this study, the type of research used is research and development. In this study, a product was produced in the form of the development of e-LKPD on chemo-entrepreneurship-based freezing point reduction material assisted wizer.me student-oriented creativity. The development model used in the study was the one developed by Lee & Owens. The Lee & Owens model is a procedural development model in which the sequence in the development process is systematically arranged and at each stage of development is clearly arranged. This model



consists of 5 stages that are adjusted to the ADDIE framework, namely (Analysis, Design, Development,implement, Evaluate). A more detailed development procedure can be seen in Figure 1.

Figure 1. Development Procedure

At the analysis stage, the researcher conducted a study of problems in chemistry learning at SMA Negeri 8 Muaro Jambi, which includes: (1) needs analysis, (2) student characteristics analysis, (3) objective analysis, (4) material analysis, and (5) educational technology analysis. This stage is carried out to understand the situation and conditions in the field, so that proper analysis is needed. Furthermore, at the design stage, the main goal is to design teaching materials to be developed, so that e-LKPD is produced with chemo-entrepreneurship-based frozen point reduction materials. The design stages include several activities, such as the formation of a development team, the determination of research schedules, the preparation of product specifications, the design of material structures, and the creation of flowcharts and storyboards for e-LKPD teaching materials. At this stage, an initial evaluation of the product design is also carried out before entering the development stage.

At the development stage of making learning media according to the design that has been prepared, e-LKPD is a Wizer.me platform to package e-LKPD into digital teaching materials with the integration of various learning components such as text, images, videos, interesting features and direct interaction. After the product is completed, validation is carried out by material experts and media experts to assess the suitability of content, appearance, language, and the feasibility of using media. Suggestions and inputs from validators are used as the basis for product revisions until e-LKPD is obtained that is suitable for use. At the implementation stage, a trial was carried out for grade XII F.3 students at SMA Negeri 8 Muaro Jambi. The chemistry teacher first assesses the developed media. After that, a small group trial was carried out to see the suitability of e-LKPD in learning and to see the students' response to the teaching materials developed.

The final stage is evaluation, this stage is carried out formatively at each stage of analysis, design, development, and implementation as the basis for product improvement. Evaluation at the analysis stage ensures the suitability of students' needs with classroom conditions, at the design stage assesses the alignment of the media design with learning outcomes and the syntax of the project-based learning model, and at the development stage analyzes the appearance, content of the material, activities, and functionality of the teaching materials before the implementation stage. In the implementation stage, the evaluation refers to the level 1 (reaction) of the Lee & Owens model to determine the students' responses. The evaluation aims to determine the feasibility level of e-LKPD based on the results of validation of material experts, media experts, teacher assessments, and student responses. The results of the evaluation became the basis for the final revision so that e-LKPD based on chemo-entrepreneurship assisted by wizer.me was obtained that is suitable for use in chemistry learning.

The test subjects in this study were students in grade XII F.3 of SMA Negeri 8 Muaro Jambi. The trial was conducted in a limited manner in small group tests involving 10 students. Subjects were randomly selected taking into account differences in cognitive abilities (high, medium, and low) based on the chemistry teacher's recommendation. The trial was carried out to obtain student response data to the developed e-LKPD, so that the results can be used as a basis for improvement and improvement of the product.

This research produced two types of data, namely qualitative data and quantitative data. Qualitative data was obtained through interviews with chemistry teachers as well as validation sheets from subject matter experts and media experts with comments and suggestions for improvement. Meanwhile, quantitative data was obtained from assessment scores given by material experts, media experts, teachers, and student response questionnaires after the use of e-LKPD. Both types of data are used as a basis to assess the feasibility and quality of the e-LKPD developed.

Data collection in this study was carried out through interviews and questionnaires that were selected because they complemented each other, interviews were conducted with chemistry teachers to obtain qualitative data related to learning needs, obstacles faced, and classroom conditions. Meanwhile, the questionnaire was used to collect quantitative data in the form of assessment scores from material experts, media experts, teachers, and student responses after using e-LKPD, as well as qualitative data in the form of comments and suggestions. The combination of the two techniques provides more comprehensive information as the basis for the development and improvement of e-LKPD based on chemo-entrepreneurship assisted by wizer.me. The data collection instruments in this study were compiled to obtain data at each stage of development. The instruments used include interview guidelines to explore the initial learning needs, validation sheets for material experts and media experts to assess the feasibility of products, and teacher assessment questionnaires. In addition, the student response questionnaire was used to find out the responses and students after using the developed e-LKPD. The data that has been collected

is then analyzed based on assessments on the instruments of student needs and characteristics, validation of material experts, media, and teachers, and student responses. The calculation of the analysis of the needs and characteristics of the students is carried out using the rating scale through the calculation:

$$\%\ Score = \frac{Total\ score\ obtained}{Total\ score}\ x\ 100\%$$

The data obtained from the analysis of the validation sheets of media experts, materials, and teacher assessments are quantitative. The validation categories by expert and teacher are based on the average answer score, which is calculated through the following formula:

$$Average\ score = \frac{Total\ score}{Number\ of\ items}\ \text{x}\ 100\%$$

Furthermore, the data obtained was then analyzed and processed descriptively into interval data using the Likert scale. The scale that has higher variability, is good and complete is the scale of five. The criteria of the scale five used are the criteria in table 1.

Table 1. Categories of Expert Validation Assessment and Teacher Assessment

Scale	Criteria
5	Excellent (SB)
4	Good (B)
3	Less Good (KB)
2	Not Good(TB)
1	Very Bad (STB)

[9]

After getting scores from material experts, media, and teachers, the product was then tested on students through small group testing consisting of 10 students who had different cognitive abilities ranging from low, medium and high. Student responses were analyzed according to the average score on the likert scale and the percentage of eligibility to determine the extent to which the product is feasible to use. The score obtained is converted to a value using the following formula:

$$\text{K} = \frac{\text{F}}{\text{N X I X R}}\ \text{x}\ 100\%$$

Description:

K = Eligibility Percentage (100%)
F = total number of respondents' answers
N = Highest score in the questionnaire
I = Number of questions in the questionnaire
R = Number of respondents

The assessment criteria for the percentage of student response questionnaires are presented in table 2.

Table 2. Category of Assessment Student Response Instruments

Yes	Average Score	Criteria
1	>81% – 100%	Excellent
2	>61% – 80%	Good
3	>41% – 60%	Less Good
4	>21% – 40%	Not Good
5	1%– 20%	Very Bad

[10]

RESULTS AND DISCUSSION

The results of the research and at the same time a comprehensive discussion was given regarding the feasibility of e-LKPD in chemo-entrepreneurship-based freezing point reduction material assisted wizer.me

oriented to student creativity. The results of the study were presented based on the validation of material experts, the validation of media experts, teacher assessments, and student responses in small group trials. The results are presented in the form of a table so that readers can easily understand the research findings.

3.1. Validation of Subject Matter Experts

Validation of material experts is carried out to determine the feasibility of the content of the developed learning media, including relevance to the curriculum, completeness of content, assessment, and language. Validation is carried out in two stages so that the media can be revised based on the input of the validator until it reaches the expected feasibility category, the results of the validation of material experts can be seen in table 3.

Table 3. Material Expert Validation Results

Validation Stage	Total score	Average	Percentage (%)	Criteria
Validation I	39	3,25	65%	Less Good
Validation II	55	4,58	91,6%	Excellent

Based on Table 3, the validation of material experts showed an increase from phase I of e-LKPD to obtain a score of 39 with an average of 3.25 (65%) with the "Poor" category. There are several things that need to be improved, in particular changing the cover logo, cutting YouTube videos, creating sources on images and videos, and making the salt content in the student project different so that the results can be compared. After revision and improvement in accordance with comments and suggestions from material experts, a score of 55 was obtained with an average of 4.58 and a feasibility percentage of 91.6%. The score is in the interval of 4.2-5.0 with the category "Excellent". This feasibility is an important foundation in achieving the goals of based learning chemo-entrepreneurship which encourages students' creativity and entrepreneurial interest. This is in line with the theory of cognitivism, which views that the formation of knowledge occurs through complex internal processes involving the understanding, processing, and storage of information in long-term memory. This is in line with research [11] which indicates that the e-LKPD is loaded chemo-entrepreneurship It is very feasible and able to increase students' entrepreneurial interest and creativity. And supported [12], regarding the development of e-LKPD-based Project Based Learning oriented chemo- entrepreneurship showed that the e-LKPD motivated students in learning and had a validity rate of 91% and practicality of 88%, as well as obtaining positive responses from teachers and students.

3.2. Media Expert Validation

Media expert validation aims to assess from the aspects of simplicity, cohesion, emphasis, color, shape, balance. Validation is carried out in two stages to ensure that the media has met the eligibility standards, the results of the validation of media experts can be seen in table 4.

Table 4. Media Expert Validation Results

Validation Stage	Total score	Average	Percentage (%)	Criteria
Validation I	54	74	66%	Less good
Validation II	74	4,62	92,4%	Excellent

Based on Table 4, the validation of media experts in phase I of e-LKPD obtained a score of 54 with an average of 3.3 (66%) with the category of "not good". There are several things that need to be fixed, especially fixing incorrect words or spelling, more detailed instructions for use, adding a bibliography, and creating sources for images and videos. After revisions and improvements in accordance with comments and suggestions from media experts, a total score of 74 was obtained with an average of 4.62 and obtained a feasibility percentage of 92.4% in the interval of >4.2 - 5 with the criterion of "Very Good". Based on the scores obtained, media experts stated that the e-LKPD teaching material products that have been developed are suitable for field trials.

This is in line with the theory of learning behaviorism, where stimuli in the form of a clear visual display, harmonious colors, and easy-to-use navigation will generate a positive response in the form of increased student motivation and activeness, thereby strengthening the desired learning behavior. The results of this study are in line

with the research [13] which shows that e-LKPD is assisted wizer.me Obtaining excellent reviews from the aspect of display and effective and practical use in learning, thus reinforcing that visual quality and ease of navigation are important indicators of the feasibility of a digital teaching material.

The display of e-LKPD on the material on the freezing point reduction material based on chemo-entrepreneurship assisted wizer.me student-creativity oriented which has been validated by material experts and media experts is presented in figure 2.

Figure 2. e-LKPD Based on Chemo-entrepreneurship Assisted Wizer.me

Interactive multimedia products in figure 1. It can be accessed via website wizer.me.
Links : https://app.wizer.me/learn/ZEKXC4

3.3. Teacher Assessment

Teacher assessments are carried out as a validation of practitioners to determine the feasibility of media in terms of application in the classroom. The aspects that are assessed include the suitability of the material, clarity of presentation, ease of use, and the benefits of media for the learning process. The results of teacher assessments can be seen in table 5.

Table 5. Teacher Assessment Results

Appraiser	Total score	Average	Percentage (%)	Criteria
Chemistry Teacher	73	4,56	91,2%	Excellent

Based on the results of the chemistry teacher's assessment, the eligibility percentage was obtained of 91.2% with the category of "very good". teachers stated that this e-LKPD teaching material is attractive, easy to use, and suitable based on chemo-entrepreneurship. Teaching Materials Declared eligible when it meets the aspects of content, presentation, language, and ease of use [14]. In addition, teachers assessed that e-LKPD was able to increase students' motivation, creativity, and entrepreneurial spirit. The positive response of teachers as practitioners shows that the e-LKPD teaching materials developed are in accordance with the needs in the field and can be used in chemistry learning, especially the freezing point reduction material.

3.4. Small Group Trials

A small group trial was conducted on 10 students with different cognitive abilities, this stage aims to see the students' response to e-LKPD, including the relevance, convenience, and benefits of media in learning, the results of the e-LKPD trial can be seen in table 6.

Table 6. Small Group Trials

Subject	Total score	Percentage (%)	Criteria
10 students of grade XII phase F.3	581	89,4%	Excellent

Based on Table 7, the results of the student response questionnaire, the percentage of all respondents' answers was obtained of 89.4% with the category of "excellent". students assessed that the e-LKPD developed was attractive, easy to understand, helped independent learning, and encouraged creativity and entrepreneurial spirit of students [15]. Thus, it can be concluded that the e-LKPD developed is interesting and can be used as teaching material in learning how to reduce the freezing point.

Overall, the results of validation of material experts, media experts, teacher assessments, and tests on students show that the e-LKPD based on chemo-entrepreneurship assisted by wizer.me developed is in the category of very feasible and very good. This media can be used as a support for learning in the classroom or as a means of independent learning because it is easily accessible, interesting, and helps students understand concepts more deeply through project activities and can increase students' creativity and entrepreneurship [16].

CONCLUSION

Based on the results of development research, e-LKPD teaching materials based on chemo-entrepreneurship assisted wizer.me student-creativity oriented were developed using the Lee & Owens model which includes the stages of analysis, design, development, implementation and evaluation. The results of the study show that the e-LKPD developed has met the feasibility criteria conceptually and procedurally. The validation of material experts obtained an average score of 4.58 or 91.6% (very feasible), the validation of media experts of 4.62 or 92.4% (very feasible), and the teacher's assessment of 4.56 or 91.2% (very feasible). The product trial was carried out through a small group trial, each obtained a response percentage of 89.4% with the very good category, so that the e-LKPD on the chemo-entrepreneurship-assisted wizer.me creativity-oriented frozen point reduction material developed was declared feasible and very good to be used as teaching material in the learning process of freezing point reduction.

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