The Development of e-LKPD with a Culture-Based Integrated Learning Model (MPTBB) to Improve Student Learning Outcomes on Buffer Solution Material

Alexon[1,*] and Dewi Handayani[2]

[1]The Master Program of Educational Technology at University of Bengkulu, Indonesia
[2]Education Chemistry Study Program, Department of Science Mayor Education, Faculty of Teacher Training and Education, University of Bengkulu, Indonesia
Email: alexon@unib.ac.id (A.); d.handayani@unib.ac.id (D.H.)
[*]Corresponding author
Manuscript received July 12, 2023; revised August 11, 2023; accepted September 12, 2023; published January 29, 2024

***Abstract*—The aim of this research is to determine the feasibility, responses, and student learning outcomes of e-LKPD (Lembar Kerja Peserta Didik, i.e., Student Worksheets), by using the Culture-Based Integrated Learning Model (MPTBB) on buffer solution material. The research method uses the ADDIE development model which consists of Analysis, Design, Development, Implementation, and Evaluation. The research subjects were determined using purposive sampling with a total of 12 students in Class XI Natural Science 5 (Class XI IPA 5) for small group trials, and 31 students in Class XI IPA 6 for large group trials. The results showed that the developed electronic LKPD was included in the very feasible category with a score of 4.92 on the media aspect and 4.69 on the material aspect. Student responses to the developed LKPD were in the "very good" category with the content quality aspect obtained a score of 4.73; display aspect with a score of 4.70; the usefulness aspect gets a score of 4.70; and on the user aspect a score of 4.75. After using the e-LKPD with a MPTBB in the learning process of buffer solution material, it was found that there was an increase in student learning outcomes with an N-gain score of 0.54 in the medium category. So that this electronic LKPD can be used for learning media on buffer solution material. This e-LKPD is very interesting because it integrates an integrated learning model based on local culture in chemistry learning.**

***Keywords*—buffer solution, culture-based integrated learning model, e-LKPD, learning outcomes**

I. Introduction

Education is all about maximum utilization of all the potentials of the students. Education in Indonesia seeks to build the character of students to suit the philosophy of the Indonesian nation. The Indonesian nation itself is known as a nation with commendable culture, therefore of course education in Indonesia must reinforce Indonesian cultural values. Education and learning cannot be implemented without the cultural context, because cultural education will produce students who uphold manners and culture [1]. Culture has a variety of forms, it can be in the form of traits such as honesty, courtesy, etc., and it can also be in the form of local wisdom culture such as food, customs, arts, and so on. Culture-based learning has several advantages, including being able to increase appreciation of culture and being able to improve student learning outcomes [2].

Based on the results of observing the implementation of learning at Sekolah Menengah Atas Negeri (SMAN 1) Bengkulu City, learning in the classroom has implicitly instilled cultural values in the form of traits (honesty, courtesy, discipline, etc.), but has not explicitly implemented learning based on cultural context. Local culture can be integrated through learning materials at school. Regarding culture-based learning models, Alexon and Sukmadinata [2] offered a culture-based learning model called Culture-Based Integrated Learning Model (MPTBB). MPTBB in its stages contains elements of cultural simulation as well as learning topics related to culture. This shows that this learning model applies cultural education.

Local wisdom culture has many forms, one of which is in the form of regional specialties. Regional specialties were chosen because currently many students are not familiar with typical of regional specialties in their area. As in Bengkulu, regional specialties are "lemang tapai" and "sirop kalamansi". This food can be related to chemistry learning, for example with the degree of acidity (pH) because of course food has a certain pH value. Chemistry is one of the subjects that is formally taught to students at the senior high school Sekolah Menengah Atas (SMA) level. Chemistry subjects contain various kinds of concepts, one of which is the concept of buffer solutions. The concept of this buffer solution can be related to the local wisdom culture in the form of regional specialties, because in our body there is a buffer solution system that works when consuming certain foods.

The concept of a buffer solution is a chemical concept that is difficult for students to understand, they have difficulty in explaining, distinguishing, and calculating the pH of a buffer solution, as well as difficulties in explaining the function of a buffer solution in the human body. Students' difficulties in understanding the buffer solution material are caused by many factors, one of the factors is the learning method or model that does not involve students [3]. Based on the results of observations at Sekolah Menengah Atas Negeri 1 (SMAN 1) Bengkulu City, students are still not actively involved in learning chemistry, they tend to only accept the material provided by the teacher. It is hoped that this lack of student involvement can be overcome by using MPTBB in which there is a discussion process.

A quality of discussion and student learning outcomes can be influenced by student worksheets (LKPD) used in the discussion process [4]. Therefore, the LKPD that will be used needs to be developed so that it can assist the discussion process and help improve student learning outcomes. LKPD can be presented in digital or electronic form, hereinafter referred to as e-LKPD. The advantages of e-LKPD when compared to LKPD are being able to utilize technology in learning, presenting more interesting material and questions,

and being able to insert videos or animations in it [5, 6]. Based on the background that has been described, researchers are interested in developing e-LKPD with a culture-based integrated learning model (MPTBB) to improve student learning outcomes on buffer solution material.

II. Literature Review

A. Electronic Student Worksheets (e-LKPD)

Student Worksheets (LKPD) are printed sheets containing summaries, theories, assignments and instructions for implementing the use of LKPD in learning [7]. Along with the development of technology, printed LKPD has changed in terms of presentation, which is integrated with developing electronic technology so that it can be accessed via a laptop or smartphone. Electronic Student Worksheets (e-LKPD) is a teaching material containing learning activities that are systematically arranged and presented in electronic form [8]. Each learning activity on the e-LKPD is connected with an active link as navigation and is equipped with audio, image, video and animation presentations as a learning experience for students to easily understand the material.

E-LKPD has advantages compared to printed LKPD, namely the presentation of e-LKPD in electronic form makes it easier for users to access it quickly, flexibly, and easy to use. E-LKPD which can contain audio, video and animation has a function to increase interest in learning and make students more independent in understanding the material so that it can affect learning outcomes [9]. E-LKPD can be designed and developed according to the conditions and situation of students' learning needs. There are eight key components of LKPD, namely title, working time, basic competencies, learning steps, assignments, materials used in completing assignments, supporting information, and reports to be completed [7].

B. Culture-Based Integrated Learning Model

Culture-Based Integrated Learning Model (MPTBB) is a learning model that integrates culture in the learning process as a learning experience given to students [2]. Culture acts as a tool in the learning process that functions to interpret the learning process and the character of students. This is because, culture can be used as an apperception to understand the concept of knowledge so that students will gain contextual learning experiences and can interpret their own culture [10, 11].

The application of a culture-based integrated learning model is based on constructivism theory. Constructivism theory states that students construct meaningful knowledge as a result of thinking and interacting with social contexts [12]. There are four principles that must be considered in culture-based learning, namely; (i) substance and competence in the field of science, (ii) meaningfulness and learning processes, (iii) assessment of learning outcomes, and (iv) the role of culture in learning [13].

MPTBB designs to increase students' appreciation of local culture with preliminary stages (conditioning), core stages (creation of meaning) where at this stage material development occurs by exploring, discussing and deepening concepts as well as development and application. The closing stage (consolidation) is carried out with two activities, namely the teacher and students jointly draw conclusions from the learning that has been implemented. Then, students are given the task of reading the material to be studied next.

The culture-based integrated learning model is important to be applied in schools because the implementation of learning is not only aimed at intellectual learners but also must emphasize the formation of the values of the nation's cultural character. The advantages of culture-based learning have several advantages, namely being able to increase appreciation of culture and being able to improve student learning outcomes [2].

C. Flip PDF Corporate Edition

Flip PDF Corporate Edition is a software that is used to create e-books in flipbook format. The Flip PDF Corporate Edition application is also equipped with various multimedia features such as images, audio, flash animation, swf, hyperlinks, flash, and video files in MP4, FLV format, and YouTube videos [14]. The output formats on Flip PDF Corporate Edition are EXE, HTML5, zip, FBR, mobile version, burn to CD, Mac App. Flip PDF Corporate Edition technology can be utilized in developing teaching materials in the form of interesting and varied e-LKPD because it has additional audio, video and animation features [15].

There are several advantages of using Flip PDF Corporate Edition, namely [16]:

- Can be operated on laptops and mobile device.
- Easy to use and operate.
- Can make teaching materials or learning media interesting and equipped with videos and animations [17].
- Has various templates that differ in terms of flipbook presentation and can be adapted to the digital book that will be made.
- Supports social networks, because you can share digital books that have been created via Twitter, Facebook, or send a link via email.

While the drawbacks of using Flip PDF Corporate Edition are the slow conversion process, and output in offline form can only be opened via a computer or laptop.

III. Materials and Methods

A. Research Setting

This research was conducted in the period of February-April 2023 at one of the high schools in Bengkulu City, Indonesia Class XI Natural Science (Class XI IPA). The test subjects were determined using a purposive sampling technique. In this study, the subjects were selected based on the considerations of the chemistry teacher SMAN 1 Bengkulu City. The subjects in this study were 12 students in Class XI IPA 5 for small group trials, and 31 students in Class XI IPA 6 for large group trials. The selected classes have almost the same abilities, support student facilities and student competence in the use of Information Technology (IT) is better than other classes.

B. Research Design

The e-LKPD with a MPTBB development uses the ADDIE model. The following is the development procedure in this study which was adapted from the ADDIE procedure [18]. The analysis stage aims to identify problems, analyze needs, and perform task analysis. The stages of analysis carried out were initial and final analysis, analysis of student material,

task analysis, analysis of learning objectives [19]. The design stage is carried out to make a draft of the e-LKPD that will be developed. The design phase involved designing the e-LKPD draft (covering introduction, content, and closing) and designing evaluation questions (pretest and posttest). The development stage aims to develop products based on the designs that have been prepared. The development stage carried out is as follows development of e-LKPD, expert validation, Stage I revision, small group trial, and Stage II revision. The implementation stage of the e-LKPD that has been developed is carried out in Class XI IPA 6 SMAN 1 Bengkulu City. The implementation phase is carried out to find out the learning outcomes of students after using the developed e-LKPD. The evaluation stage includes formative evaluation and summative evaluation. Formative evaluation is carried out to assess each stage of development carried out with the aim of perfecting the product. The analysis and design phases were evaluated by practicing lecturers and chemistry teachers. At the development stage, an evaluation is carried out through validation by material and media experts as well as small group trials. At the implementation stage, an evaluation is carried out based on the learning outcomes obtained. A summative evaluation is carried out after the e-LKPD has been implemented and aims to evaluate the e-LKPD that has been developed as a whole. From this evaluation it can be seen the achievement of the e-LKPD which was developed in improving student learning outcomes.

C. Data Analysis Technique

1) Qualitative data

Qualitative data consists of suggestions or input on validation sheets by experts and student response questionnaires. The data was analyzed descriptively qualitatively and used as a reference for the revision of the e-LKPD being developed.

2) Quantitative data

a) An analysis of product validation results

The rating scale used in the product validation instrument is a Likert scale. The Likert scale consists of very feasible, feasible, moderately feasible, less feasible, and not feasible. For the purposes of quantitative analysis, the Likert scale data can be scored [20]. Likert scale data scores according to the provisions in Table 1 below.

Table 1. Product validation Likert scale data

Scale	Score
Very feasible	5
Feasible	4
Moderately feasible	3
Less feasible	2
Not feasible	1

The validation value obtained from the expert is then calculated on the average and then interpreted in the feasibility category based on the calculation of the level categorization [21]. Product feasibility categories can be seen in Table 2 below.

Table 2. Product feasibility categories

Validation Value	Categories
$x \leq 2$	Not feasible
$2 < x \leq 2.67$	Less feasible
$2.67 < x \leq 3.33$	Moderately feasible
$3.33 < x \leq 4$	Feasible
$x > 4$	Very feasible

b) Analysis of student response results

The rating scale used in the product validation instrument is a Likert scale. The Likert scale consists of strongly agree, agree, moderately agree, disagree and strongly disagree. For the purposes of quantitative analysis, the Likert scale data can be scored [20] Likert scale data scores according to the provisions in Table 3 below.

Table 3. Student response Likert scale data scores [22]

Scale	Score
Strongly agree	5
Agree	4
Moderately agree	3
Disagree	2
Strongly disagree	1

The response values obtained from students are then calculated on average and interpreted to be a feasibility category. The answers strongly agree on the questionnaire instrument can be adjusted to be very satisfied, very good, or always [23]. The response values can be interpreted into the feasibility categories in Table 4 below.

Table 4. Feasibility categories of student responses

Nilai Response	Kategori
$x \leq 2$	Very bad
$2 < x \leq 2.67$	Bad
$2.67 < x \leq 3.33$	Prety good
$3.33 < x \leq 4$	Good
$x > 4$	Very good

c) Analysis of student learning outcomes improvement

To find out the increase in student learning outcomes after using the e-LKPD with a MPTBB, values from the pre-test and post-test were used which were analyzed by the normality gain (N-gain) test. N-gain is a test that can provide an overview of the increase in learning outcomes scores between before and after the application of certain treatments [24]. The N-gain formula used is as follows:

$$N - gain = \frac{Score_{posttest} - score_{pretest}}{Score_{maks} - Score_{pretest}}$$

Note: N−gain = Normalized gain
$Score_{posttest}$ = post test Score
$Score_{pretest}$ = pre test Score
$Score_{maks}$ = Maximum Score

The N-gain scores that have been obtained for each student are then sought for the average value and converted into Gain index criteria to determine the criteria for improving student learning outcomes according to Table 5 below.

Table 5. Criteria for n-gain

N-gain	Criteria
$x > 0.7$	High
$0.3 \leq x \leq 0.7$	Medium
$x < 0.3$	Low

IV. Result and Discussion

The development of e-LKPD with a MPTBB uses the ADDIE model which consists of Analysis, Design, Development, Implementation, and Evaluation stages.

A. Analysis

The analysis stage is carried out to identify problems

through initial analysis, needs analysis, and task analysis. Initial analysis was obtained through observation of learning conducted in Class XI 1 Bengkulu City. Data from the initial observations of students were obtained through a questionnaire analyzing student needs. Based on the results of observations it is known that students have not been actively involved in the learning process. Learning outcomes are measured to see how the use of the e-LKPD with a MPTBB affects the learning. This is because teachers still use teacher-centered learning. Through observation, it is also known that learning in the classroom has implicitly instilled cultural values in the form of traits (honesty, courtesy, discipline, etc.), but has not explicitly applied learning based on the cultural context of local wisdom. Furthermore, it is known that the learning carried out is already group-based, but the discussion has not run optimally. This is because the teacher has not used the discussion guide in the form of LKPD.

Needs analysis is carried out by distributing student needs questionnaires. Based on the results of the questionnaire, it was found that the students consisted of various tribes or ethnicities, including Serawai, Lembak, Rejang, Javanese, and Palembang tribes. Through the results of the questionnaire, it was also known that students had technological support such as laptops and smartphones to support learning and most of them liked group-based learning. In addition, students prefer teaching materials in visual or audio-visual form compared to text-based teaching materials.

Task analysis is carried out by identifying and determining the tasks given to students to achieve competency achievement indicators. The results of the task analysis can be seen in Table 6 below.

Table 6. Task analysis results

Indicators of Competence Achievement	Tasks to Achieve Competence
Explain the meaning of buffer solution	Observing and analyzing animated videos to determine the meaning of buffer solutions
Describe the types of buffer solutions	Observing and analyzing illustrations for making buffer solutions and changing their pH after adding a little acid or a little base to describe the types of buffer solutions
Analyze the working principle of a buffer solution to maintain the pH of the solution	Observing and analyzing animated videos to analyze the working principle of buffer solutions in maintaining the pH of the solution
Calculate the pH of a buffer solution	Observe and understand explanatory videos to serve as a guide in calculating the pH of a buffer solution
Describe the role of buffer solutions in the human body	Linking the principle of buffer solutions to the food that humans consume to explain the role of buffer solutions in the human body

Based on the results of the analysis phase described previously, it is known that learning problems, student needs, and tasks that can support competency achievement. The results of the analysis phase are used as a reference in the development of e-LKPD with the Culture-Based Integrated Learning Model (MPTBB) to improve student learning outcomes in the buffer solution material.

B. Design

At the design stage, a draft e-LKPD is designed to be developed. The design of e-LKPD learning activities refers to the MPTBB syntax and also the results of the task analysis. The e-LKPD design is divided into several parts, namely introduction, content and closing. The introduction contains a preface, table of contents, instructions for use, competencies, and concept maps. The content part consists of the MPTBB learning syntax, namely conditioning, meaning creation, and consolidation. The closing section contains a bibliography of the references used in the e-LKPD.

At the design stage, evaluation questions were also prepared in the form of pre-test and post-test. The pre-test and post-test questions consist of 10 multiple-choice questions that are adjusted to indicators of competence attainment in the buffer solution material. The pre-test and post-test items are made differently but are still at the same cognitive level, so neither can be used to measure initial and final abilities properly.

C. Development

1) Product development

The e-LKPD with a MPTBB product on buffer solution material was developed based on the initial design reference (draft) that had been made with the necessary improvements. The e-LKPD product was developed using the Flip PDF Corporate Edition application. The form of e-LKPD being developed is in the form of an e-LKPD link which can be accessed online via a smartphone or computer.

2) Product validation media

The media validation stage is carried out to assess the feasibility of the product developed on the media aspect. Media validation was carried out by media experts consisting of two chemistry teachers and one chemistry education lecturer. Media validation results data are presented in Table 7 below.

Table 7. Media validation results

Assessment aspect	Score				Categories
	V1	V2	V3	Average	
Graphic	5	4.83	4.83	4.88	Very feasible
Presentation	5	5	5	5	Very feasible
Ease of use	5	5	4.67	4.89	Very feasible
Average	5	4.94	4.83	4.92	Very feasible

Based on Table 7, it is known that the mean score of the three aspects of product feasibility, namely the aspects of graphics, presentation, and ease of use by the validator team is 4.92. Based on the validity criteria in Table 7, the e-LKPD developed according to material experts is included in the very feasible category. A description of each aspect assessed in the media validation aspect is as follows.

a) Graphic

The validation results for the graphic aspects of validators 1, 2, and 3 are 5, 4.83, and 4.83 with the average is 4.88 and included in the very decent category. A high validity score on the graphical feasibility aspect shows that the cover of the e-LKPD with a MPTBB in the developed buffer solution has fulfilled the eligibility indicators in the validation instrument, namely having good layout, typography and images so that it is able to show the contents of the e-LKPD to readers. This result is in accordance with the opinion which states that a good cover is able to attract attention and become a communication tool that provides information to readers

about the identity and description of the contents of a book [25].

A high validity score also shows that the graphics in the contents of the e-LKPD have met the feasiblity indicators, namely having good layout and typography as well as pictures and videos. Good LKPD graphics, namely having an attractive design including the technical preparation and suitability of the color of the writing, images, and background used so that it can make students comfortable when reading or working on LKPD [26].

Even though the graphical aspect of the e-LKPD obtained a very decent validity feasibility score, the developed e-LKPD has deficiencies in the image section contained in the contents of the e-LKPD. Based on the analysis conducted by the researcher and comments from the validator, this deficiency is the sharpness of some images which are still low (unclear) so that it can make it difficult for e-LKPD users to understand the images presented. The deficiencies found are used as a reference for researchers to carry out revisions which will be explained in the Stage I product revision section.

b) Presentation aspect

The average validation score for the presentation aspect of validators 1, 2, and 3 is 5 and is included in the very feasible category. A high validity score on the presentation feasibility aspect indicates that the e-LKPD with a MPTBB on the developed buffer solution has fulfilled the presentation feasibility indicators, namely it has fulfilled the presentation attributes which include prefaces, table of contents, tables, pictures, videos, instructions for use, concept maps, core competencies, basic competencies, indicators of competence achievement). In addition, there are titles for each learning activity and material presented and there are step titles for the MPTBB learning model. This is in line with the opinion which states that a good LKPD must have a title structure for each activity, instructions for use, competencies achieved, tasks, and supporting information [7].

c) Aspects of ease of use

The validation results for the ease of use aspect of validators 1, 2, and 3 are 5, 5, and 4.67, respectively, with the average of 4.89 and included in the very decent category. A high score on the feasibility aspect of ease of use indicates that the e-LKPD with a MPTBB on buffer solution that has been developed has met the feasibility indicators in the validation instrument, namely having easy-to-understand instructions for use, easy to use and access, no errors when operating, and all buttons. Existing navigation can function properly. These results are in accordance with the opinion which states that a good e-LKPD is an e-LKPD that can be accessed and operated easily and has clear and easy-to-understand instructions for use so that it can become a user guide [27].

Overall, the average score obtained from the validator team is in the very feasible category. This shows that the e-LKPD with a MPTBB product developed in terms of the media aspect is very feasible to be tested on students. However, at the media validation stage, there was input in terms of graphics provided by the validator, this input was used as a reference for product revision Stage I.

3) Product validation (material)

The material validation stage is carried out to assess the feasibility of the product developed in the material aspect. Material validation was carried out by material experts consisting of two chemistry teachers and one chemistry education lecturer. Material validation results data are presented in Table 8 below.

Table 8. Material validation results

Assessment aspect	Score				Categories
	V1	V2	V3	Average	
Content quality	5	4.43	4.57	4.67	Very feasible
Language	4	5	4.5	4.5	Very feasible
MPTBB Characteristics	5	5	4.75	4.9	Very feasible
Average	4.67	4.81	4.61	4.69	Very feasible

Based on Table 8, it is known that the mean score of the three aspects of product feasibility, namely aspects of content quality, language, and MPTBB characteristics carried out by the validator team is 4.69. Based on the validity criteria, the e-LKPD developed based on material experts is included in the very feasible category. A description of each aspect assessed in the material validation aspect is as follows.

a) Aspects of content quality

In the aspect of content quality, the validation scores from validators 1, 2, and 3 were 5, 4.43, and 4.57, respectively, with the average of 4.67 and included in the very feasible category. A high validity score on the feasibility aspect of content quality indicates that e-LKPD with a MPTBB on buffer solution has met the eligibility indicators on the validation instrument, namely having clear learning objectives and the material presented is in accordance with learning objectives, accurate, in-depth, easy to understand, and useful. In addition, the e-LKPD also contains good practice questions. This result is in accordance with the opinion which states that a good e-LKPD must include material that is in accordance with the learning objectives and development of chemistry which is theoretically and conceptually correct (accurate) [28].

The results of high validity on the aspect of content quality are also based because the developed e-LKPD contains good depth of material, namely the material presented is arranged in detail and coherently from simple to complex with the aim that students can understand the material well. In addition, the e-LKPD is also equipped with pictures, animated videos, and examples that are appropriate to the material so that it can motivate and assist students in understanding the material. The previous description is supported by previous research which states that material arranged in a coherent manner is intended to make it easier for students to understand the material and the use of animated images and videos can motivate and make it easier for students to understand the material [29]. In the developed e-LKPD, there are also practice questions which are useful for training students' knowledge on buffer solution material. Practice questions on learning media can support a learning process [30].

Even though the content quality aspect of the e-LKPD with a MPTBB obtained a very feasible validity feasibility score, the developed e-LKPD has deficiencies in the concept presented. The concept errors in some figures in teaching material can lead to misconceptions in students. This is in line

with research conducted by Purwanti and Kuntjoro (2020) which states that one of the factors causing misconceptions is the material presented in teaching materials [31]. Therefore, deficiencies in the form of conceptual errors in the images presented on the e-LKPD will be used as a reference for researchers to make improvements in the Stage I product revision section.

b) Language aspect

The validation results for the language aspect of validators 1, 2, and 3 are 4, 5, and 4.5, respectively, with the average of 4.5 and included in the very decent category. A high score on the feasibility aspect of ease of use indicates that the e-LKPD with a MPTBB on the developed buffer solution has met the language feasibility indicators on the validation instrument, namely the product developed has good sentences and grammar. This result is in accordance with the opinion which states that good linguistic characteristics are using the correct Indonesian spelling, the vocabulary used is appropriate, and is communicative [32].

The high validity results on the language aspect are also based on the fact that the developed e-LKPD uses sentences that do not have double meanings. In addition, grammar includes writing punctuation used in accordance with Enhanced Spelling (EYD). Even though the linguistic aspects of the developed e-LKPD obtained a very feasible validity score, deficiencies were still found.

c) Characteristic aspects of MPTBB (Culture-Based Integrated Learning Model)

In the aspect of the characteristics of MPTBB, the results of the validation scores obtained from validators 1, 2, and 3 are 5, 5, and 4.75, respectively, with the average of 4.9 and included in the very feasible category. A high validity score on the feasibility aspect of the MPTBB characteristics shows that the e-LKPD with a MPTBB on buffer solution has met the eligibility indicators on the validation instrument, namely presenting learning activities according to the syntax of the MPTBB learning model (conditioning, creating meaning, and consolidation) and referring to the learning objectives set. In addition, the learning activities in the developed e-LKPD can also help students develop ideas and construct their knowledge.

A high score on the characteristics aspect of the MPTBB also shows that the developed e-LKPD buffer solution meets the feasibility indicators at each MPTBB stage, namely at the conditioning stage, the developed e-LKPD contains learning objectives, information on topics to be studied, and presents cultural simulations of Bengkulu local wisdom in the form of eating lemang tapai and sirop kalamansi. The existence of a cultural simulation at the conditioning stage is used as an apperception so that students can understand concepts and obtain contextual learning and can appreciate culture. In addition, at the conditioning stage questions related to the material that has been studied are also given to identify students' initial abilities and questions related to the material being studied are presented to stimulate students.

The stage of creating meaning in the e-LKPD also fulfills the feasiblity indicators in the validation instrument, namely an explanation of the connection between local wisdom culture and material for buffer solutions, videos and questions can encourage students to find concepts, as well as assignments regarding explaining the role of buffer solutions in living things associated with local wisdom culture. Based on the validation score, at the consolidation stage it is also in accordance with the characteristics of the MPTBB in the validation instrument which can encourage students to draw conclusions, present practice questions, provide space for students to reflect, and present reading material related to further learning material.

Overall, the average score obtained from the validator team is in the very feasible category. This shows that the e-LKPD with a MPTBB product on the buffer solution material developed in terms of the material aspect is very feasible to try out on students. However, during the material validation stage, several deficiencies were found. These deficiencies are used as a reference for researchers in conducting product revisions in Stage I.

4) Test instrument validation

Test instrument validation was carried out to test the feasibility of pre-test and post-test instruments that had been designed. Test instrument validation was carried out by material experts consisting of two chemistry teachers and one chemistry education lecturer. Data from the test instrument validation results are presented in Table 9 below.

Table 9. Test instrument validation results

Question Number	Pre-test			Decision	Post-test			Decision
	V1	V2	V3		V1	V2	V3	
1	✓	✓	×	Revision	✓	×	×	Revision
2	✓	✓	✓	Feasible	✓	✓	✓	Feasible
3	✓	✓	✓	Feasible	✓	✓	✓	Feasible
4	✓	✓	✓	Feasible	✓	✓	✓	Feasible
5	✓	✓	✓	Feasible	✓	✓	✓	Feasible
6	✓	✓	✓	Feasible	✓	✓	✓	Feasible
7	✓	✓	✓	Feasible	✓	✓	✓	Feasible
8	✓	✓	✓	Feasible	✓	✓	✓	Feasible
9	✓	✓	✓	Feasible	✓	✓	✓	Feasible
10	✓	✓	✓	Feasible	✓	✓	✓	Feasible

Note: ✓ = all feasibility indicators are met
× = there are indicators of feasibility that are not met

Based on the results of the test instrument validation, it can be seen that of the 20 questions developed, 18 of them are feasible to use because they have fulfilled all feasibility indicators in the material, construction, and language aspects. However, there are still 2 questions that are not suitable for use because they still do not meet several feasibility indicators so that revisions are needed. These two questions did not meet feasibility because there were unclear formulation of the answer choices and also the distractor's answer items were not good because the narratives of the answer choices were very different (not similar).

a) Stage I revision

At the validation stage, there are several suggestions and input for the product being developed. These suggestions and input were used as a reference in the revision of Stage I. Based on suggestions and input from media experts, the thing that needed to be revised was regarding the quality/sharpness of some images so that they would be more clarified. The follow-up taken by the researchers was to recreate the less sharp images with a higher resolution.

Furthermore, based on suggestions and input from material experts, things that need to be revised from the product are

presented in Table 10 below.

Table 10. List of material expert revisions

Revisions	Follow-up
On page 2 there is a typing error	Fix a typing error
On page 5 the video shows the addition of KOH but in the narration of the questions NaOH is added	Chang the narration of questions into KOH
Figures 4b and 5b The pH and solutions are conceptually reversed	Fix an inverted concept error in the figures
On page 7 there is a writing error in the Google form question	Fix a writing error

b) Small group trial

In this development research, a small group trial was carried out on 12 students in Class XI IPA 6 SMAN 1 Bengkulu City to obtain responses in using e-LKPD with a MPTBB on buffer solution material. The results of student responses to the developed e-LKPD can be seen in Table 11 below.

Table 11. Student response questionnaire results

Aspect	Score	Category
Content Quality	4.73	Very good
Display	4.70	Very good
Usefulness	4.70	Very good
Usage	4.75	Very good
Average	4.72	Very good

Based on the results of the student response test, it is known that the response score of the e-LKPD with a MPTBB product on the buffer solution material which consists of aspects of quality of content, display, usefulness, and usage is 4.73, 4.70, 4.70, and 4.75, respectively. The response score on the aspect of content quality is 4.73 and is included in the very good category. These results indicate that according to students the product content is easy to understand, the material is relevant to everyday life, the MPTBB-based learning steps and animated images/videos presented help the process of understanding the material. Animated videos can explain things that are difficult to understand if you only read them and can explain stages or an abstract mechanism so that they can help students understand the material [33].

The response score on the display aspect is 4.70 with a very good category. This shows that the e-LKPD has a clear font type and size, an interesting combination of writing and image layouts, easy-to-understand language, and clear and attractive images/videos. This is in accordance with what states that an interesting e-LKPD must meet several elements including the accuracy of choosing the type and size of letters, the suitability of the layout, and also the clarity of the learning videos presented [34]

The response score on the usefulness aspect is 4.70 with a very good category. This shows that the e-LKPD with a MPTBB is beneficial for students, namely it can increase respect for local cultural wisdom, help independent learning, increase learning motivation, add insight, and make students actively involved in learning. The MPTBB learning model can increase appreciation of local culture and can encourage active participation of students in learning. The response score on the usage aspect is 4.75 with a very good category. This shows that e-LKPD can be accessed and operated easily. An e-LKPD can be said to be good in terms of usage if it is easy to access and also the features provided are easy to operate [34].

Overall, the results of student responses to the developed e-LKPD product obtained a score of 4.72 which is included in the very good category. This shows that according to the students the e-LKPD being developed is of very good quality. This can also be seen from some of the comments that came in during the response test, many students stated that the e-LKPD that had been developed was good, interesting, and easy to understand.

c) Stage II revision

Even though the results of small group trials or student response tests showed positive results, there were still some suggestions and input given by students. These suggestions and input include that there is a table of contents button that doesn't work, and there are several writing errors. These suggestions and input were then used as a reference and followed up in the second stage of the revision.

d) Final product

Products that have gone through a series of development stages from initial to phase II revision, then the product has been defined as the final product that is ready to be implemented in large groups. The final product results can be accessed via QR code can be seen in Fig. 1, and product examples can be seen in Fig. 2.

Fig. 1. QR code final product.

Fig. 2. E-LKPD product.

D. Implementation

The final results of the products that have been developed and have passed the small group trials as well as Stage II revisions, can then be implemented or applied to the learning process in large classes. The implementation was carried out on Class XI IPA 5 students at SMAN 1 Bengkulu City. The implementation stage aims to measure learning outcomes and n-gain interpretation of student learning outcomes. Implementation of learning in the implementation phase begins with taking pre-test scores as students' initial scores, then proceeding with implementing e-LKPD with a MPTBB,

and at the end of learning taking post-test scores as student learning outcomes. The results of the students' pre-test and post-test are presented in Table 12 below.

Table 12. Pre-test and post-test results

	Pre-test	Post-test	N-gain	Category
Number of samples	30	30	0.54	Medium
Highest score	50	90		
Lowest score	10	50		
Average	25.67	66.67		

Based on Table 12, it is known that the results of the students' pre-test and post-test. These results were then analyzed using N-gain to determine the increase in student learning outcomes after using the MPTBB-based e-LKPD. Based on the calculations, the average N-Gain score of students is 0.54 and is included in the medium category. This shows that the implementation of the e-LKPD with a MPTBBB is effective in increasing the learning outcomes of students in the medium improvement category.

These results are supported by the integration of the local cultural context in learning which is able to improve student learning outcomes [2, 35, 36]. The positive results shown were also supported by the enthusiasm of the students in participating in learning using the MPTBB-based e-LKPD, in which a cultural simulation was carried out at the beginning of the lesson with the aim of appreciating the local culture. In the context of this study, a cultural simulation was carried out in the form of consuming lemang tapai and also sirop kalamansi. Through this cultural simulation, it is then linked to learning so that the learning remains contextual. Students who are enthusiastic and active in learning can encourage student learning outcomes [37].

E. Evaluation

The evaluation stage aims to see the effectiveness of the developed the e-LKPD with a MPTBB in achieving the learning objectives of the predetermined buffer solutions. The evaluation is divided into 2, namely formative and summative evaluation. Formative evaluation is an evaluation at each stage of development (analysis, design, development, and implementation) that has been carried out to improve the product, while summative evaluation is carried out at the end of development activities to determine the effectiveness of the product being developed [38]. In the analysis stage, an initial analysis was carried out through observation in Class XI IPA SMAN 1 Bengkulu City. Furthermore, an analysis of the students was carried out by distributing a questionnaire to the students, as well as a task analysis based on the learning curriculum that was applicable in the school where the research was conducted. At the analysis stage, the researcher conducted an analysis only at one school, namely SMAN 1 Bengkulu City, so that the problems analyzed were only the problems observed at that school. Therefore, a more comprehensive study is needed to find the link between the problems and the products developed through an analysis of several schools.

Furthermore, at the design stage, the researcher makes draft designs and learning activities according to the MPTBB syntax. In addition, the researcher also developed test questions which consisted of pretest and posttest questions, each of which consisted of 10 multiple choice questions. Then, after the draft has been designed, the MPTBB-based LKPD product is made on the buffer solution material at the development stage according to the draft with the necessary improvements.

Then, the developed e-LKPD product is evaluated through validation by media and material experts and tested on small groups to obtain student responses. The validation results from the media and material expert team stated that the product developed was very feasible to try out. However, before being tested, the product developed must be revised first because several deficiencies were found. Therefore, the researcher conducted a Stage I revision based on the validator's comments to improve the product so that the quality of the product produced would be even better. In addition to product validation, the pretest and posttest questions that have been developed are also validated by material experts. Based on the validation results, it is known that only 18 out of 20 questions are feasible to use. Meanwhile, the other 2 questions still have to be revised if you want to use them. Then, after the validation and revision of Stage I was carried out, the developed e-LKPD product was tested on a small group consisting of 12 XI IPA 6 students at SMAN 1 Bengkulu City. The results obtained are in the form of an excellent response to the developed e-LKDP. Apart from that, the students also gave some suggestions and input to fix the non-functioning navigation and writing errors (typos). These suggestions and inputs are used as a reference for researchers to carry out product evaluations and Stage II revisions so that the e-LKPD products developed have even better quality.

In the implementation stage, a formative evaluation is carried out based on the application of the MPTBB-based e-LKPD in the buffer solution learning process in Class XI IPA 5 SMAN 1 Bengkulu City. In the learning activities carried out, students looked very enthusiastic in using the e-LKPD which can be accessed via their respective smartphones because it presents interesting pictures and videos. The students also looked enthusiastic when the cultural simulation was carried out by consuming lemang tapai and sirop kalamansi. The learning process using the e-LKPD with a MPTBB also makes students actively involved and understands the material more easily because the learning is done contextually by connecting cultural simulations with the buffer solution material being studied. However, based on the results of the evaluation at the implementation stage, several obstacles were found, namely there were several students who could not access the e-LKPD because they did not have a quota or were constrained by signals. Therefore, the solution that researchers have made is to display the e-LKPD using a projector so that students who cannot access it can still follow the learning process.

In addition to conducting a formative evaluation, the researcher also carried out a summative evaluation based on the results of the N-gain score obtained. Based on the N-gain analysis, it is known that there is an increase in learning outcomes with moderate criteria in Class XI IPA 5 students at SMAN 1 Bengkulu City after using the e-LKPD with a MPTBB on the developed buffer solution material. This shows that the application of the e-LKPD with a MPTBB on buffer solution material is effectively used in class to improve student learning outcomes with moderate improvement categories.

V. Conclusion

Based on the results of the research, the following conclusions are obtained. PBL-based e-LKPD on the buffer solution material that has been developed has a feasibility level in the very feasible category and student responses to the e-LKPD with a MPTBB on the buffer solution material that has been developed are in the very good category. After using the MPTBB-based e-LKPD in the learning process of buffer solution material, it is known that there is an increase in student learning outcomes with an N-gain score of 0.54 in the medium category. This e-LKPD with a MPTBB research is in line with previous research which stated that there was an increase in student learning outcomes and student appreciation for local culture increased if learning focused on themes developed based on students' early cultural experiences.

Based on the development research that have been carried out, suggestion for further development is to provide offline access to e-LKPD, which will make it easier for students who do not have internet acces. In addition, the suggestion for further development research is that tests can be carried out on other variables to determine the effect of the e-LKPD with a MPTBB on the buffer solution material being developed. For example, to find out the effect of the the e-LKPD with a MPTBB on the appreciation of local cultural wisdom and students' learning motivation.

Conflict of Interest

The authors declare that there is no conflict of interest.

Author Contributions

Alexon: Conceptualization, design, analysis, writing, final approval, securing funding. supervision, acquisition. Dewi Handayani: Analysis, editing, reviewing, supervision. All participants passed the final paper version.

Funding

This research was funded by PNBP FKIP University of Bengkulu for the scheme Postgraduate Learning Quality Improvement Research (PPKP) FKIP of the 2023 with contract No 2283/UN.30.7/PP/2023.

Acknowledgment

The research team would like to thank all those involved in this research special for University of Bengkulu and SMA Negeri 1 Bengkulu. To the editors and the reviewers who have provided suggestions and inputs to improve the article.

References

[1] I. W. C. Sujana, "Fungsi Dan Tujuan Pendidikan Indonesia," *Adi Widya: Jurnal Pendidikan Dasar*, vol. 4, no. 1, pp. 29–39, 2019. https://doi.org/10.25078/aw.v4i1.927 (in Indonesian)

[2] Alexon and N. S. Sukmadinata, "Pengembangan model pembelajaran terpadu berbasis budaya untuk meningkatkan apresiasi siswa terhadap budaya local," *Cakrawala Pendidikan*, vol. 2, pp. 189–203, 2010. https://doi.org/10.21831/cp.v2i2.339 (in Indonesian)

[3] N. K. Sariati, I. N. Suardana, and N. M. Wiratini, "Analisis Kesulitan Belajar Kimia Siswa Kelas XI pada Materi Larutan Penyangga," *Jurnal Ilmiah Pendidikan & Pembelajaran*, vol. 4, no. 1, pp. 86–97, 2020. https://doi.org/10.23887/jipp.v4i1.15469 (in Indonesian)

[4] S. Nurjanah, R. B. Rudibyani, and E. Sofya, "Efektivitas LKPD Berbasis Discovery Learning untuk Meningkatkan Keterampilan Kolaborasi dan Penguasaan Konsep Peserta Didik," *Jurnal Pendidikan Dan Pembelajaran Kimia*, vol. 9, no. 1, pp. 27–41, 2020. https://doi.org/10.23960/jppk.v9.i1.202003 (in Indonesian)

[5] R. Julian and Suparman, "Analisis Kebutuhan E-LKPD Untuk Menstimulasi Kemampuan Berpikir Kritis dalam Memecahkan Masalah," *Proceeding of the 1st Steeem*, vol. 1, no. 1, pp. 238–243, 2019. (in Indonesian)

[6] G. S. Nurulia and N. Qomariyah, "Pengembangan E-LKPD Berbasis Learning Cycle 5E Materi Sistem Pencernaan untuk Meningkatkan Ketrampilan Proses Terintegrasi Peserta Didik Kelas XI SMA," *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, vol. 11, no. 2, pp. 285–293, 2022. https://doi.org/10.26740/bioedu.v11n2.p285-293 (in Indonesian)

[7] A. Prastowo, *Panduan Kreatif Membuat Bahan Ajar Inovatif*, Diva Press, 2011. (in Indonesian)

[8] D. N. I. Sari, A. S. Budiarso, and S. Wahyuni, "Pengembangan E-LKPD Berbasis Problem Based Learning (PBL) untuk Meningkatkan Kemampuan Higher Order Tingking Skill (HOTS) pada Pembelajaran IPA," *Jurnal Basicedu*, vol. 6, no. 3, pp. 3699–3712, 2022. (in Indonesian)

[9] S. Rahayu, I. Ladamay, F. N. Kumala, R. H. Susanti, and N. Ulfatin, "LKPD elektronik pembelajaran tematik berbasis high order thinking skills (HOTS) untuk Siswa Kelas III Sekolah Dasar," *Jurnal Basicedu*, vol. 5, no. 6, pp. 6110–6119, 2021. https://doi.org/10.31004/basicedu.v5i6.1791 (in Indonesian)

[10] I. Syasmita, D. Setiawan, and D. Saragi, "The influence of Ethno pedagogy approach and interpersonal intelligence on the results of civic education learning in Pelangi elementary school Medan," *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, vol. 2, no. 4, pp.603–615, 2019. https://doi.org/10.33258/birle.v2i4.652 (in Indonesian)

[11] F. A. Wanhar and A. M. Hasibuan, "Pengaruh model pembelajaran etnopedagogi dan keterampilan sosial terhadap perkembangan karakter siswa di era Pandemi," *Elementary School Journal PGSD FIP UNIMED*, vol. 11, no. 3, pp. 236–245, 2021. https://doi.org/10.24114/esjpgsd.v11i3.29588 (in Indonesian)

[12] A. Fadli and Irwanto, "The effect of local wisdom-based ELSII learning model on the problem solving and communication skills of pre-service Islamic teachers," *International Journal of Instruction*, vol. 13, no. 1, pp. 731–746, 2020. https://doi.org/10.29333/iji.2020.13147a.

[13] Pannen, Paulina, R. D. Riyanti, and B. E. Pramuki, "Innovative practices on ICT-audiovisual technologies and ESD integration in promoting quality education: Hybrid learning for Indonesian teachers (HYLITE)," presented at the Asia and the Pacific Regional Seminar on Educational Technology–Tokyo, 2007. http://gauge.u-gakugei.ac.jp/apeid/apeid07/CoutryReport/SEAMOLEC.pdf

[14] F. A. Febrianti, "Pengembangan digital book berbasis flip PDF professional untuk Meningkatkan Kemampuan Literasi Sains Siswa," *Caruban: Jurnal Ilmiah Ilmu Pendidikan Dasar*, vol. 4, no. 2, 102, 2021. https://doi.org/10.33603/caruban.v4i2.5354 (in Indonesian)

[15] I. G. K. Soenarko, A. A. Purwoko, and S. Hadisaputra, "The validity and reliability of electronic students' worksheet based on discovery learning on thermochemical topic," *Prisma Sains: Jurnal Pengkajian Ilmu Dan Pembelajaran Matematika Dan IPA IKIP Mataram*, vol. 10, no. 1, 151, 2022. https://doi.org/10.33394/j-ps.v10i1.4863

[16] A. Setyawan and F. I. Faqih, "Flip pdf professional application as ICT-based learning media in the era of Merdeka Belajar," in *Proc. Conference of Humanities*, 2022, pp. 350–356.

[17] D. Handayani, E. W. Winarni, A. Sundaryono, M. L. Firdaus, and M. Alperi, "The development of organic chemistry teaching materials on the topic of lipid using android stem based approach," *iJIM*, vol. 16, no. 3, 105, 2022.

[18] K. Y. Tung, *Desain Instruksional: Perbandingan Model dan Implementasinya*, ANDI Offset, 2017. (in Indonesian)

[19] D. Handayani, I. Elvinawati, and M. Alperi, "Development of guided discovery based electronic module for chemical lessons in redox reaction materials," *International Journal of Interactive Mobile Technologies*, vol. 15. no. 7, 2021.

[20] Sugiyono, *Metode Penelitian Kuantitatif, Kualitatif dan R&D*, Alfabeta, 2013. (in Indonesian)

[21] S. Azwar, *Penyusunan Skala Psikologi (II)*, Pustaka Pelajar, 2012. (in Indonesian)

[22] Neliwati, *Metodologi Penelitian Kuantitatif (Kajian Teori dan Praktek)*, Widya Puspita, 2018. (in Indonesian)

[23] A. Rizkiani, "Pengaruh sistem boarding school terhadap pembentukan karakter peserta didik," *Jurnal Pendidikan Universitas Garut*, vol. 6, no. 1, pp. 10–18, 2012. https://doi.org/10.52434/jp.v6i1.45. (in Indonesian)

[24] R. R. Hake, (1999). *Analyzing Change/Gain Score*. Dept. of Physics, Indiana University. [Online]. Available: https://web.physics.indiana.edu/sdi/AnalyzingChange-Gain.pdf

[25] R. Galingging, "Analisis desain cover buku anak ayo sekolah 'Lukisan Aini'," *Jurnal Magenta*, vol. 4, no. 1, pp. 583–593, 2020. (in Indonesian)

[26] F. Rati, S. Rohiat, and Elvinawati, "Pengembangan multimedia pembelajaran interaktif berbasis Problem Based Learning (PBL) menggunakan aplikasi articulate storyline pada materi ikatan kimia," *Alotrop*, vol. 6, no. 1, pp. 70–79, 2022. https://doi.org/10.33369/alo.v6i1.21799 (in Indonesian)

[27] F. F. Indriani and N. C. Sakti, "Pengembangan e-LKPD Berbasis Komik untuk Meningkatkan Kemampuan Berpikir Kritis Peserta Didik Kelas XI IPS SMA," *Jurnal PTK Dan Pendidikan*, vol. 8, no. 1, pp. 65–77, 2022. https://doi.org/10.18592/ptk.v8i1.6414 (in Indonesian)

[28] M. Aslam, A. A. Azis, and Adnan, "Pengembangan E-LKPD Berbasis Salingtemas (Sains, Lingkungan, Teknologi, Masyarakat) Materi Perubahan Lingkungan Kelas X SMA," *Jurnal Biotek*, vol. 9, no. 2, pp. 224–243, 2021. https://doi.org/10.24252/jb.v9i2.25885 (in Indonesian)

[29] E. F. Manzil, S. Sukamti, and M. A. Thohir, "Pengembangan e-modul interaktif heyzine flipbook berbasis scientific materi siklus air bagi siswa kelas v sekolah dasar," *Sekolah Dasar: Kajian Teori Dan Praktik Pendidikan*, vol. 31, no. 2, pp. 112–126, 2023. https://doi.org/10.17977/um009v31i22022p112 (in Indonesian)

[30] R. Rachmat and Syahlan, "Analisis materi dan tujuan pembelajaran pada materi listrik dinamis," *Jurnal Pendidikan MIPA*, vol. 10, no. 2, pp. 60–64, 2020. https://doi.org/10.37630/jpm.v10i2.340 (in Indonesian)

[31] W. M. Purwanti and S. Kuntjoro, "Profil Miskonsepsi Materi Ekologi Menggunakan Four-Tier Test pada Peserta Didik Kelas X SMA," *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, vol. 9, no. 3, pp. 414–421, 2020. (in Indonesian)

[32] K. Dwiningsih, Sukarmin, Muchlis, and P. T. Rahma, "Pengembangan media Pembelajaran kimia Menggunakan media Laboratorium virtual Berdasarkan Paradigma Pembelajaran di era global," *Kwangsan: Jurnal Teknologi Pendidikan*, vol. 6, no. 2, pp. 156–176, 2018. https://doi.org/10.31800/jtp.kw.v6n2.p156--176 (in Indonesian)

[33] S. Tasyari, F. N. Putri, A. A. Aurora, S. Nabilah, Y. Syahrani, and A. Suryanda, "Identifikasi media Pembelajaran pada materi Biologi dalam meningkatkan pemahaman konsep peserta didik di masa Pandemi Covid-19," *BIO-EDU: Jurnal Pendidikan Biologi*, vol. 6, no. 1, pp. 1–8, 2021. https://doi.org/10.32938/jbe.v6i1.905 (in Indonesian)

[34] Putri, N. L. P. D., & Astawan, I. G. (2022). E-LKPD Interaktif Dengan Model Project Based Learning Materi Bangun Ruang Kelas V Sekolah Dasar. *Jurnal Pedagogi Dan Pembelajaran*, *5*(2), 303–311. https://doi.org/10.23887/jp2.v5i2.47231 (in Indonesian)

[35] Wandari, A., Kamid, K., & Maison, M. (2018). Pengembangan Lembar Kerja Peserta Didik (LKPD) pada Materi Geometri berbasis Budaya Jambi untuk Meningkatkan Kreativitas Siswa. *Edumatika : Jurnal Riset Pendidikan Matematika*, *1*(2), 47–55. https://doi.org/10.32939/ejrpm.v1i2.232 (in Indonesian)

[36] D. P. Subakti, J. Marzal, and M. H. E. Hsb, "Pengembangan E-LKPD Berkarakteristik budaya jambi menggunakan model discovery learning berbasis STEM untuk meningkatkan kemampuan berpikir kreatif matematis," *Jurnal Cendekia: Jurnal Pendidikan Matematika*, vol. 5, no. 2, pp. 1249–1264, 2021. https://doi.org/10.31004/cendekia.v5i2.629 (in Indonesian)

[37] C. C. Astuti, "Analisis korelasi untuk mengetahui keeratan hubungan antara keaktifan mahasiswa dengan hasil belajar akhir," *JICTE (Journal of Information and Computer Technology Education)*, vol. 1, no. 1, pp. 1–7, 2017. https://doi.org/10.21070/jicte.v1i1.1185 (in Indonesian)

[38] I. M. Tegeh and I. M. Kirna, "Pengembangan bahan ajar metode Penelitian pendidikan Dengan ADDIE model," *Jurnal Ika*, vol. 11, no. 1, pp. 12–26, 2013. https://doi.org/10.23887/ika.v11i1.1145 (in Indonesian)

Copyright © 2024 by the authors. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (CC BY 4.0).