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Research Artikel

DEVELOPMENT OF E-BOOKLET BASED ON PROBLEM BASED LEARNING ON ACID BASE MATERIAL FOR PROBLEM SOLVING ABILITY

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Abstract

Teaching materials are a source of learning for students. For this reason, efforts are needed to develop teaching materials that accommodate the needs of students in terms of ease of access, attractive presentation, and encouraging student activity. This research focuses on the development of electronic booklets (e-booklets) using the "problem-based learning (PBL)" model on acid-base materials. Research and Development (R&D) with the 4-D model consisting of define, design, and develop was used as this research method, but dissemination stages were not conducted because of limited research time. 34 purposively selected students of SMAN 21 Bekasi City were given a questionnaire to determine the need for e-booklet development at the define stage. Meanwhile, the questionnaire that had been developed at the development stage was validated by 4 experts. After the instrument was deemed feasible, the e-booklet was tested on 34 purposively selected students. The research findings showed that the percentage of the results of the trial of teaching materials to students was 81.53% with very good criteria. This study concludes that the teaching materials developed are suitable for use as a learning resource for students in solving problems on acid-base materials.

***Keywords**: acid base; chemistry learning; e-booklet; PBL model; development of four-D (4-D) model.*

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INTRODUCTION

Teaching materials are a very influential component in teaching and learning activities (Kinanda, Herdini, Noer, 2022). Teaching materials are a set of learning tools containing materials, methods, and learning evaluations arranged systematically and interestingly to achieve learning competencies (Suprihatin & Manik, 2020). Making creative and interesting teaching materials according to curriculum demands can support the achievement of learning objectives (Magdalena, Sundari, Nurkamilah, Nasrullah, Amalia, 2020). With the help of teaching materials, it can facilitate teachers and students in learning activities (Depdiknas, 2008). In addition, 21st-century learning also encourages students to be able to master technology, information, and communication (ICT) to be able to use media and teaching materials that can involve students actively, creatively, and interactively (Kinanda, dkk, 2022). This is what encourages teachers to be able to develop teaching materials. The development of teaching materials is important because it can help improve student understanding and activeness. Magdalena, Prabandani, et al (2020) stated that teaching materials are an aspect that greatly influences the results of teaching and learning activities. Applying teaching materials can facilitate teachers and students in the learning process. Therefore, teachers must be able to develop creative teaching materials to achieve learning goals.

However, teachers' teaching materials are still limited to LKS and textbooks (Nur, 2012). Teaching materials in the form of LKS and textbooks are less effective and efficient to learn because these teaching materials include printed teaching materials that are less practical to carry, and these teaching materials present material with language that tends to be difficult to understand so that it gives the impression of burdening students to learn it. In addition, students are still fixated on the material in textbooks or worksheets, which tend to be monotonous because they only contain dense and complicated material, so students need help understanding the material, and they are less skilled in honing their problem-solving skills. (Chairudin & Dewi, 2021). Based on the results of a questionnaire given to students at SMAN 21 Bekasi City, it is known that teaching materials used at the school lack creativity, are less varied and tend to be difficult to understand. In addition, overall students need teaching materials that are effective, flexible, and easy to understand. Based on the statements of teachers and students who have conducted a needs analysis, knowledge is needed to develop teaching materials that are innovative, applicable, and in accordance with learning to support learning activities that encourage student activity.

One of the innovations made to meet students' needs and learning resources is developing teaching materials in the form of booklets. According to Pribadi (2017), a booklet is a practical book that is small in size and contains information and knowledge presented in a concise, lightly discussed and more easily understood by readers. Booklets are also accompanied by illustrative images that make it easier for students to understand the concept of abstract material (Rani, Widiyaningrum, dan Anggraito, 2020). Booklet teaching materials can support student learning outcomes (Indriyanti & Dewi, 2018). The use of booklets as teaching materials has been researched by Suryani, Hairida, Hadi (2019), which resulted in booklets affecting student learning outcomes. In addition, the use of technology in learning activities can also maximize the learning process (Irdhayanti, 2021). Therefore, the booklet researchers will develop uses corporate flip pdf software to convert booklets into digital flipbook form. This application can also add items that can support such as audio, video, and YouTube links. This e-booklet makes it easier for students to understand the concept of material and is more effective in studying e-booklets anywhere and anytime (Khairinal,Suratno, Aftiani, 2021). However, the weakness of this e-booklet media is that it has limited pages and cannot explain the material as thoroughly as books in general (Christie & Lestari, 2019).

E-booklet teaching materials will empower students to think critically and hone their problem-solving skills when combined with student-centered learning models such as the "problem-based learning" (PBL) model (Chairudin & Dewi, 2021). PBL is defined as a pedagogy focused on student activities in exploring real-world problems and used

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to enhance learning and link concepts and facts directly (Hotimah, 2020). PBL can improve critical thinking, problem-solving, cognitive, and performance skills compared to teacher-focused approaches (Joshi, Desai, dan Tewari, 2020). Problem-solving skills are essential to develop in students because by solving problems, students will be trained to reason logically and choose the proper and systematic strategies to solve problems. The PBL model is in line with a student-centered learning approach and can be used to empower students to improve their problem-solving skills (Amir, 2016).

Booklet development has been done by Masrifah et al. (2020), who developed a booklet on colloidal material by obtaining a valid category so that it is feasible to use as teaching material. In addition, Wijayanti, Alvanisa, Assaat (2022), developed an e-booklet on reaction rate material to obtain feasible criteria as teaching material. Booklet development was also carried out by Nisa & Khaira (2021), who developed a booklet based on guided inquiry on molecular shape material and obtained valid and practical criteria for use in chemistry subjects. Based on relevant research, e-booklet teaching materials that integrate problem-based learning models have never been developed in chemistry learning, especially on acid-base material. Whereas this e-booklet teaching material based on PBL can be used to understand difficult concepts (Noviatika, 2019). Acid-base is a suitable chemistry material for developing e-booklets based on problem-based learning because it involves concrete and abstract concepts (Amry, Rahayu, Yasmin, 2017). Based on the supporting background, researchers are interested in developing e-booklets based on problem-based learning (PBL) as teaching materials on acid-base materials that teachers and students can use to make it easier for students to understand concepts and hone their ability to solve problems.

METHODS

This research was designed by Research and Development (R&D). This development research is used to produce new products through e-booklet teaching materials. The research subjects were class XII SMAN 21 Bekasi City, with 34 students. This research uses the 4-D (four-D) model following Thiagarajan's theory (Muis, 2019). However, this research was limited to only include the define, design, and develop stages, while dissemination stage was not conducted due to limited research time.

Stage I : Define

This stage aims to define learning needs and begin by analyzing the objectives of the material restrictions related to the product to be developed. At this stage, five analysis steps are carried out: early-end analysis, student needs analysis, concept analysis, task analysis, and specific learning objectives. The early-end analysis stage analyzes teachers' fundamental problems in the chemistry learning process. The activity carried out at this stage is to provide a questionnaire for chemistry teachers. Through this stage, researchers can determine the problems faced by teachers in learning chemistry. The student needs analysis stage is carried out by distributing questionnaires to get an overview of student problems regarding materials, teaching materials, and strategies used in learning activities. Concept Analysis is an activity to describe the concepts that students learn in teaching materials. The concept contained in the e-booklet is understanding problems related to acid-base solution material. Task analysis aims to compile comprehensive tasks and are implemented in learning materials in e-booklets. Specific learning objectives are the final stage of the previous analysis activities. At this stage, the formulation of learning objectives that refer to the essential competencies in the 2013 curriculum is carried out.

Stage II: Design

The second stage was carried out activities to design teaching materials. The design begins after formulating the learning objectives used in teaching materials. There are four steps in the design stage, namely (a) Determining the initial design to provide an overview of the resulting product. This activity is carried out to determine the title of teaching materials, collect supporting information for teaching materials, create concept maps, and compile evaluations to measure students' abilities after studying e-booklets, (b) Determine learning models following the objectives to be achieved. The

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learning model used is the problem-based learning model. (c) Presentation of teaching materials is carried out to present products following the criteria for the format of the e-booklet teaching material as awhole. (d) Preparation of expert validation questionnaires and student responses that will be used at the product validation stage.

Stage III: Develop

The development stage carried out four activities, including making e-booklet teaching materials, validity of teaching materials, revision of teaching materials, and field trials. Activities carried out at the stage of making e-booklet teaching materials are completing the process of making teaching material products following the design stage and will be validated. The validity of teaching materials is measured by expert assessment of the product's design and content or material so that the shortcomings and advantages are known. After the e-booklet teaching material product is validated by expert validators, further revisions or improvements are made based on comments from validators so that the product can be tested on a limited basis. The finished teaching material product is then carried out in a limited trial. In this activity, a response questionnaire was given to 34 students who were selected purposively for those who had studied acid-base material as research subjects to assess the product's feasibility level. This trial was obtained from response data and suggestions from the target subjects of e-booklet product users.

The data obtained was analyzed using the product feasibility technique formula by Akbar in (Nesri, 2020) as follows:

$$P = \frac{\sum x}{\sum x_i} \times 100\%$$

Description

P = Percentage of validity
$\sum x$ = Total number of expert assessments per aspect
$\sum x_i$ = total number of ideal values or maximum values per aspect.

To determine the feasibility of a product, criteria are needed. The average score of all aspects must be converted into qualitative data using the assessment criteria listed in Table.1 below.

Table 1. E-booklet Teaching Material Assessment Criteria

No.	Validity Presentation	Level of Validity
1.	85.01 % - 100 %	Very High
2.	70.01 % - 85.00 %	High
3.	50.01 % - 70.00 %	Medium
4.	01.00 % - 50.00 %	Low

Akbar (Nesri, 2020)

The percentage calculation guidelines based on the student response questionnaire assessment are listed in Table.2 below.

Table 2. Student Response Scoring Criteria

No.	Score average interval	Category
1.	81.25 < skor ≤ 100 %	Very Good
2.	62.50 % < skor ≤ 81,25%	Good
3.	43.75 % < skor ≤ 62.5 %	Not so good
4.	25 % < skor ≤ 43.75 %	Not good

(Auliya & Lazim, 2020)

HASIL DAN PEMBAHASAN

The development of this e-booklet follows the 4-D model development stages. However, this research is limited and only the define, design, and develop stages. The dissemination stage was not conducted due to time constraints, which required more than one trial on a broader scale.

Define stage

a) Early-end analysis

This step is done to determine the fundamental problems students face and to analyze the urgency of the need for e-booklet development at the school. At this stage, a needs questionnaire was filled out by chemistry teachers to identify learning tools and learning strategies used by teachers. The results of the early-end analysis showed that the teaching materials used were still in the form of textbooks and worksheets, making them less interesting and less effective for students in understanding the concept of material. In addition, information was found that teachers still use lecture, discussion, demonstration, and project methods and have not applied the problem-based learning (PBL) learning model to teaching materials. As for the learning resources used, there are no additional teaching materials that can support students in solving problems. Therefore, additional teaching materials are needed in the form of e-booklets based

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on problem-based learning (PBL), which can help students become active in solving a problem by discussing it with their group friends.

b) Student Analysis

Student analysis aims to discover students' characteristics and find solutions to problems faced by students during the learning process. This stage was completed by filling out a needs questionnaire by 34 students. The following results of student needs analysis are shown in Table 2.

Table 2. The results of the student needs questionnaire on the e-booklet-based PBL

No	Criteria	Percentage (%)	
		Yes	No
1.	Interest in learning chemistry	61.8	38.2
2.	Difficulties in learning chemistry, especially acid-base solution materia	64.7	35.3
3.	Teaching materials used		
	a. Texbook	11.8	
	b. LKS	85.3	
	c. Module	38.2	
	d. Teacher's Book	23.5	
	e. Student Book	8.8	
	f. E-modules	23.5	
	g. E-booklet	2.9	
4.	Teaching materials used by teachers are less interesting	38.2	61.8
5.	The teaching materials used by the teacher are difficult to understand	44.1	55.9
6.	Teaching materials used by teachers are less varied	41.2	58.8
7.	The need for teaching materials that can be used flexibly and are easy to understand	100	0
8.	Learning method		
	a. Lecture	23.5	
	b. Discussion	55.9	
	c. Presentation	50	
	d. Demonstration	17.6	
	e. Project	14.7	
9.	The teacher's explanation is still theoretical by giving formulas and practice problems.	97.1	2.9
10.	Responses support the development of e-booklets based PBL on acid-base materials	85.35	14.7

Based on Table. 2 above, it was found that the teaching materials used at school were LKS and modules. Some students also stated that the teaching materials used by teachers were still less interesting and varied. In addition, chemistry teachers provide learning that is still theoretical by providing formulas and practice questions so that learning is not interactive. Overall, students need teaching materials that are flexible and easy to understand.

c) Concept Analysis

Concept analysis is carried out in two steps: (1) analyzing Basic Competencies and indicators of competency achievement and (2) analyzing the material needed to support the making of learning designs (Mi'rojiyah, 2016). Based on the results of this analysis, the basic competencies for acid-base solution material are KD 3.10, 3.13, 4.10, and 4.13.

Table 3. Basic Competencies (KD) and Competency Achievement Indicators (IPK)

Basic Competencies	Competency Achievment Indicators	
3.10 Explain the concept of acids and bases and their strength and ionization equilibrium in solution	3.10.1	Explain the properties of acidic solutions and basic solutions and relate them to the food intake that is consumed more dominantly acidic or basic
	3.10.2	Explain the concept of acid-base based on acid-base theories
	3.10.3	Analyze the properties of acidic and basic solutions based on their strength
	3.10.4	Explain "acid-base equilibrium" and determine "the degree of acidity (pH) of acid-base solutions through chemical calculations.
4.10 Analyze the trajectory of pH changes of some indicators extracted from	4.10.1	Predict the degree of acidity (pH) of acidbase solutions with acid-base indicator

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natural materials through experiments"		
3.13 Analyze data on the results of various types of acid-base titrations"	3.13.1	Determine "the concentration of acid or base based on titration data and analyze the curve of acid and base titration results
4.13 Conclude the results of data analysis of acid-base titration experiments	4.13.1	Conduct "experiments and analyze the data of acid and base titration experiments

Based on the KD and formulation of GPA, several concepts were found to be included in the e-booklet teaching materials: acid-base theory, acid-base strength, acid-base equilibrium, identification of the degree of acidity (pH) of acid-base solutions, and acid-base titration, as well as acid-base titration experiments with natural indicators.

d) Task Analysis and specification of learning objectives

The task analysis stage is to compile the scope of tasks that will be contained in the e-booklet presented with the problem-based learning (PBL) stage. The preparation of the task list is based on the KD and GPA that have been determined. The last analysis stage is the specification of learning objectives, converting the results of concept analysis and task analysis into learning objectives.

Chemistry learning is often considered difficult because it is abstract, such as acid-base material. This acid-base material not only involves concrete concepts but also represents invisible concepts, so misconceptions frequently occur in students (Amry et al., 2017). In addition, learning chemistry is often seen as less interesting. This is due to the lack of student interest in chemistry caused by the learning methods teachers use that are less suitable and less favoured by students (Priliyanti et al., 2021).

Based on the results of the needs questionnaire, students need help learning acid-base materials. These concepts involve the submicroscopic (Sholehah & Azhar, 2019). Chemistry learning in schools usually rarely explains submicroscopic concepts, so many students have difficulty understanding the concept. Therefore, teaching materials are needed that can explain the concept concretely. Based on this explanation, the researcher offers a solution in the form of a problem-based learning (PBL) e-booklet developed using the flip pdf corporate application that can be used in chemistry learning, especially acid-base material. The e-booklet developed makes this electronic teaching material flexible and easy to use anytime and anywhere and can be accessed on smartphones and PCs/laptops. This electronic booklet also integrates chemistry learning with a problem-based learning (PBL) model that can apply real contexts so that students can identify, learn, search, and find solutions to these problems (Tan, 2003).

1) Design Stage

The design stage is the initial stage of systematizing the e-booklet, which consists of four stages: the initial design, the use of learning models, the presentation of teaching materials, and the making of e-booklet assessment tools.

a) Initial design

The initial design stage carried out activities to determine the title of the e-booklet teaching material developed, that is, "E-booklet Larutan Asam Basa Berbasis Model Problem Based Learning." Determining learning instructions and concept maps. After that, include the basic competencies (KD) and indicators of competency achievement (IPK) that have been analyzed and practice questions for each learning activity. The following is the front cover of the e-booklet, which contains the title of the teaching material in Figure 1.

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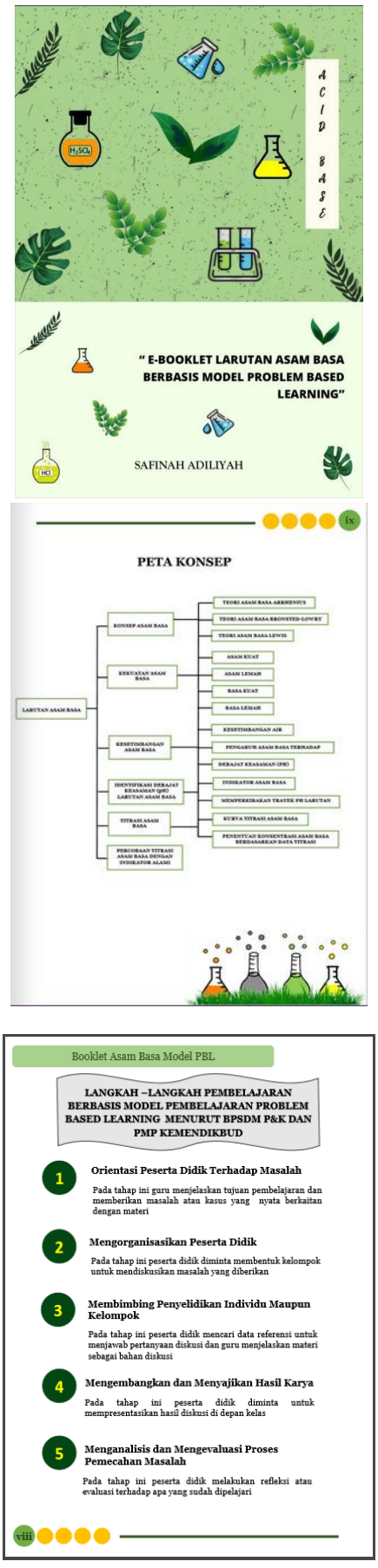

Figure 1. Display of *e-booklet* acid-base based on PBL

Figure 1. is the result of the PBL-based e-booklet design. The content design of this PBL-based e-booklet consists of the front cover, introduction, table of contents, instructions for using the e-booklet, PBL learning steps, concept maps, materials equipped with pictures and learning videos, and evaluation questions to assess students' concept understanding. The content presentation in this e-booklet is based on the syntax of the problem-based learning model.

b) Learning Strategy Selecting

Problem-based learning is a model that will be applied to the acid-base solution e-booklet teaching materials. This is because PBL can encourage the improvement of critical thinking and problem-solving skills by finding solutions to real problems given in the learning material (Joshi et al., 2020). The learning stages in this e-booklet refer to the "PBL model which consists of orienting students to the problem, organizing students, guiding group investigations, developing and presenting work, and analyzing, and evaluating the problems solving process." The following display of the PBL model stages in the e-booklet is shown in Figure 2.

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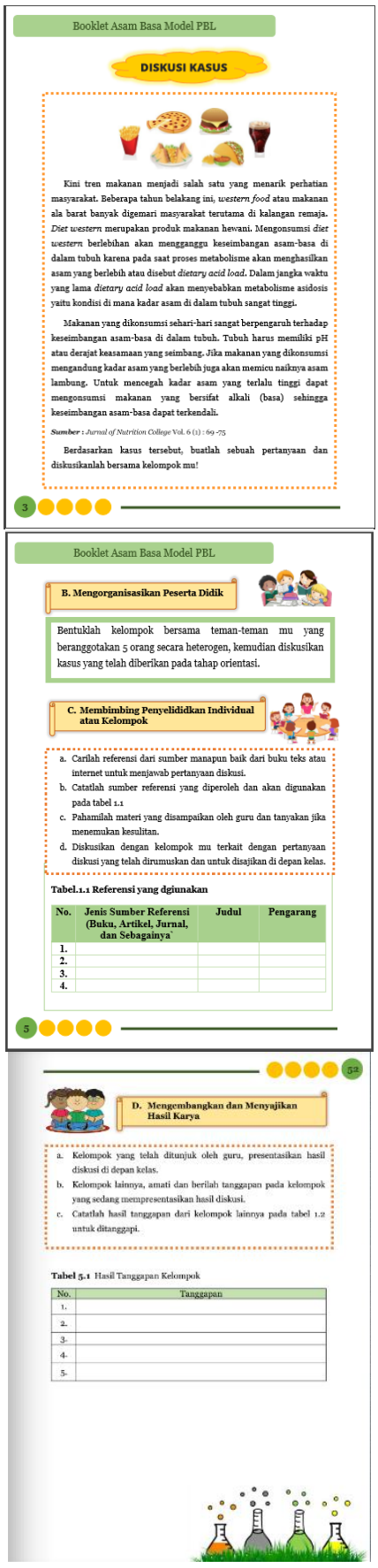

Figure 2. Display of PBL steps in the *e-booklet*

Figure 2. These are the steps of the PBL model, which begins with the orientation stage of students to the problem. At this stage, a contextual problem or case related to acid-base is presented, which will be discussed by students. After students formulate a question from the case, the next step is for the teacher to organize students to form discussion groups. In the next stage, the teacher guides the learners' investigation to find information from various references as material in answering the questions that have been formulated. The next stage is learners presenting and evaluating the results of their group discussions. The five stages of PBL integrated into this e-booklet can hone students' problem-solving abilities.

c) Presentation of e-booklet teaching materials

At this stage, media selection is also done to support the completeness of compiling the learning booklet and the selection of flip PDF corporate software that will be used to design and convert booklets into electronic form. In this e-booklet, learning videos are inserted to make it easier for students to understand the concept of acid-base material. Here is how the e-booklet looks like with the flip PDF corporate software.

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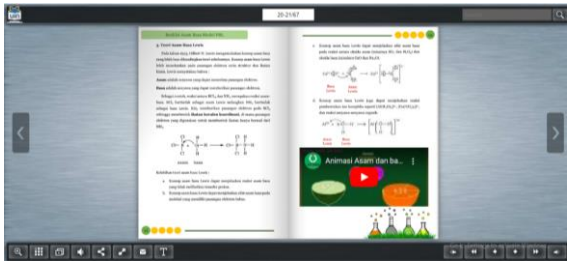

Figure 3. Display of e-booklet with flip pdf corporate

d) Creation of e-booklet assessment tool

Develop an e-booklet assessment tool instrument used to assess the feasibility of the developed e-booklet. The measuring instrument used is expert validation questionnaire and student response to the developed e-booklet.

2) Development Stage

After completing the design stage, which is the process of making PBL-based e-booklet teaching materials, then the development stage, experts carry out validation to assess the feasibility of the products that have been developed. The validation process was carried out by 4 validators, namely 3 chemistry education lecturers and 1 chemistry teacher at SMAN 21 Bekasi. The average validation score by each validator on each aspect can be seen in Table 4, Table 5, Table 6, and Table 7.

Table 4. Percentage score of expert validation for the feasibility aspect of material content

Indicator	Validator Expert (percentage)				Average	Criteria
	1	2	3	4		
Conformity with KD	75	83.3	91.6	93.7	86	Very high
Material accuracy	100	85	85	91.6	90	Very high
Up-to-date material	100	100	100	91.6	98	Very high
Encourage Curiosity	100	100	100	100	100	Very high
average					94	Very high

Based on the validation results for the feasibility aspect of the material content, the percentage for conformity with KD is 86% (very high). The accuracy of the material obtained a percentage of 90% (very high). In the up-to-date material indicator, 98% (very high) was obtained, and the e-booklet encourages curiosity obtained a percentage of 100% (very high). From the four indicators, the average validity percentage of the material content feasibility aspect is 94%. Therefore, the criteria for e-booklets developed regarding material feasibility are very high.

Table 5. Percentage score of expert validation for presentation feasibility aspect

Indicator	Validator Expert (percentage)				Average	Criteria
	1	2	3	4		
Presentation Technique	75	100	100	100	94	very high
Presentation Support	75	100	83.3	91.6	89	very high
Presentation of Learning	75	75	75	100	81	very high
Coherence and coherence of thought	75	75	87.5	87.5	81	very high
average					86	Very high

Based on the validation data for the presentation feasibility aspect, the percentage for presentation techniques is 94% (Very High). The percentage of supporting presentations is 89% (very high). The percentage of learning presentation is 81% (high), as well as on the coherence indicator and the conciseness of the flow of thought obtained a percentage of 81% (high). Of the four indicators, the average percentage of validity of the presentation feasibility aspect is 86%, with very high criteria**.**

Table 6. Percentage score of expert validation for linguistic feasibility aspect

Indicator	Validator Expert (percentage)				Average	Criteria
	1	2	3	4		
Straightforward	75	100	100	100	94	very high
Communivative	75	100	75	100	88	very high
Dialogical and Interactive	75	100	100	100	94	very high
Appropriateness of	75	100	75	100	88	very high

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students' developmental level						
Conformity with language rules	75	100	100	100	94	very high
Average					92	Very high

Based on the validation results for the linguistic feasibility aspect, the percentage for the use of language in the e-booklet is straightforward at 94% (very high). E-booklets using communicative language obtained a percentage of 88% (very high). In the dialogical and interactive indicators, the percentage obtained is 94% (very high). In the indicator of conformity with the level of student development of 88% (very high), as well as conformity with language guidelines of 94% (very high). Based on the five indicators, the average percentage of validity of the linguistic feasibility aspect is 92%, which indicates that in terms of linguistic feasibility it is very high.

Table 7. Percentage of expert validation scores for PBL component aspects

Indicator	Validator Expert (percentage)				Average	Criteria
	1	2	3	4		
Problem-oriented (problem stage)	100	100	91.6	100	98	Very high
Collecting and presenting data from findings (inquiry stage)	100	100	100	87.5	97	Very high
Developing the results of the data found (findings development stage)	100	100	100	100	100	Very high
Evaluate the method and findings with the items (evaluation stage)	100	87.5	100	87.5	94	Very high
Average					97	Very high

Based on the validation results for the PBL component aspects, the presentation of the orientation indicator to the problem was 98% (very high), and the indicator of collecting and presenting the findings obtained a percentage of 97% (very high). The indicator of developing the results of the data found obtained a percentage of 100% (very high), and the indicator of evaluating the findings obtained 94% (very high). Of the four indicators, the average validity percentage was 97%, with very high criteria. Therefore, the criteria for e-booklets developed from the aspect of PBL learning components are very high.

Based on the results of the validity of all aspects, it shows that the PBL-based acid-base e-booklet has very good feasibility. The problem-based learning (PBL) e-booklet developed prioritizes how students can solve a problem. Therefore, applying the stages of this PBL model can increase student activeness (Nurrohim dkk, 2022).

In the next stage, after product validation, the e-booklet was tested on students of class XII SMAN 21 Bekasi City to assess the feasibility of the e-booklet as a companion book in chemistry learning. The results of student responses to the e-booklet are listed in Table 8.

Table 8. Results of students' response to the e-booklet

Aspect	Statement	Percentage (%)	Average Percentage (%)	Criteria
Technical	*This acid-base e-booklet is interesting.*	86.02	85.53	Very Good
	This acid-base e-booklet is presented in color and equipped with pictures.	85.29		

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	This acid-base e-booklet is in accordance with the material taught at school.	85.29		
Contruction	The learning objectives in each acid-base e-booklet are clear	79.41	78.18	Good
	The steps in this acid-base e-booklet are easy to understand.	76.47		
	The questions in this acid-base e-booklet are easy to understand.	78.67		
Didactics	*This acid-base e-booklet generates motivation to learn*	85.29	80.88	Good
	This acid-base e-booklet encouraged me to solve a problem	79.41		
	By using this acid-base e-booklet, I was guided to think critically.	75		
	This acid-base e-booklet involves phenomena in everyday life.	83.82		
Averager of All Aspects			81.53	Very Good

Based on the average percentage of all student response questionnaire assessments of PBL-based acid-base e-booklets developed, we obtained 81.53% in the "very good" category. The criteria obtained indicate that this e-booklet is suitable as a companion book in chemistry learning. This is because, in this e-booklet, problems involving daily life phenomena are presented, thus encouraging students to be able to solve problems and guide students in critical thinking. This result follows Tan's statement in Palennari (2018) that the learning process using the problem-based learning (PBL) model must involve real problems in life. These results also align with Violla & Fernandes (2021): "using media in learning can enable students to think critically, become problem solvers, be more likely to seek more information and be more motivated in the learning process". Applying the PBL model to e-booklets can improve students' critical thinking, cognitive, and problem-solving skills (Joshi et al., 2020).

CONCLUSION

In this study, a problem-based learning-based e-booklet on acid-base material was developed. The results showed that experts declared the e-booklet based on the PBL model on acid and base developed was valid and obtained the "Very Feasible" criteria for use in chemistry learning. Students' responses to the e-booklet based on the PBL model on acid and base materials get the "Very Good" category with positive responses. Thus, e-booklets based on problem-based learning can be used as a learning resource for students in solving chemical problems on acid-base materials. The e-booklet based on problem-based learning has been produced through the findings obtained in this study. It needs to be tested until the dissemination stage and a broad range of trials to measure the effectiveness and practicality of the e-booklet products that have been developed. In addition, it is also necessary to develop e-booklets based on other learning models so that they can train students' thinking skills.

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