JURNAL PENDIDIKAN KIMIA (JPKIM)
ISSN: 2085-3653| e-ISSN: 2549-3116

J. Pendidik. Kim 2023, 15(2), 163 - 169
DOI 10.24114/jpkim.v15i2.48264

Research Article

Based E-LKPD development based problem based learning to improve students' creative thinking skills on acid-base material

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Received 05 July 2023 ♦ **Revised** 30 August 2023 ♦ **Accepted** 31 August 2023

Citation: Mariyana, M., Syahri, W., & Haryanto, H. (2023). Based E-LKPD development based problem based learning to improve students' creative thinking skills on acid-base material. Jurnal Pendidikan Kimia (JPKIM), 15(2), 163–169. https://doi.org/10.24114/jpkim.v15i2.48264

Keywords

Acid-base material
Creative thinking skills
E-LKPD
Problem based learning

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Abstract

Students' creative thinking skills tend to be lowas found in SMAN 2 Muaro Jambi. Hal this is due to students' low learning interest in chemistry subjects. Therefore the teacher must be able to create creative learning such as developing a teaching media. This study aims to develop media-based E-LKPD Problem Based Learning to be able to improve students' creative thinking skills on acid-base material. The type of development research carried out is Research and Development using a combination approach, namely between qualitative and quantitative approaches. The qualitative approach is intended to analyze the development process which will be described in depth about the events that occurred during the research, while the quantitative approach is used to analyze the results and path analysis. Electronic student worksheets (E-LKPD) which were developed based on problem-based learning models using Page flip Professional 3D software using a 4-D model development design. In this development research, the last stage is to test the effectiveness of the product using type experimental research design equivalent time serises design so it uses one experimental class by measuring the value posttest each meeting 3 times using the E-LKPD media that has been developed in the format pfprj. Based on the results of the study that there are differences in learning out comes without using the media and when using the media, that is obtained a difference of 11.56. Every meeting there is an increase of 5 - 7 average score so that the media developed is effective for improving students' creative thinking skills.

Introduction

Education is something very important to do. It is intended to be productive, creative, innovative, and effective generations through the integration of attitudes, abilities, and knowledge with life skills (Taghva et al. 2014). In the classroom, the teacher must encourage 4C ability, especially considering any kind of creativity. That is because the teacher is important person in preparing the students to face the demands of the era and to enhance the quality of learning (Kurniawan et al. 2019). In studying chemistry, it is not enough just to memorize concepts. Chemistry is a subject in high school equivalent with regard to nature, but some students consider chemistry subject matter difficult to understand and saturate. This is the cause of lower student interest in learning, such as in acid-base material where some chemical reactions involve acid-base reactions. Even though students are also required to be skilled in creative thinking. Purwaningrum (2016) said that creative thinking skills are a thought process for expressing new relationships, seeing things from a new perspective, and forming new combinations of two or more previously mastered concepts. According to Desmarani et al. (2021) the process of creative thinking skills involves several elements such as fluency, flexibility, originality, and details (elaboration).

Creative thinking is based on the experience and existing knowledge used to help people find a variety of input ideas in multiple perspectives and dimensions to create a new idea (Daud et al. 2012). Creative thinking consist of (1) Fluency is the ability to produce a large number of ideas, the way students represent their

answers also included flexibility and originality (Wiyarsi et al. 2018), (2) Flexibility is the ability related to the number of ideas or answers generated, not only having many answers but the answers must be varied. This also relates to the way students solve problems where sometimes students can produce more than one answer, (3) originality is the ability to produce unique ideas or unpredictable ideas (Ernawati et al. 2019).

Based on the results of an interview with one of the chemistry subject teachers at SMA Negeri 2 Muaro Jambi that students' creative thinking skills tend to be low, this is also due to students' low learning interest in chemistry subjects. The students consider that the chemistry lesson delivered by the teacher is less interesting. This is due to the limited learning media and learning resources used in the learning process, especially acid-base material. So that in the learning process the teacher still uses learning media in printed form such as books, worksheets and others. Therefore the teacher must be able to create creative learning, so that the learning process becomes more fun for students by actively involving students, as well as increasing understanding of material concepts and students' thinking skills in chemistry learning. One learning model that can be integrated to improve students' creative thinking skills is the problem-based learning models. The PBL model is a model that delivers learning material from problems that exist in students' daily life environment, to more complex material. This is of course also in accordance with the characteristics of the subject matter of acid and base, namely in the form of concepts and facts.

Based on the results of observations of students' needs analysis at SMA Negeri 2 Muaro Jambi, 69.5% of students said that it was difficult to learn acid-base material. Then 91.43% of students said that using various kinds of learning media, one of which was the E-LKPD, made learning more fun. Furthermore, all students said that learning media needed to be developed (containing photos, videos, animations, and practice questions) in chemistry learning that could be used anytime and anywhere, making it easier for students to understand acid-base subject matter.

The use of technology as a learning medium has an effective and better impact on learning (Novira et al. 2022). Utilization of technology-based learning media is able to make learning more interesting, meaningful and able to increase the effectiveness and efficiency of learning time so that learning objectives can be achieved by students. Instructional media that are designed and developed can be inserted with a learning model syntax which is certainly in accordance with the characteristics of acid-base material. The one model that can be used is problem-based learning (PBL) (Purba et al. 2018; Nasution et al. 2018), so as to be able to direct teaching materials to support the learning process which involves students in activities to solve an acid-base problem both individually and in groups.

E-LKPD learning media has advantages that can simplify and narrow the space of time so that learning becomes more effective. In addition, E-LKPD can be used as the right solution to attract students' low interest in learning (Syafitri, 2020). This is in line with opinion Susanti et al. (2021) said that student worksheets are media that are made for the purpose of motivate as well can increase the attention and interest of students in learning activities, so that students do not get bored easily.

In general, for the development of student worksheet learning media, both in print and in electronic form, a lot has been done. One of them is research conducted by Lestari et al. (2022) who developed problem-based learning-based worksheets on colloidal material. As a result, problem-based learning-based worksheets were very feasible to use. In line with research Danial et al. (2022) with the development of problem-based E-LKPD on acid-base solution material, where the results obtained by the E-LKPD media are valid, practical and effective used to improve student learning outcomes. Then the research conducted by Tafonao et al. (2022) The research results show that problem-based learning electronic module learning media in the material colligative properties of the solution as a whole is very feasible to use as a learning medium.

Based on this explanation, it is necessary to develop learning media in the form of electronic-based student worksheets (LKPD). PBL on acid-base chemistry. The E-LKPD media developed does not only aim to assist students in learning, but can provide knowledge for teachers and students to make optimal use of technology in the learning process. Development of PBL-based E-LKPD, designed according to the syntax or stages of the PBL model because of the problem-based learning model. This corresponds to the material characteristics of the acid-based solution. So that the learning media developed can be directed and can support the process of achieving the expected learning objectives.

Method

The type of research conducted is Research and Development (development research) (Sugiyono, 2014) using a combination approach, namely between qualitative and quantitative approaches. The qualitative approach is intended to analyze the development process which will be described in depth about the events that occurred during the research, while the quantitative approach is used to analyze the results and path analysis. Electronic student worksheets (E-LKPD) developed based on the problem-based learning model use software 3D Page flip Profesional using 4-D model development design. In the developed E-LKPD media, it is designed to include video, animation material for acid-base solutions for students in class XI MIPA SMA which aims to optimize or improve students' creative thinking skills. The following chart of the development model used on Fig.-1.

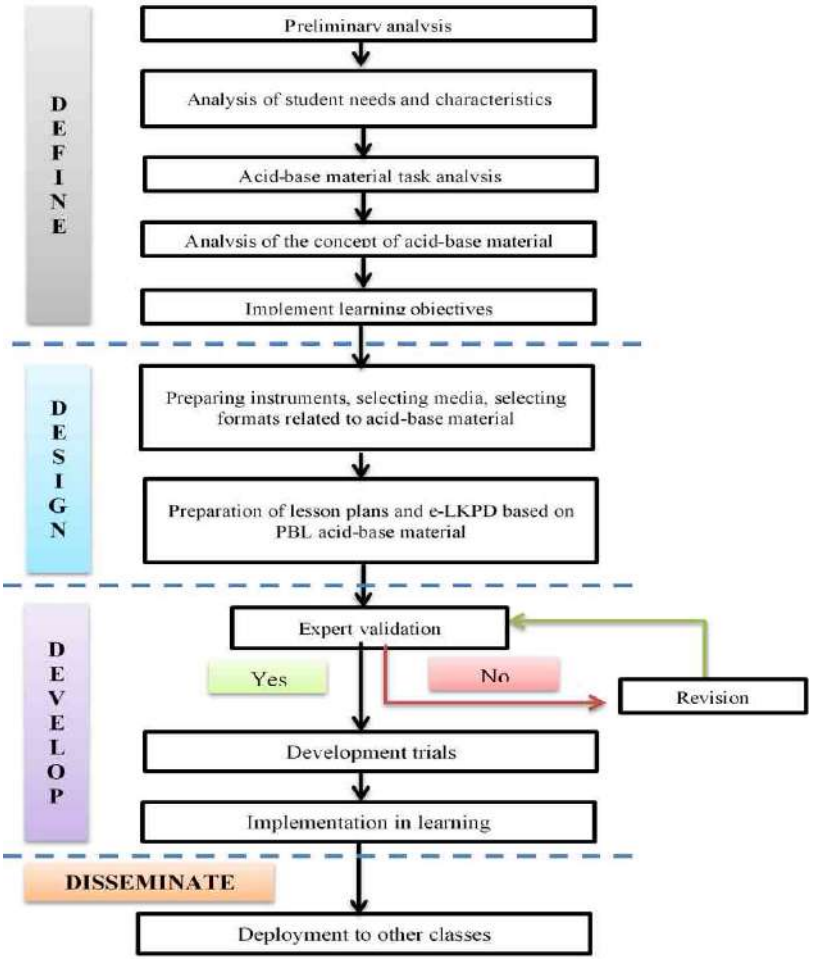

Fig.-1. 4-D Learning Device Development Model Chart

In this development research, the final stage is to test product effectiveness. The effectiveness test was carried out to find out how far the level of effectiveness of the developed E-LKPD media is when it is applied in the learning process on acid-base material. This test uses a type experimental research design equivalent time series design so that this study only used one experimental class by measuring value posttest students from each meeting on skills students' creative thinking. Based on Creswell (2012) an over view of the research design in the effectiveness test used is:

X	O_1	X	O_2	X	O_3

Information:

$O_1 - O_3$: Value measurement *posttest* creative thinking skills of class XI MIPA students for 3 times from meeting one to meeting three using questions *posttest* presented in the E-LKPD media

X : Giving treatment (treatment) for 3 meetings using model-based E-LKPD *problem based learning.*

Results and Discussion

This study was designed by applying the 4-D model development design developed by Thiagarajan et al. (1974) The 4-D model consists of 4 stages, namely defining, designing, developing, and disseminating. In this study, a product was produced, namely an electronic student worksheet (E-LKPD) which was developed based on a problem-based learning model use software 3D Page flip Profesional acid-based solution material for class XI MIPA high school students which aims to improve students' creative thinking skills.

Define Stage

In the early stages of designing Problem Based Learning-based E-LKPD media, several analyses were carried out contents such as needs analysis, situation in the school environment and research purposes. The result was that students at SMA Negeri 2 Muaro Jambi had been introduced to the Problem Based Learning learning model and received positive responses. In learning activities the teacher already uses media such as textbooks and power point, even though in reality there are still some students who do not bring textbooks when studying chemistry so they learn by sharing books with their classmates. This shows the lack of interest of students in learning chemistry.

Therefore, in presenting chemical material to make it more attractive, teachers must be able to choose appropriate learning media to use, so that the learning objectives expected of competency standards can be achieved by students. For this reason, a Problem Based Learning-based E-LKPD media was developed to be able to overcome this problem.

Design Stage

Media E-LKPD with Problem-Based Learning assist, also supported by the results of the student needs questionnaire, which stated that they liked electronic media to increase their understanding and were interested in using 3D Page Flip-based E-LKPD (Electronic-Student Worksheets) learning media which linked text, images, graphics, photos, videos and animations become one in chemistry learning to help understand chemical material with excellent responses. As for the display of media developed and stored in the format pfprj like on Fig.-2.

Fig.-2. The display of the E-LKPDtDone Developed

Develop Stage

Before the final product is obtained, this media has been validated by material experts, media experts, design experts, and teacher and student responses so that the writer can proceed to the next stage. The validation results show that the E-LKPD media is suitable for use after revising it twice.

The success of the media is inseparable from how well the media is planned and designed. The media can change student behavior (behavior change) and improve learning outcomes for students, especially on creative thinking skills that must also be owned by students at this time. So that this cannot be done directly or spontaneously, but a comprehensive analysis is needed by paying attention to various aspects that can influence the success of learning (Mudlofir and Rusydiyah, 2016).

Disseminate Stage

At this stage, participant worksheet learning media is socialized electronic education (E-LKPD) based on the problem-based learning model for limited amounts of acid-based material, namely teachers and class XI MIPA students. This spread is intended to gain responses, or feedback from the learning media that has been developed. The results of this distribution can be seen from the comparison of student learning outcomes before studying using E-LKPD media with student learning outcomes after using E-LKPD media using posttest assessment for 3 meetings times. During the deployment stage, students take part in learning well in class.

Table 1. Student Posttest ResultsSduring 3 meetings

Rate-Rata Value Before Using E-LKPD	Rate-Rata Value After Using E-LKPD		
	Meeting 1	Meeting 2	Meeting 3
64.5	69.37	76.07	82.90
64.5	76.11		

Students' creative thinking ability is said to increase if at least two of the following conditions are met: 1) students who fulfill the three components of creative thinking increase, meaning that the number of students who fulfill the three components of creative thinking during the posttest is more than the previous meeting. 2) students who fulfill the two components of creative thinking increase, meaning that the number of students who fulfill the two components of creative thinking during the posttest is more than the previous meeting. 3) students who fulfill one component of creative thinking increase, meaning that the number of students who fulfill one component of creative thinking during the posttest is more than the previous meeting. 4) students who did not fulfill the creative thinking component decreased, meaning that the number of students who did not fulfill the creative thinking component during the posttest was less than the previous meeting. Based on the results of the analysis of students' posttest scores, it is known that students have been able to fulfill 1-3 components of creative thinking.

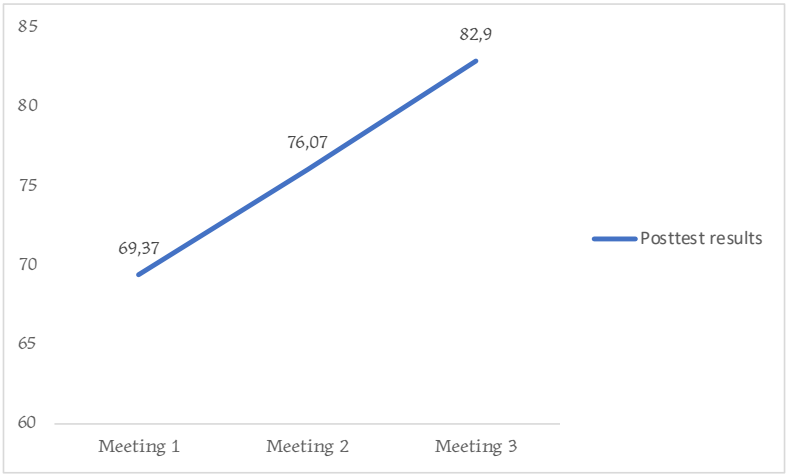

Fig.-3. Posttest Result Graph

Based on the Table 1, it is known that there are differences in student learning outcomes before using E-LKPD-based Problem-Based Learning and after using E-LKPD based Problem-Based Learning which has a difference gain of 11.61. From the table it can also be seen that at each meeting there was an increase of 5 - 7

average score. The improvement can also be seen from the Fig.-3. Based on the graph, it can be seen how the increase occurred from the results posttest every meeting. This means that this increase shows that with the existence of E-LKPD-based Problem Based Learning this can improve students' creative thinking skills.

Good or bad learning outcomes depend on the individual students who learn and the teacher who teaches, because learning outcomes are obtained from students who experience the learning process and the teacher who teaches them. How well students receive lessons in the teaching and learning process and how well the teacher makes learning interesting for students to accept is one of the determining factors in learning outcomes. Likewise, the learning outcomes seen in this study through the posttest, which showed that students who studied using the Problem Based Learning-based E-LKPD media developed experienced an increase in their learning outcomes through the posttest of creative thinking abilities.

The theory of behaviorism is one of the important factors used in the development of E-LKPD products, where the E-LKPD products are used as a stimulus in learning activities and the learning results are obtained that using the E-LKPD is able to produce a strong response with increased interest, motivation and learning activeness learners. Whatever the teacher gives is a stimulus, and whatever the student produces is a response, everything must be observable and measurable. Behaviorists prioritize measurement, because measurement is an important thing to see whether a change in behavior occurs or not. So from the results of the study it can be seen that changes in behavior, namely E-LKPD media can improve creative thinking skills.

Conclusion

Based on the results of the research that has been done, it can be concluded that: (1) This research produced Problem Based Learning-based E-LKPD media which was created using 3D page flip professional software using the 4D development model (define, design, develop, and disseminate) and saved in the format pfprj so that students can use it more easily; (2) The Problem Based Learning-based E-LKPD media that has been developed is conceptually feasible and gets positive responses from teachers and students in improving creative thinking skills on acid-base material. As well as the Problem Based Learning-based E-LKPD media, it is suitable for use by teachers and students in procedural learning on acid-base material; and (3) After the Problem Based Learning-based E-LKPD media is implemented in the learning process by teachers and students, it can be concluded that this E-LKPD is effective in improving students' creative thinking skills on acid-base materials.

Conflict of Interests

The author (s) declares that there is no conflict of interest in this research and manuscript.

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