Terakreditasi S4 sinta Science and Technology Index

pISSN 2685-0761
eISSN 2685-0850

JURNAL INOVASI PEMBELAJARAN KIMIA
(Journal of Innovation in Chemistry Education)
https://jurnal.unimed.ac.id/2012/index.php/jipk
email: Jinovpkim@unimed.ac.id

Recieved : 18 July 2024
Revised : 9 October 2024
Accepted : 27 October 2024
Publish : 31 October 2024
Page : 345 – 356

Validity of Problem Based Learning Oriented E-LAPD for Practicing Creative Thinking Skills Reaction Rate Material

Marttina Rachmawati[1] and Rusly Hidayah[2]*

[1,2]*Chemistry Education, Universitas Negeri Surabaya, Surabaya*

**Email*: ruslyhidayah@unesa.ac.id

Abstract: *The era of education that occurs in the 21st century places demands on students to ensure the ability to think creatively to solve various problems. Apart from that, the development of the industrial revolution 4.0 plays a role in the current generation in terms of technology and the internet. The aim of this research is to determine the validity of E-LAPD oriented Problem Based Learning (PBL) to train creative thinking skills on reaction rate material. This research uses an R&D model, one of which is ADDIE. The ADDIE development research model consists of 5 stages, namely Analyze, Design, Develop, Implement, and Evaluate, but without carrying out the Implementation stage. This validation was carried out by 3 validators, namely 2 chemistry lecturers and 1 chemistry teacher at SMA Labschool Unesa 1 Surabaya. The results of the analysis of aspect of content validity get a mode value of 4 with a valid category, while for aspect construct validity it gets a mode value of 5 with a very valid category, the results of the content and construct validity values get a mode score of ≥ 3, so E- LPAD can be declared valid. So that E-LAPD media can be used in learning.*

Keywords: *learning media; problem based learning; creative thinking skills; reaction rate*

INTRODUCTION

The era of education that occurs in the 21st century places demands on ensuring students' ability to think at a higher level including reasoning abilities, systematic abilities, critical thinking abilities and creative thinking abilities in order to solve various problems and be able to answer educational challenges that will occur in the future. is coming (Wahyuni & Rahayu, 2021). Curriculum Merdeka is a learning system that includes a diversity of materials that provide opportunities for all students to strengthen their competencies by maximizing learning time. In this curriculum, teachers have the flexibility to choose a variety of learning tools that suit the needs and interests of learners Naqsyahbandi et al. (2024).

The education period is currently being pursued by generation Z, who has been nicknamed the internet generation because of the skills they have to use technology intelligently, creatively and critically (Christiani & Ikasari, 2020). The development of the industrial revolution 4.0 has spoiled the generation Z era in terms of technology and the internet, so it is necessary to develop human resources through technologically standardized learning (Prasetyo & Trisyanti, 2018). Based on a

circular from the Ministry of Research, Technology and Higher Education in 2016, learning resources that can be used to develop education are materials based on Information and Communication Technology (ICT) using the internet and smartphones (Wahyuni & Rahayu, 2021). Additionally, based on results of student needs analysis, students gave positive responses which explained that they needed learning media in the learning process (Sembiring et al., 2024). The use of technology in the learning process can be implemented through technology-based learning media. One learning media that can increase effectiveness and efficiency is E-LAPD.

E-LAPD learning media has the advantage of making it easier and narrowing the time space Therefore, E-LAPD is an appropriate study to gain interest in students who have no desire to learn (Syafitri & Tressyalina, 2020). Students will learn to understand the material and do assignments independently in order to practice independent learning and improve their thinking abilities through questions that are conceptualized in a meaningful and interesting way. E-LAPD will maximize students' active role in learning (Nuralifah & Hidayah, 2021). The implementation of the problem-based learning model will change learning patterns to be more active and leave a conventional impression of the learning model (Liana et al., 2021).

The problem oriented learning model or problem based learning has the characteristics that problems are the beginning of the learning process which are often encountered in real life and is a learning pattern that is collaborative, communicative and cooperative because it forms students' skills to discuss the problems chosen to be solved in a way. Good. The use of the PBL model in learning activities in the chemistry branch, especially when compared with conventional learning, shows that the PBL model approach is more effective (Rusly et al., 2021). Apart from that, the learning model with problem based learning is deliberately designed to encourage students to be able to explore the ideas they have in mind so that they will produce a hypothesis of knowledge and get used to thinking logically and thinking creatively (Nellasari, 2018).

The creative thinking process is the ability to build ideas to create new things or can be applied to solve problems. There are indicators on skills of creative thinking include originality, fluency, elaboration and flexibility (Liana et al., 2021). The importance of improving creative thinking skills in students is to train mental development regarding problems that occur around them, so that it will shape students into independent individuals. Thus, there is a difference between students with high level thinking skills who have low initial knowledge assessments and students who have high initial knowledge generally have higher thinking skills scores (Hutabarat & Sinaga, 2024).

Pre-research carried out at SMA Labschool Unesa 1 Surabaya found that the level of creative thinking skills of students was still in the low category. This is proven by the results obtained when students work on creative thinking skills questions given during pre-research. The results obtained on the 4 components of creative thinking include (1) Originality 25.59%, (2) Flexibility 46.42%, (3) Fluency 62.30%, (4) Elaboration 40.47%. Based on the results obtained which are still in the low category, efforts are needed to improve students creative thinking abilities regarding reaction rate concepts. Carrying out interviews with teachers also resulted in the KKM score in the chemistry subject being 77, in the reaction rate material 84% of students had achieved the specified KKM, namely 77. The learning method used depends on the characteristics of the material, constraints on the reaction rate material, namely time. The delivery of material is deemed insufficient because reaction rate is material that is difficult for students to understand optimally.

These activities are clarified in the student questionnaire results with the statement 66.66% of students consider reaction rate material to be one of the chemical materials that is difficult to learn. Apart from that, it is reinforced by the results of the questionnaire that 52.38% of students in carrying out the learning process on reaction rate material were not always given a problem and as many as 47.61% of students felt that they had never been given the task of formulating a hypothesis (temporary guess) about a problem. Therefore, it is very important to develop an E-LAPD that is problem based learning oriented which can train creative thinking skills on reaction rate material. Students' creative thinking skills require a feasibility value on E-LAPD. Ontologically, the feasibility of E-LAPD includes validity, practicality and effectiveness.

In this explanation, problem based learning (PBL) oriented E-LAPD is expected for student-centered learning, improve creative thinking skills, create learning conditions in a comfortable and peaceful atmosphere so that students can understand the concepts in the learning material. reaction. However, in reality there is no E-LAPD oriented problem based learning (PBL) reaction rate material in the independent curriculum. This research was conducted to produce validity of the E-LAPD being developed.

LITERATURE REVIEW

1. Electronic Student Activity Sheet (E-LAPD)

The student activity sheet (LAPD) is a learning tool that plays a crucial role in learning. E-LAPD means guidelines used to carry out investigative activities or solve problems in electronic form and packaged in a medium to make it clearer and more interesting. One of the software that can be used to create E-LAPD is Live Worksheet (Khotimah et al., 2019). E-LAPD is an electronic teaching material that contains guidelines for completing task that students must execute both in theory and in practice. A teaching tool to assist teachers in activating students is E-LAPD (Satura et al., 2021).

E-LAPD learning media comes from LAPD which is modified into a file form that can be opened electronically and has the advantage that material and questions can be viewed from multiple directions, in learning you can use cellphones and laptops. Students using digital technology since childhood can be used as an opportunity to develop learning media with various problems whose operations utilize the internet and gadgets (Perrotta & Feinberg, 2016).

Learning media using electronics based on Problem Based Learning (PBL) which was developed can be utilized by students whenever and wherever they are absent interpretation of place and tempo, more effectively used, can be reused, easy carried, and used independently (Dalimunthe & Ginting, 2022). The tasks contained in E-LAPD can be theoretical tasks such as resume assignments whose results are then presented, or practical assignments such as practicum assignments or field assignments (Prastowo, 2014).

2. Problem Based Learning (PBL)

Problem based learning has been implemented by various countries for 20 years at various levels of education. The application of the problem-based learning model was first applied in the medical field and after being deemed successful the problem-based learning model was widely applied by various other scientific disciplines throughout the world. The problem based learning model has the characteristics that problems are the beginning of the learning process which are often encountered in real life and are a learning pattern that is collaborative, communicative and cooperative because it forms students' skills to discuss the problems chosen to be solved well. The problems given can come from the teacher or from the students themselves so that students also have the responsibility to

seek information from various sources to obtain and solve problems through a competent learning process (Nellasari, 2018).

Interactive and innovative learning process that involves more of the role of technology to overcome students' low creative thinking skills, such as through providing learning media. The problem-based learning model is declared effective because it empowers students to carry out research and apply theories that have been understood based on the skills possessed by each student (Pratiwi & Mitarlis, 2019).

Applying the Problem Based Learning learning model must understand the syntax of the learning model to provide a more meaningful learning concept. PBL syntax consists of orientation about problems, organizing students, helping independent and group investigations, developing and presenting results, and analyzing and evaluating. Using a learning model problem based learning (PBL) can be seen that students provide positive response that students feel satisfied and can better understand the material studied with using problem-based teaching materials in the learning process because it connects directly to everyday life (Pulungan et al., 2021).

3. Creative Thinking Skills

Thinking is a form of mental activity experienced when faced with a situation that must be resolved. Creative thinking is an analytical ability that must be understood based on data obtained to solve problems using certain strategies or creative thinking can be defined as a form of thinking to obtain new idea (Wahyuni & Rahayu, 2021). According to (Nellasari, 2018) the definition of creative thinking ability is a form of high-level thinking which is characterized by the ability to create new ideas through the data information obtained. In the field of education, development on creative thinking is necessary for students to train their mental readiness regarding the problems they will face in social life.

There are several indicators of creative thinking in the learning process according to (Munandar, 2017) which include: fluency, which is the ability of students to produce many relevant ideas. Flexibility is a form of thinking skill that is different from most people, namely through the ability to quickly find alternative considerations for the problems faced. Original thinking skills, are students' skills to think about the latest ideas and obtain the latest strategies to be able to solve the problems they face in accordance with the thoughts of each student. Detailing skills (elaboration), is a student's skill to develop ideas obtained by exploring more in-depth information regarding problem solving solutions by detailing the steps taken, developing ideas expressed by other people, and testing the details of the solution that will be implemented.

METHODS

The study has a type of development study in the field of education. The development of E-LAPD uses an R&D research and development model, one of which is ADDIE. The ADDIE research model includes five phase: development, analysis, design, implementation and evaluation. However, in research without carrying out the Implementation stage. The ADDIE model goes through an evaluation and revision process at each stage in order to minimize errors. The sequence of procedures for this research is as follows:

a. Analyze Stage dan Evaluation

The first stage is the analyze and evaluation stage, which is carried out at this stage as follows:

1) Validate performance gaps
2) Determine instructional objectives
3) Analyzing students
4) Check resource availability
5) Propose a potential learning system
6) Develop a research management plan
7) Evaluation

b. Design Stage and Evaluation

The second stage is the design and evaluation stage, the steps taken at this stage are as follows:

1) Identify important tasks
2) Develop performance goals
3) Conclude the testing strategy
4) Estimate profit
5) Evaluation

c. Develop Stage and Evaluation

The third phase is the development stage, which occurs once the design and planning phase have been finalized. The action taken during this development stage include:

1) Produce content or products
2) Select or develop media
3) Developing guidelines for students and educators
4) Carry out formative revisions
5) Pilot test
6) Evaluation

The instrument utilized in this study is an E-LAPD media validation sheet, which includes assessments of both content validity and contruct validity. The validation sheet is used to collect assessment data carried out by validators, namely two Unesa chemistry lecturers and one chemistry teacher at Labschool Unesa 1 Surabaya High School on the content and construct validity of E-LAPD to train creative thinking skills. The validation sheet regarding the content and construct validity of the E-LAPD can be filled out by providing a checklist of the range of scores given, each aspect has a score range of 1 with an invalid statement to a score of 5 with a very valid statement. The results of the E-LAPD validity analysis are the results of the validator's assessment of the learning tools that were developed and analyzed by considering suggestions, input and comments from the three validators in order to improve the E-LAPD learning tools before testing. The validator provides an assessment of each component based on Table 1 on a Likert scale.

Table 1. Scale likert

Assessment Categories	Scale Value
Very Invalid	1
Less Valid	2
Quite Valid	3
Valid	4
Very Valid	5

Based on Table 1, the validation data is in the form of ordinal data which has unequal properties and cannot be carried out with mathematical operations, whether added, subtracted, combined or divided (Lutfi, 2021). Therefore, the research produced in the validation results uses the following modes, namely that the decision for each aspect or indicator is determined at the highest number provided that the minimum criteria for the score obtained is a score of 3. The outcomes of the validation are expressed as ordinal data, which can be analyzed by calculating the mode for each aspect or indicator based on the specified criteria.

1) If the aspect assessed by the validator has a score mode ≥ 3, then the aspect is declared valid.
2) If the aspect assessed by the validator has a score mode of < 3, then the aspect is declared invalid.

If there are aspects that do not meet the valid requirements, then they must be corrected (revised) and validated again until they reach the specified criteria (Lutfi, 2021).

RESULT AND DISCUSSION

1. Analyze Stage dan Evaluation

a. Validate Performance Gaps

This step is carried out to identify the current state of learning. Several things described in this step are the applicable curriculum, future demands and appropriate materials for developing E-LAPD learning media. The curriculum that applies at SMA Labschool Unesa 1 Surabaya is the independent curriculum. The aim of the independent curriculum is to prepare students to have deeper knowledge of various innovations so that they have open minds

through scientific work, one of which is through creative thinking skills.

b. Determine Instructional Objectives

In E-LAPD, questions will be presented regarding problems related to everyday life. Apart from that, learning activities using problem based learning (PBL) oriented E-LAPD provide students with the opportunity to be actively involved in learning. Such as working individually or discussing between groups and giving each other opinions that show the ability to understand concepts, creative thinking skills, and the ability to reason scientifically.

c. Analyzing Students

This stage is carried out to recognize the characteristics of students based on students cognitive development and age., academic abilities and the learning environment that motivates students in chemistry subjects in reaction rate material.

d. Check Resource Availability

The step of checking the availability of resources aims to support problem solving during learning activities. The resources described in this step relate to learning facilities, namely, technology, networks, content and other supporting resources

e. Propose a Potential Learning System

This step is used to determine an effective learning system carried out through learning resources provided within the Labschool Unesa 1 Surabaya High School school environment. The learning system emphasizes several components including materials, models, learning media, and other learning tools.

f. Develop a Research Management Plan

At this stage the aim is to manage the E-LAPD media development process so that it is disciplined and directed. After analyzing the material, student characteristics, required learning models and media, as well as the availability of resources at SMA Labschool Unesa 1 Surabaya, the next step is to create an E-LAPD design which will be implemented in accordance with the steps in the teaching module created.

g. Evaluation Analyze

Evaluation at the analysis stage is a summary of the analysis used as a reference in determining the E-LAPD design to be developed. In implementing the independent curriculum, it is guaranteed that students are required to have high-level thinking skills in the 21st century, one of the high-level thinking skills is the ability to think creatively to solve various problems and be able to answer educational challenges that will occur in the future.

2. Design Stage and Evaluation

a. Identify Important Tasks

This step is used to analyze tasks on products that will be developed and carried out by students in learning activities. The things described in this step are, identification of learning outcomes, identification of related material to be developed and the task analysis stage in accordance with the study material in the E-LAPD being developed.

b. Develop Performance Goals

Formulating performance goals is carried out by referring to the analysis of material and tasks that have previously been carried out. In this section, the learning objectives to be achieved at the end of the lesson will be formulated based on learning outcomes and the applicable curriculum.

c. Conclude the Testing Strategy

At the testing strategy stage the aim is to design a research instrument and create a Problem Based Learning (PBL) oriented E-LAPD media design that will be developed. Before the product is developed and tested, it must go through a review stage for revisions or improvements carried out by a chemistry lecturer. Suggestions from reviewers were made to improve the E-LAPD that will be developed, before finally proceeding to the validation stage by three validators, namely two chemistry lecturer validators and one

chemistry teacher validator at Labschool Unesa 1 Surabaya High School.

d. Evaluation Design

Evaluation at the design stage is a design summary that is used as a reference in developing E-LAPD media. At this stage, the E-LAPD design is prepared based on learning outcomes in accordance with the independent curriculum that is in effect at SMA Labschool Unesa 1 Surabaya, then identifying the material is carried out to identify the main concepts being conveyed. This identification process is based on Chemistry Learning Outcomes (CP) regarding reaction rates in the F phase.

3. Develop Stage and Evaluation

a. Producer Content or Products

Based on the data obtained from the design stage, the first activity at this stage is to produce problem based learning (PBL) oriented E-LAPD media to train students' creative thinking skills on reaction rate material. The E-LAPD that has been designed consists of several components, including:

1) Cover
2) Foreword
3) Table of Contents
4) Intriduction
5) Introductions for E-LAPD
6) PBL Leraning Steps
7) Student Activities
   a) Problem Orientation Stage

Figure 1. Problem orientation stage

b) Stage of Organizing Students

Figure 2. Stage of organizing students

c) Stage of Guiding Investigation Individually or In Group

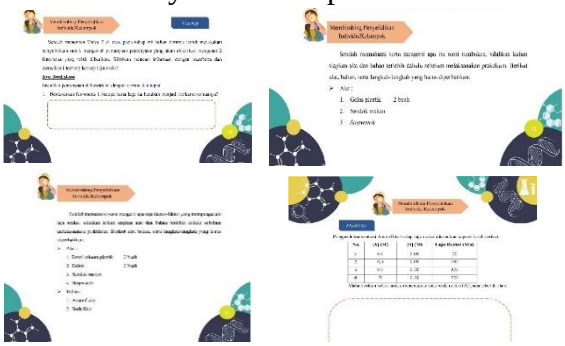

Figure 3. Stage of guiding investigation individually or in groups

d) Developing and Presenting Work Result Stage

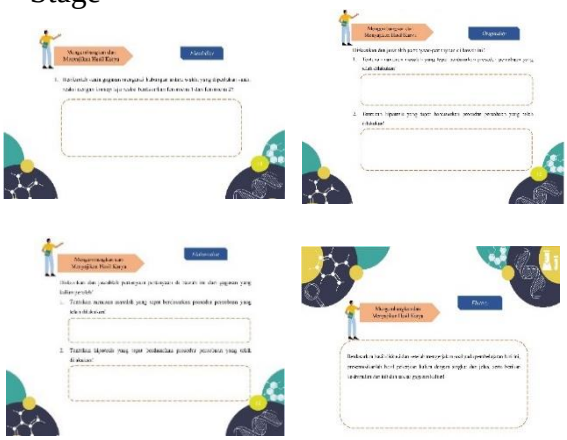

Figure 4. Developing and presenting work result stage

e) Analyzing and Evaluating Stage of the Problem Solving Process

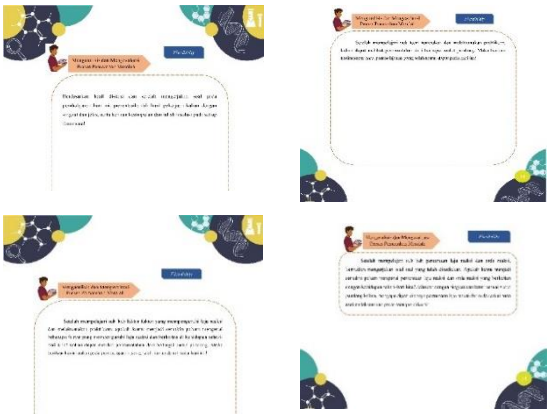

Figure 5. Developing and presenting work result stage

8) Conformity With Aspects of Creative Thinking Skills
   a) Elaboration
   b) Originality
   c) Flexibity
   d) Fluency
9) Reference

b. Select or Develop Media

At this stage, a learning media design has been produced, namely E-LAPD, which will be developed and tested on students. Before the trial is carried out, a study will be carried out at this stage. The study stage will be carried out by one chemistry lecturer with a process of examining or reviewing the media. E-LAPD and other research instruments. The results of the study are in the form of suggestions and input from reviewers.

c. Developing Guidelines For Student and Educators

Before carrying out the trial phase, guidance or guidance is needed to carry out trials using problem based learning (PBL) oriented E-LAPD media. This procedure aims to provide information to teachers and students in carrying out the learning process. The teacher's guide aims to guide students in carrying out the learning process using problem based learning-oriented E-LAPD, while the student guide aims to provide information to students during the learning process.

d. Carry Out Formative Revisions

The formative revision stage is the process of collecting data for evaluating problem based learning-oriented E-LAPD learning media before it is tested. This stage was carried out by assessing the validity of the developed E-LAPD. Validator performs for validation assessment, consisting of two chemistry education lecturers and one chemistry teacher at Labschool Unesa 1 Surabaya High School to obtain an E-LAPD that met the validity criteria. E-LAPD is assessed for validity based on content criteria and construct criteria, where E-LAPD is declared valid if it gets an assessment mode with a minimum score of 3 by the three validators based on the interpretation of the Likert scale scores proposed by Riduwan (2017) in Table 1.

Decision making using this mode is based on validation data in the form of ordinal data which has unequal properties and cannot be carried out with mathematical operations, whether added, subtracted, combined or divided (Lutfi, 2021). Validation data analysis provisions are analyzed using mode, namely if the aspect or indicator assessed by the validator obtains a mode at a score of ≥ 3 then it can be declared valid, whereas if the aspect or indicator assessed by the validator obtains a mode at a score of < 3 then it can be declared invalid. So revisions and reassessments must be carried out until the predetermined criteria are reached, namely each aspect or indicator obtains an assessment mode with a score of ≥ 3. The results of the validity assessment of E-LAPD 1 to E-LAPD 4 are shown in Table 2.

Table 2. Result of e-lapd validity assessment

Component Being Assessed	Assessment By Validator			Modus
Content Validity				
	V1	V2	V3	
Conformity of E-LAPD content with Learning Achievements and Learning Objectives	4	5	5	5
Conformity of E-LAPD content with Problem Based Learning (PBL) learning syntax				
a. Orientation towards problems	3	4	4	4
b. Organizing Students	3	5	5	5
c. Guide Individual or Group Investigations	4	5	4	4
d. Develop and Present work Results	4	4	4	4
e. Analyze and Evaluate The Problem Solving Process				
Conformity of E-LAPD with the indicators of creative thinking skills being trained	4	4	4	4
a. *Fluency*				
b. *Flexibility*				
c. *Originality*				
d. *Elaboratoin*				
Correspondence of facts, reaction rate concept in E-LAPD				
	3	5	5	5
	4	4	4	4
	4	4	4	4
	4	5	5	5
	4	5	5	5
Construct Validity				
The E-LAPD content format is arranged in a coherent and interrelated manner	4	4	5	4
The layout of the script, images and illustrations make it easier for users to understand the material				
The presentation of E-LAPD is interesting and fun				
1) Cover				
2) Foreword				
3) Table of Contents	4	4	5	4
4) Learning Outcomes				
5) Learning Objectives				
6) Instrunctions for Using E-LAPD				
7) Learning Activities				
8) Reference				
The cover is attractive and presents the contents of E-LAPD				

Component Being Assessed	Assessment By Validator			Modus
Content Validity				
	V1	V2	V3	
The use of clear font types and sizes makes it easier for readers to use E-LAPD	4	4	5	4
There is a place to write answers as needed	5	4	5	5
There is an explanation of the PBL learning steps on E-LAPD	5	5	5	5
The E-LAPD language uses terms that are easy to understand	4	5	4	4
Writing E-LAPD word/sentence structures in accordance with Indonesian language rules	4	4	4	4
The sentences used represent the content of the message or information for students	4	5	5	5
The command/instruction sentences are clear	4	4	3	4
	4	4	5	4
	4	4	5	4
	5	5	5	5
	4	5	5	5
	4	5	5	5
	4	5	5	5
	4	4	5	4
	4	4	5	4
	4	5	5	5

From Table 2, it can be seen that each assessment criterion in E-LAPD has a minimum mode of 4, so it can be categorized as valid. In the validation results that have been obtained, there are 15 aspects and 3 of them have more detailed aspects, so that sixteen aspects get a valid category, namely with a mode value of 4 and thirteen other

aspects get a very valid category, namely with a mode value of 5.

CONCLUSION

In the research, it can be concluded that the E-LAPD based on PBL or problem-based learning with the use of practicing creative thinking in the theory of reaction rates developed. The results of the validity tests that have been carried out on E-LAPD media are included in the valid and very valid categories. So it can be interpreted that the E-LAPD media developed is valid for use. Apart from that, the E-LAPD used can support science and technology, namely that E-LAPD can be studied and accessed by students anywhere with the smartphone they use. And make good use of technology as a means of education.

REFERENCE

Christiani, L. C., & Ikasari, P. N. (2020). Generasi Z Dan Pemeliharaan Relasi Antar Generasi Dalam Perspektif Budaya Jawa. *Jurnal Komunikasi Dan Kajian Media*, *4*(2), 84–105. https://doi.org/10.31002/JKKM.V4I2.3326

Dalimunthe, M., & Ginting, R. J. (2022). Pengembangan Modul Berbasis Problem Based Learning dengan Pendekatan Saintifik pada Materi Asam-Basa. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *4*(2), 177–190. https://doi.org/10.24114/JIPK.V4I2.38991

Hutabarat, C. M., & Sinaga, M. (2024). Implementation of an Integrated Guided Inquiry Learning Model in Generic Science Skills to Improve HOTS. *Jurnal Inovasi Pembelajaran Kimia (Journal of Innovation in Chemistry Education)*, *6*(1), 59–67. https://doi.org/10.24114/JIPK.V6I1.56467

Khotimah, H., Astuti, E. Y., & Apriani, D. D. (2019). Pendidikan Berbasis Teknologi (Permasalahan Dan Tantangan). *Prosiding Seminar Nasional Program Pascasarjana Universitas Pgri Palembang*. https://jurnal.univpgri-palembang.ac.id/index.php/Prosidingpps/article/view/3050

Liana, L., Wiryokusumo, I., & Leksono, I. P. (2021). Pengembangan E-Book Berbasis Problem Based Learning Pada Pelajaran Bahasa Jawa Kelas IV Sekolah Dasar. *Jurnal Inovasi Dan Teknologi Pembelajaran*, *8*(3), 289–298. https://doi.org/10.17977/UM031V8I32021P289

Lutfi, A. (2021). *Research and development (R&D): Implikasi dalam pendidikan kimia*. Surabaya: Jurusan Kimia FMIPA Universitas Negeri Surabaya

Munandar, U. (2017). *Mengembangkan Bakat dan Kreativitas Anak Sekolah*. Jakarta: Rineka Cipta.

Naqsyahbandi, F., Simatupang, N. I., & Mulyopratikno, F. W. (2024). *Implementation of The Merdeka Curriculum in The High School Chemistry Learning Process : Analysis of Variations in Hydrocarbon Material. Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, 6(1), 77-84. https://doi.org/10.24114/jipk.v6i1.57380

Nellasari, K. (2018). Pengaruh Model Pembelajaran Problem Bases Learning dengan Metode Brainstorming terhadap Kemampuan Berpikir Kreatif Siswa. Pendidikan Kimia. Jakarta: UIN Syarif Hidayatullah.

Nuralifah, R. N., & Hidayah, R. (2021). Pengembangan LKPD Berbasis Ideal Problem Solving Pada Materi Larutan Penyangga Untuk Melatihkan Keterampilam Pemecahan Masalah. UNESA Journal Of Chemical

education, 10(2), 9-102.

Perrotta, K. A., & Feinberg, J. R. (2016). Using Digital Simulations for Teaching the Consititutional Convention in Undergraduate History. *Social Studies Research and Practice*, 11(1), 158-176. doi:https//doi.org/10.1108/SSRP-01-2016-B0010

Prasetyo, B., & Trisyanti, U. (2018). Revolusi Industri 4.0 dan tantangan Perubahan Sosial. Prosiding SEMATEKSOS 3. 5, pp. 22-27. Surabaya: IPTEK ITS. http://dx.doi.org/10.12962/j23546026.y2018i5.4417

Prastowo, A. (2014). Panduan Kreatif Membuat Bahan Ajar Inovatif. Yogyakarta: Diva Press.

Pratiwi, I. P., & Mitarlis. (2019). *Implementation of Beach Ball Type Discussion Learning Model with Mind Mapping Strategy to Train Creative Thinking Skill in Class X on Chemical Bond Matter. Unesa Journal of Chemical Education*, 8(3), 436-442. Doi:https://doi.org/10.26740/ujced.v8n3.p%25p

Pulungan, A. N., & Sitepu, P. (2021). Pengembangan Modul Elektronik Berbasis *Problem Based Learning* (PBL) Pada Materi Larutan Elektrolit dan Non Elektrolit. *Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education)*, 3(2), 201-207. https://doi.org/10.24114/jipk.v3i2.27076

Riduwan. (2017). *Pengantar Statistika untuk Penelitian: Pendidikan, Sosial, Ekonomi, Komunikasi, dan Bisnis*. Alfabeta.

Rusly, H., Fauziatul, F., & Romita, E. N. (2021). Pengembangan Model Pembelajaran *Collaborative Problem Based Learning* Dalam Pembelajaran Kimia Di Perguruan Tinggi. Jurnal Pendidikan, Sosial, Agama. https://DOI:10.37680/qalamuna.v13i2.1016

Satura, Y. T., Abdullah, A., & Rery, R. U. (2021). Pengembangan LKPD Aplikatif Integratif Berbasis Inquiri Terbimbing Pada Materi Kesetimbangan Kimia. *Jurnal Pijar Mipa*, *16*(1), 64–67. https://doi.org/10.29303/JPM.V16I1.1647

Sembiring, D., & Susanti, N. (2024). *Development of PowToon-Based Audio-Visual Media in Chemical Bonding Materials. Jurnal Inovasi Pembelajaran Kimia (Journal Of Innovation in Chemistry Education),* 5(2), 94-101. https://doi.org/10.24114/jipk.v5i2.45014

Syafitri, R. A., & Tressyalina. (2020). *The Importance of the Student Worksheets of Electronic (E-LKPD) Contextual Teaching and Learning (CTL) in Learning to Write Description Text during Pandemic COVID-19*. 284–287. https://doi.org/10.2991/ASSEHR.K.201109.048

Wahyuni, L., & Rahayu, Y. S. (2021). Pengembangan E-Book Berbasis Project Based Learning (PjBL) untuk Melatihkan Kemampuan Berpikir Kreatif pada Materi Pertumbuhan dan Perkembangan Tumbuhan Kelas XII SMA. *Berkala Ilmiah Pendidikan Biologi (BioEdu)*, *10*(2), 314–325. https://doi.org/10.26740/BIOEDU.V10N2.P314-325