International Journal of Contextual Science Education (IJCSE)
e-ISSN. 3046-8876
Vol. 2, No. 3, September 2024
pp. 93-97

Chemistry Learning Innovation: Development of Guided Inquiry-Based E-LKPD for 10th Grade Students at SMAN 2 Rambatan

Muhammad Syadam Nashyra[1] , Elvy Rahmi Mawarnis[1*] , Mohd. Yusri Abd. Rahman[2]

[1] Department of Chemistry Education, FTIK, UIN Mahmud Yunus Batusangkar, Jl. Jendral Sudirman No. 137, West Sumatera, Indonesia 27217
[2] Institute of Microengineering and Nanoelectronics (IMEN), Universiti Kebangsaan Malaysia, 43600, Bangi, Selangor, Malaysia
Corresponding author emai: elvyrahmimawarnis@gmail.com

Accepted: August 7th 2024, Approved: August 29th 2024, Published: September 30th 2024

Abstract— This research is based on the low learning outcomes of students. One of the factors causing low student learning outcomes is teaching materials. Learning resources at SMAN 2 Rambatan use package books, but the school's package books are lacking, besides that bulky textbooks that make students lazy to carry the book. When viewed from teaching materials, examples of sample questions and discussions are lacking. In the learning process students only depend on the teacher's discussion. The purpose of this research is to produce valid and practical Guided Inquiry Based Electronic Student Worksheet (E-LKPD). This research uses the Research and Development research method with the 4-D development model (define, design, development, and disseminate), but the stages in the 4-D model are only carried out from the first to the third stage, namely the define, design, and development stages. This study used research instruments in the form of validation sheets and practicality questionnaires. The data analysis techniques used in this research are validity analysis techniques, practicality analysis. Furthermore, the results of the initial E-LKPD designed were continued in the validity and practicality tests. Guided Inquiry Based E-LKPD has met the valid criteria with validation results obtained 88%. Guided Inquiry-Based E-LKPD has met the practical criteria with the results of the 89% learner response questionnaire.

Keywords— electronic student worksheet (E-LKPD), guided inquiry, validity, practicality
How to Cite— Nashyra, M. S., Mawarnis, E. R., & Rahman, M. Y. A. (2024). Chemistry Learning Innovation: Development of Guided Inquiry-Based E-LKPD for 10th Grade Students at SMAN 2 Rambatan. *International Journal of Contextual Science Education*, *2*(3), 93-97. https://doi.org/10.29303/ijcse.v2i3.675

1. Introduction

Education is a process that aims to help students adapt to their environment, which will result in internal changes necessary for them to live well in society. In essence, the scientific method, scientific results, and scientific attitudes are the foundation on which science is based. Chemistry is one of the fields of natural science that studies everything related to substances, including their composition, structure, dynamics, properties, changes, and energy. Chemistry requires analytical thinking skills and competencies [1]

Chemistry is related to two insperable aspects, namely: First, chemistry as a result of scientific discoveries outlined in the form of rules, ideas, concepts, and facts. Second, chemistry as a procedure that is considered as scientific work or a scientific approach used to learn new things through experiments or experience-based research. The scientific method and experimentation are the basis of chemistry. Through scientific process activities in chemistry education, such as conducting experiments, students will acquire science process skills, which are necessary for them to acquire new information and abilities. The ability of students to use the scientific method to collect, understand, develop and discover knowledge is known as science process skills [2]

Chemistry is a scientific discipline that studies the characteristics, composition, and conversion of substances. Chemical bonding is one of many abstract concepts in this field. Studying chemistry, particularly chemical bonding, requires strong reasoning and understanding. It also necessitates the use of appropriate methodologies to make these abstract concepts more accessible to students. Chemistry is a branch of science that studies the energy involved in the transformation of matter as well as the characteristics, composition, and changes in matter. A material can change its structure and composition into a new material with various properties through chemical processes. Various structures and compositions also produce various properties in a material. Energy in the form of heat energy and electrical energy is often involved in chemical processes.[3]

In general, the implementation of a quality learning process is closely related to the accessibility of learning resources. Through learning media can help clarify ambiguous content presented by educators, the presence of media has significant significance. Infrastructure and facilities are all necessary for the local learning process to run smoothly, consistently, effectively, and efficiently - an integral part of the implementation of the learning process. Good learning also requires teaching materials that help students

© 2024 The Author(s).
This article is published by International Journal of Contextual Science Education (IJCSE) and licensed under a Creative Commons Attribution 4.0 International License (CC BY 4.0).

understand circuit learning as a whole In reality, not all schools can carry out learning well and smoothly. The implementation of chemistry learning has several challenges in reality. Lack of student enthusiasm in learning and less teaching materials, heavy workload and little time available, teachers are not motivated to design, prepare, chemistry teaching materials. Not only that, [4] in his research explains that the teaching materials used at school are not varied. In line with that, [5] in his research explained that students were bored in the learning process because the teaching materials were thick and difficult to carry. The current way of teaching chemistry in the classroom still does not help students build science process skills; instead, teachers teach more ideas, principles, and hypotheses without explaining how an idea is discovered. As a result, children do not naturally develop a scientific outlook. This results in interactions that occur, namely between students and teachers or between students and students, because interactions between students rarely occur during the learning process. This causes disruption to the learning process. Based on the problems obtained through the research journal above, these conditions are not much different from the results of observations made by researchers at SMA N 2 Rambatan. Through observations and interviews with chemistry teachers, researchers found problems faced by teachers related to learning materials. Teaching materials in these schools are very limited, the teaching materials used are only textbooks and even those are provided by the school, when viewed by design, a lot of material is incomplete and the discussion of questions is also lacking. Based on local learning conditions, students are overwhelmed in understanding the material on chemical bonding material, because this material requires discussion with examples of sample problems. However, this package book does not provide examples of problems and complete discussions. The package book is also monotonous due to the teacher's limitations in developing teaching materials, the teacher continues to use this package book.

Researchers also conducted interviews with students, students said that the learning process was constrained in teaching materials at school. This teaching material is less practical, students want the latest and practical teaching materials and are easy to carry anywhere and interesting. Thick teaching materials make students lazy in reading the material, besides that in the learning process students also feel bored because of repetitive teaching methods, the teacher only explains the material, this has an effect on learning outcomes below KKTP.[6]

E-LKPD (Learner Worksheet). One of the learning resources that can be made by teachers to assist learning activities is E-LKPD. E-LKPD is a set of worksheets containing tasks for students in accordance with the material discussed. E-LKPD serves as a learning guide for students as they engage in learning activities. In order to foster relationships between students and teachers as well as student activities that increase interest in learning, the use of E-LKPDs can help and promote students in teaching and learning activities.[7]

With regard to student problems that inhibit student creativity and exploration in the learning process, making students less actively involved in learning and students who feel bored, especially for students who are more responsive to learning that involves direct interaction. then the teaching materials developed E-LKPD based on quided inquiry. Characteristics Students are actively involved in the learning process, by formulating questions, seeking information, and making conclusions based on their findings. Gulo in Trianto (2010) states that the first characteristic of the guided inquiry learning model is the provision of questions or problems. Thus, students will be trained to find potential solutions to problems, which is none other than science process skills. After the disclosure of the problem, students formulate and test hypotheses based on their ideas. In the second stage, students gather information through book reviews and experiments. After that, students check the information to make sure the hypothesis is accurate.[8]

According to [9] conducted research related to the guided inquiry learning paradigm. They found that chemical equilibrium material improved learning outcomes and science process skills. Berliana and Yonata (2019) found similar results, stating that the science process skills educated through the use of the guided inquiry learning paradigm increased The use of the internet to search for educational resources, virtual face-to-face classes through video conferencing, learning management system (LMS) websites, and other innovations have contributed to the rapid development of information technology in education. However, the potential of the internet for teaching and learning is still not fully realized. Students use social media as long as they are not using the internet for educational purposes, and only use it to do homework. When students are not in the classroom, they more often use the internet for social networking and very rarely for educational purposes. The utilization of internet-based information technology advances, such as learning management systems (LMS) and video conferencing, in the field of education, especially during the learning process, is considered to have the potential to significantly improve the quality of education [10]

To answer the interactive kekimian material with the use of an interesting learning platform, the development of this E-LKPD is assisted by edmodo. Since 2008, Jeff O. Hara has developed Edmodo, a dynamic, imaginative, and engaging information technology-based learning platform, through the Edmodo social learning network. Similar to Facebook, Edmodo is a social media platform specifically designed for use by instructors and students in online classrooms. Edmodo can facilitate engaging and simple learning activities. Notes, documents and links can be shared between teachers and students. Instructors can choose to post assignments, events, and alerts for students in a publicly viewable time window [11]

Students and teachers can access learning resources anytime and from anywhere with a learning management system such as Edmodo application. Saepulloh (2020) states that Edmodo application is a personal microblogging tool created for educators and learners to protect student privacy. Teachers and students can use Edmodo to share documents, links and notes. This allows students to access the app at home to review lessons that have been taught or while studying in class. The Edmodo program is defined as a networked learning management system (LMS). Teachers and students can support the learning of electrical chemistry in modern times by using this medium. Besides being accessible through mobile devices, Edmodo can also be accessed through a PC or computer connected to the internet. The Edmodo program has many features, including award badges, parent codes, quizzes, textbooks, files and links, libraries, polls, assignments, and libraries. These features can help teachers and students in the learning process [12]

Teachers can use Edmodo as a learning tool as it is a secure and easy-to-use platform for collaboration between students and teachers in sharing resources, handling assignments and tracking all activities. By providing learner worksheet (E-LKPD) that learners can access and complete anytime and from anywhere, for example, the Edmodo program can assist teachers in creating a virtual classroom that mirrors the physical classroom environment. Students will be encouraged to learn independently by using the Edmodo program, which allows them to view and read shared teaching materials and learning tools from the teacher.[9]

2. Method

Based on the problem, the type of research that researchers use in this study is research and development. In this research and development using the Research and Development (R & D) method is a process or phase used in this research and development to create new items or improve and improve existing ones, as well as to evaluate their efficacy.[13]

Research and development (R&D) is defined by Sugiyono (2020: 297) as initial research activities to collect data on user demand (needs assessment), followed by ongoing development operations to create products and evaluate their efficacy. Research and development are two terms that make up development research. To create a specific product design, the first step is to conduct research and literature review. The second step is development, which entails evaluating the feasibility and validating the design created before it is transformed into an item that is tested and made available to the general public (Merlinda, 2019)

The four development steps followed by the 4-D development model in this study are defining, developing, designing and disseminating. Since the goal of each step is to create a feasible learning media, the materials and media are changed at each stage. The 4-D development stages conducted by Thiagarajan, Semmel, and Semmel. There are four steps included in this 4-D development model: Dessiminate stage, Design stage, Develop stage, and Define stage. However, the researcher's work was only carried out at the development stage [15]

3. Results and Discussion

Reasech and Developemt (R&D) research has been completed by researchers. The research was conducted at SMA N 2 Rambatan in class X. This research was conducted using the 4D model, namely (define, design, development, and disseminate), but the researchers only carried out until the development stage. The define stage was carried out to find out an overview of the conditions and problems found in schools and find solutions, the needs of students, and learning objectives. To find out all that, several analyzes were carried out such as preliminary analysis, learner analysis, curriculum analysis.

In the initial analysis, interviews and observations were conducted with chemistry educators of class X SMAN 2 Rambatan. Not only that, this analysis also analyzes the needs of students, teaching materials and curriculum. The following are the steps:

Interview with grade X chemistry educators. At this stage an analysis of the chemistry learning process was carried out with chemistry educators. In conducting interviews, there are several questions that researchers ask related to learning tools that will be prepared by educators before entering the classroom, including models, approaches, methods, teaching materials, media, and learning facilities and infrastructure. Learner analysis was conducted by conducting interviews with several students, class X at SMAN 2 Rambatan. Researchers also asked several questions related to facilities and infrastructure, learning media and teaching materials, but during the interview students emphasized more about teaching materials.

Complex teaching materials lead to students' over-reliance on teacher explanations. When viewed from teaching materials that are less practical at school, students want practical teaching materials, thick materials so that students are lazy to carry the book.

Chemistry class X Phase E based on the independent curriculum is known in Thermochemistry unit consists of Learning Outcomes (CP), Learning Objectives (TP) Learning Objective Flow (ATP). The curriculum analysis ensures the achievement of the practicum guide from each Learning Outcome (CP), Learning Objective (TP), and the Flow of Learning Objectives (ATP) can be achieved. ATP is developed based on the learning objectives that have been made.

Table 1. Analysis of the Results of the Instrument Validation Sheet Validity Test of E-LKPD based on guided inquiry

No	Aspects Validated	Validator				Total	Score Max	%	Category
		1	2	3	4				
1	Questionnaire format		3	3	4	13	16	81	Very Valid
2	Language used	8	7	6	6	27	32	84	Very Valid
3	Questionnaire Statement	12	10	9	9	40	48	83	Very Valid
Total						80	96	83	Very Valid

Table 2. Analysis of the Results of the Learner Response Questionnaire Instrument Validation Sheet

No	Aspects Validated	Validator				Total	Score Max	%	Category
		1	2	3	4				
1	Questionnaire format	3	3	3	4	13	16	81	Very Valid
2	Language used	8	7	6	6	27	32	84	Very Valid
3	Questionnaire Statement	12	10	9	9	40	48	83	Very Valid
Total						80	96	83	Very Valid

Research and Development research has been completed with the 4-D development model (define, design, develop, and disseminate). The stages in this research with the 4-D model were not carried out until the disseminate stage. This is because

researchers have limited time while the disseminate stage takes a long time, besides that researchers also have other limitations in terms of ability, energy, and funds.

Table 3. Analysis of the Results of the Learner Response Questionnaire Sheet

No	Practicality aspect	Number	Score Maks	%	Category
1	Ease of Use	205	224	91	Very Practical
2	View	142	168	86	Very Practical
3	Learning Materials	199	224	88	Very Practical
4	Language	102	112	91	Very Practical
Total		648	728	89	Very Practical

The first stage of the research conducted was the define stage. In the define stage, a beginning-end analysis, learner analysis, and curriculum analysis were conducted. In the beginning-end analysis, there are several analyses carried out, namely interviews with educators, analysis of students, analysis of teaching materials, and curriculum analysis. Analysis of educators and learners is done by observation and interviews so that it can be determined what will be developed in the study.

The final initial analysis stage regarding interviews regarding the conditions in the learning process / completeness that must be held in the learning process, such as models, media, and approaches. Based on this analysis, it is known that the emphasis of the problems faced by students in the learning process is due to limited teaching materials and difficult to understand. In the analysis of learners, it was carried out to find out the problems faced by students in the learning process. The same thing was conveyed by students conveying students difficult to understand the subject matter. The curriculum analysis was conducted to assess whether the chemistry curriculum in high school is still relevant to the latest scientific and technological developments and meets the needs of students in understanding important chemical concepts.

In the first syntax of guided inquiry there is a presentation of the problem in E-LKPD presenting a problem related to chemical bonding. In the second syntax of making hypotheses in E-LKPD students are given a question and students are given a column to answer the question. In the third syntax of designing experiments in E-LKPD students are given local material-based ion cards by matching cards with groups. In the fourth syntax of conducting experiments and obtaining data, where in this E-LKPD the teacher guides students to obtain data from the results of the experiment and the last syntax is the conclusion of the teacher guiding students to make appropriate conclusions. Of the three stages, researchers carried out the design stage, the design stage was carried out with the Canva and Word programs. This has been explained in the final initial analysis and results stage, after the product is designed, the product is tested with instruments and questionnaires.

The E-LKPD design stage is carried out by identifying the media program which is compiled in GBPM (Media Program Outline). Design stage Designing E-LKPD Based on Quidead Inquiry This process involves collecting various materials related to chemical bonding material. Furthermore, this learning media is developed using word with the help of other applications for microsoftwords, namely Canva, and for the images contained in the E-LKPD. The next step is the making of a flowchart or flowchart that explains the sequence of making E-LKPD from the cover, the introductory part of the practicum guide, the content of the E-LKPD, and the closing part of the E-LKPD. This flowchart can also be referred to as the E-LKPD scenario to be designed. After the flowchart is made, it is followed by making a storyboard that contains an image explanation of each step in the flowchart. This storyboard explains the appearance that will be in the E-LKPD.

4. Conclusion

The results of the validity test of guided inquiry-based E-LKPD on chemical bonding material meet the criteria of very valid based on the validator validation sheet with a percentage of 88%. The results of the practicality test of E-LKPD based on guided inquiry on chemical bonding material meet the criteria of very practical based on the student response questionnaire with a percentage of 89%.

Recommendations

For further research, hopefully using development with the latest learning platformii.

Acknowledgements

Thank you to the supervisor who helped direct this thesis and lecturers as validators and to the research school, SMA N 2 Rambatan, which has validated this thesis research.

References

[1] S. Ujud, T. D. Nur, Y. Yusuf, N. Saibi, and M. R. Ramli, "Penerapan Model Pembelajaran Discovery Learning Untuk Meningkatkan Hasil Belajar Siswa Sma Negeri 10 Kota Ternate Kelas X Pada Materi Pencemaran Lingkungan," *J. Bioedukasi*, vol. 6, no. 2, pp. 337–347, 2023, doi: 10.33387/bioedu.v6i2.7305.

[2] A. B. Baunsele *et al.*, "Peningkatan Pemahaman Terhadap Ilmu Kimia Melalui Kegiatan Praktikum Kimia Sederhana Di Kota Soe," *J. Pengabdi. Kpd. Masy.*, vol. 1, no. 2, pp. 43–48, 2020.

[3] M. Muti'ah, J. Siahaan, and S. Sukib, "Upaya Meningkatkan Motivasi dan Pemahaman Ilmu Kimia Melalui Demonstrasi

Kimia Bagi Siswa SMA N 1 Labuapi," *J. Pengabdi. Magister Pendidik. IPA*, vol. 4, no. 2, pp. 0–5, 2021, doi: 10.29303/jpmpi.v4i2.704.

[4] M. Rivki, A. M. Bachtiar, T. Informatika, F. Teknik, and U. K. Indonesia, "No 主観的健康感を中心とした在宅高齢者における 健康関連指標に関する共分散構造分析Title," no. 112.

[5] J. Pengabdian, A. U. Islam, K. Muhammad, and A. Al, "PENGENALAN ILMU KIMIA DI LINGKUNGAN PONDOK PESANTREN AL- IHSAN PUTERI BANJARMASIN Gusti Hadiatus Solehah, Novi Rahmawanti, dan Khairullah," vol. 10, pp. 292–304, 2024.

[6] M. Nadila and E. R. Mawarnis, "Decoding The Obstacles of 10th Grade Student Learning in Atomic Structure at SMAN 1 Sungai Tarab," *Hydrog. J. Kependidikan Kim.*, vol. 11, no. 6, p. 1017, 2023, doi: 10.33394/hjkk.v11i6.10154.

[7] A. Mardatilla, O. Suryani, and M. Mawardi, "Pengembangan Buku Ajar untuk Kurikulum Merdeka pada Materi Pengenalan Ilmu Kimia Fase E SMA/MA," *J. Pendidik. Kim. FKIP Univ. Halu Oleo*, vol. 8, no. 2, pp. 119–132, 2023.

[8] M. I. Dacholfany, M. Iqbal, E. Rahmi, and M. B. Purwanto, "Principal's Leadership Strategy in Efforts to Development the Quality of Human Resources in Schools," *JIIP - J. Ilm. Ilmu Pendidik.*, vol. 7, no. 1, pp. 487–493, 2024, doi: 10.54371/jiip.v7i1.3356.

[9] S. N. Ilmi, E. R. Mawarnis, and M. Herman, "Pengembangan Media Pembelajaran E-Comic Kimia Berbasis Stem (Science, Technology, Engineering, Dan Mathematic) Pada Materi Termokimia Untuk Kelas XI MIPA SMA YDB Lubuk Alung," *J. Pendidik. Tambusai*, vol. 7, no. 1, pp. 2966–2975, 2023.

[10] I. Nasar, F. Nurdianingsih, E. Rahmi, and M. B. Purwanto, "Values Of Character Education: Study of Strengthening the Culture of Digital Literacy for Youth in Disruptive 5.0 Era," *Gema Wiralodra*, vol. 15, no. 1, pp. 596–604, 2024, doi: 10.31943/gw.v15i1.688.

[11] E. R. Mawarnis, L. Roza, S. Maiyena, and M. Y. A. Rahman, "Research-Based Teaching Materials As Innovation In Chemistry Learning," *J. Penelit. Pendidik. IPA*, vol. 9, no. 9, pp. 634–643, 2023, doi: 10.29303/jppipa.v9i9.3370.

[12] S. P. Andani, E. R. Mawarnis, and M. Herman, "Development of Learning Videos Using Wondershare Filmora Software on Acid and Base Material at SMAN 1 Sungayang," *Edusainstika J. Pembelajaran MIPA*, vol. 3, no. 1, p. 47, 2023, doi: 10.31958/je.v3i1.10120.

[13] R. P. Ilahi, E. R. Mawarnis, and M. Herman, "Development of Guided-Inquiry-Based Buffer Solution E-Module," *Hydrog. J. Kependidikan Kim.*, vol. 11, no. 1, p. 88, 2023, doi: 10.33394/hjkk.v11i1.6869.

[14] S. Merlinda, "pengembangan media video pembuatan kerajinan bantalan jarum dari limbah hasil jahitan busana untuk siswa kelas X di SMK Muhammadiyah 1 Tempel," no. 2008, pp. 13–69, 2019.

[15] M. A. N. T. Datar, "Exploring Integrated Instrument Complement at Practical Approach at MAN 4 Tanah Datar," vol. 12, no. April, 2024.