



Development of E-LKPD Based on Google Sites with PBL Model in Achieving Scientific Literacy on the Human Excretory System Subject for XI Grade Students

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Abstract: E-LKPD, an electronic learning activity, shows a good impact on student participation and ability to solve problem and apply learning concepts in some previous studies. The collaborative classroom using the problem-based learning model can be designed creatively, innovatively, and interactively, and used broadly using electronic media such as laptops or smartphones. This study aimed to develop Google Sites-based E-LKPD to create a fun learning process, encourage active participation, and improve the ability of students to solve problems and apply learning concepts in human excretory system material for grade XI. The ADDIE development model, namely Analysis, Design, Development, Implementation, and Evaluation, was applied in this study. The E-LKPD was then analyzed for its practiceness and effectiveness on achieving scientific literacy among biology teachers and XI grade students of SMA Budi Luhur Samarinda on even semester of academic year of 2024/2025. The results showed that the developed E-LKPD had a practiceness level of 87.0% and 91.5% for the students and teachers, respectively, which were categorized as very practical. The effectiveness of achieving scientific literacy was applied using N-Gain analysis, which produced N-Gain score of 0.76 (effective) and 0.49 (ineffective) for the experimental and control classes, respectively. The increase in N-Gain in the experimental class was significant ($p < 0.01$, two-tailed t-test). These results indicate that E-LKPD based on Google Sites is effective in improving students' scientific literacy of the human excretory system material and is suitable for use in school learning for XI grade students.

Keywords: E-LKPD; Google sites; Human excretory system; PBL Model; Scientific literacy

Introduction

Progress in technology in the 21st century has to penetrate various aspects of life, including education. Education in the 21st century occurs as a shift paradigm from learning independent to team, from teacher-centered education, from one direction to interactive, and from passive to active. One of the key competencies

that teachers must own in context learning in the 21st century is the ability to design effective learning by merging principles of knowledge teaching materials, pedagogy, and technology Information and Communication (ICT).

Utilization of technology in the world of education is important for all parties, including teachers, students, and parents. Therefore, the educator sued for the

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capable integration of technology in the learning process in an effective way. Development and demands use technology, which also becomes a challenge for teachers when designing activity-relevant learning. Teachers not only need their own academic competence and technical skills, but also must master soft skills, such as professional attitude, positive behavior, and supportive interpersonal skills, role they good as teachers and as individuals in environmental education (Gunawan & Widiati, 2019; Tegeh & Kirna, 2013).

Independent Learning is an innovation in the world of designed education for creating effective learning strategies Concept. This prioritizes freedom in thinking and understanding and makes a good contribution to supporting participants in educating them in a way that is independent and flexible (Marisa, 2021; Amthari et al., 2021; Sannah, 2015). Implementation curriculum-independent influences method teachers' work and all elements involved in education, including administration learning, methods teaching, and ways assessment carried out by the teacher (Rahimah, 2022). According to the Ministry of Education and Culture (2021), the Merdeka curriculum focuses on competence in each phase; students can learn material more deeply, meaningfully, and fun (Hartoyo, 2022; Nugraheny, 2018). One of the preparations made by each institution's education in the Merdeka curriculum is to provide device-learning, including activity learning and tools help learning other (Ummah et al., 2022).

Face-challenge curricula should independently require activity-appropriate learning activities. Study has many benefits for activity learning, namely, making learning more interesting, giving participants a chance to educate For Study in a way independent and reduce dependence on teacher presence, as well as making it easier for participants to learn what is needed to master (Suryani et al., 2020). LKPD (worksheet students) can be a type of teaching material that can be utilized by participants in the learning process (Puspitasari & Handziko, 2018). Indonesia has entered the digital era, which has an impact on the learning process. Teachers can utilize activity study digitally as interesting media attention students (Ummah et al., 2022). For example, Lavtania et al. (2021) stated that innovation-developing and digital-based learning can be in the form of a digital LKPD. Digital LKPD is sheet work that can access device electronics, in which load guides workmanship, material learning, as well as activity-structured learning in accordance with objective learning.

E-LKPD is teaching materials in the form of sheets containing activity learning students who are packed in a way electronics. In developing E-LKPD, many benefit in learning, especially E-LKPD, which can increase interest in studying students (Syafitri & Tressyalina, 2020; Hasanudin & Rukmelia, 2020; Aryani &

Hiltrimartin, 2011). E-LKPD is packaged in digital form containing information in the form of text material lessons, images, audio or video, activities students, who can accessed with easy on computers, laptops, gadgets and other digital devices. In addition, E-LKPD can streamline time and narrow down rooms so that it is more effective in learning; therefore, it can access wherever and whenever (Suryani et al., 2020; Chusnah et al., 2020; Fannie & Rohati, 2014).

E-LPKD is an activity learning in the form of electronics that can be used in class in a way that collaborates with using a laptop or smartphone. Facts on the ground show that the LKPD is still printed in lots used in the learning process. However, its use often causes a number of constraints, such as high-cost multiplication, poor distribution efficiency, and lack of power pull from aspect display and interactivity. This causes low participation in active participant education and literacy science in learning activities. On the other hand, participants educated in the present tend to be more familiar with digital technology; therefore, the utilization of E-LKPD becomes a relevant alternative for increasing literacy science. The hope is that existence sources learn creative, innovative, and interactive E-LKPD can create a learning process that is more fun and not boring so that participants can participate in active and solving problems as well as apply the concept that has been given by the teacher. One of the methods used to enter the E-LKPD on Google sites. E-LKPD, which is integrated into Google, is more practical than printed LKPD. In terms of costs, this E-LKPD is also superior because it only requires Internet quota capital, which can also be used for other matters. Developing E-LKPD based on Google does not require language programming without coding and can be made for free (Husniyah et al., 2022; Puskur, 2007). This Google sites-based E-LKPD can make it easier for teachers to develop it and can also be used for need individuals and groups.

Learning models used at school lots using a learning model directly dominated by delivery materials. Teacher activities in its implementation are to explain material; then, the participant listens to and notes what has been written by the teacher. This causes activity participants to educate, especially on skills breakdown problems, and literacy science is not sufficiently developed. In order to activate participants' education in developing skills breakdown problems, literacy science needs the existence of a participant-centered learning model educate so that participants educate active and responsible answers to obtain knowledge in learning. In addition, Ismawati et al. (2023), E-LKPD can be applied to problem-based learning models. A learning model based on problems (problem-based learning) is very suitable for use in material system excretion because it can be applied in a

real way through the work group in class. Problem-based learning (PBL) can become a solution for increasing the ability to educate participants in control material lessons and literacy science. Learning models: This involves participant education in every syntax's learning. All participants were educated on follow activities together with the participants educating others. The PBL learning model is capable of increasing the problem of ability breakdown that participants educate.

Electron activity learning that has not contained skills thinks that critical participants educate in field breakdown problems become reason low literacy science participants educate. Therefore, the E-LKPD is needed to support training skills literacy science. E-LKPD is capable of facilitate the learning process in a way independent and easy communicate with the teacher in person effective. The development of e-LKPD is packaged based on Google as innovation learning that can be accessed by students or teachers via laptops (PCs) or androids. The development of E-LKPD is equipped with audio visual media and provides feature learning that can train science participants in skills literacy.

Literacy science focus on building knowledge student For use draft science in a way meaning, think in a way critical and make balanced and adequate decisions to problems that have relevance to life students (Pratiwi et al., 2019; Wahyuni & Amini, 2021). Literacy science is important for participant education so as to not only understand science as a draft but also to apply science in life every day. Literacy science is important because (1) it gives satisfaction and pleasure to the person who appears after understanding and learning science; (2) everyone needs information and thinking scientific for taking decisions; (3) everyone needs involving ability they in discourse public and debate about issues important that involves science and technology; and (4) literacy science is important in the world of work, so that it requires people to study science, reasoning, thinking in a way creative, making decisions, and solving problems (Sutrisna, 2021; Otani et al., 2019; Toharudin et al., 2011).

E-LKPD is developed using the Problem Based Learning (PBL) model, namely approach learning that encourages participant educate for think critical and have skills in solve real world problems. This model is effective in increasing literacy science because it connects draft science with problems in everyday life. Thus, the ability literacy of science participant education can be achieved.

Based on results observations and interviews conducted with high school biology teacher Budi Luhur Samarinda Still Not yet using E-LKPD, because phenomenon happen based on observation is: 1) teacher readiness is not yet own skills or sufficient training for

create and use E-LKPD, even though internet facilities or WiFi Already there is; 2) that in activity learning, resources or the main teaching materials used is book packages and LKPD not yet served digitally only in form paper; 3) other than it is also in develop making E-LKPD requires time and effort more compared to using the printed LKPD that has been prepared there is; 4) teachers are also in making LKPD still Not yet containing activity participant educate, the actual LKPD should be containing activity participant educate during the learning process; 5) no dig participant educate in breakdown problem so that low literacy science participant educate. With a number of problems, the researcher will develop digital E-LKPD based on Google sites with learning model problem-based learning material system excretion man class XI.

Method

This study uses the Research and Development (R&D) method to produce certain products and test their effectiveness (Sugiyono, 2018). The development model used in this study is the ADDIE development model (Branch, 2010), which includes analysis, design, development, implementation, and evaluation. ADDIE is a systematic development model because it establishes rules and procedures that help establish and design instructions (Triana et al., 2021; Yamin, 2008). The study was conducted in SMA Budi Luhur Samarinda Class XI, even semester 2024/2025 in February - May 2025. Research and development procedures of the ADDIE model (Triana et al., 2021; Ramadhan & Fitria, 2021).

Based on the stages in the ADDIE development model, which includes Analysis, Design, Development, Implementation, and Evaluation, the process of developing E-LKPD based on Google Sites has been conducted systematically. Stage analysis covers identification need learning, characteristics of participant education, and formulates objective relevant learning with curriculum. Next, at the design stage, we analyzed E-LKPD material and preparation based on problem-based learning (PBL) syntax, as well as compilation instrument validation. Stage development covers the creation of E-LKPD on the Google Sites platform, integration of supporting media, and the validation process by expert materials and media experts. Input from the validators was used as the base refinement product. After stating proper and valid, the E-LKPD is ready for implementation through trial limitations. The stage Implementation conducted with the test uses the Google Sites-based E-LKPD, which has been validated for 28 participants in class XI-1 Budi Luhur High School Samarinda. Participants educate the requested give response through a questionnaire on the Use of E-LKPD on material system excretion in humans.

The last stage evaluation is done in a formative manner in every stage of development, starting from analysis, design, development, and implementation. Evaluation: This aimed to identify weaknesses and fix products to be more optimal and appropriate, with the need for participant education. Thus, the E-LKPD was developed as a feasible, practical, and effective learning medium.

An effectiveness test of the E-LKPD device based on Google sites using the Calculation Test (N-Gain) was carried out to determine the achievement of student literacy after receiving treatment. This achievement was taken from the pre-test and post-test scores obtained by the students. The normalized gain (N-Gain) is a comparison of the actual gain score with the maximum gain score. The normalized gain score (N-gain) was calculated using the following formula (Ramdhani et al., 2020; Santi & Santosa, 2016).

$$N\text{-Gain} = \frac{\text{Posttest score} - \text{Pretest score}}{\text{Maximum score} - \text{Pretest score}} \quad (1)$$

N-Gain (g) criteria: $g < 0.3$ is low, $0.3 \leq g \leq 0.7$ medium, $g > 0.7$ is high.

Result and Discussion

Results

Development E-LKPD products based on Google sites are available the front page of E-LKPD contains activity learning system excretion man with start click activity 1 first formerly If already finished activity 1 can carry on to activities 2 and 3.



Figure 1. Front page of E-LKPD

The stage implementation was conducted by 28 participants in class XI-1 Budi Luhur High School Samarinda. The questionnaire used to know response participants educate regarding E-LKPD based on Google sites, consisting of 24 grains indicator. The response data results that participants educated towards

the developed E-LKPD are shown in Table 1. The evaluation by the participant educates various existing aspects of E-LKPD so that it can provide a description of the success and failure of E-LKPD which has been arranged.

Table 1. Practicums of the Developed E-LKPD among Students and Biology Teachers

| Aspects | Level of Response (%) | Students Category | Level of Response (%) | Teachers Category |
|---------------------------|-----------------------|-------------------|-----------------------|-------------------|
| Interest in E-LKPD | 84.5 | Very Practical | 90.6 | Very Practical |
| Mastery of Material | 83.2 | Very Practical | 89.6 | Very Practical |
| E-LKPD Display | 89.6 | Very Practical | 92.5 | Very Practical |
| Implementation | 90.8 | Very Practical | 93.5 | Very Practical |
| Percentage Overall Aspect | 87.0 | Very Practical | 91.5 | Very Practical |

Note: There were 28 students and 1 biology teachers involved in this study

The assessment results provided participant educate on questionnaire response regarding the web-based E-LKPD Google sites show results overall by 87.0% with "very practical" criteria.

The effectiveness of the E-LKPD device product based on Google sites using the calculation test (N-Gain) was evaluated to determine the achievement of students' scientific literacy after receiving treatment. This achievement was taken from the pre-test and post-test scores obtained by students in the control and experimental classes. Class control using a learning model problem-based learning, however, without using E-LKPD based on Google Sites, learning only using printed LKPD and book packages. A class experiment was conducted using a learning model integrating

problem-based learning with E-LKPD, based on Google Sites. Table 2 presents the results of the N-Gain test.

Based on the results of the N-Gain test calculation above, the average value of the N-Gain score for the experimental class was 76.8028 or 76.9%, including effective, with a minimum N-gain score of 43.18% and a maximum of 100.00%. Meanwhile, the average for the N-gain control class was 48.7392 or 48.8%, including ineffective, with a minimum N-Gain score of 13.04% and a maximum of 69.77%. Thus, it can be concluded that the use E -E-LKPD based on Google sites in the class experiment shows the achievement of scientific literacy of educated participants, with an average N-Gain score of 76.80% and 76.9%, respectively.

Table 2. The Effectiveness of Students in a Class Using Developed E-LKPD Compared with Students without Using the E-LKPD

| Class | Pretest* | Posttest* | Min. | Max. | N-Gain* | Category |
|---|-------------|---------------|-------|--------|-------------|-------------|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| Using the developed E-LKPD (Experiment) | 47.21±12.52 | 84.54±8.31 a | 43.18 | 100.00 | 0.76±0.14 a | Effective |
| Without using the E-LKPD (Control) | 47.46±14.47 | 73.36±10.43 b | 13.04 | 69.77 | 0.49±0.17 b | Ineffective |

Note: Data for each class were obtained from 28 students. Data in columns 2, 3, and 4 are expressed as mean \pm SD.* Data in each column followed by different letters are significantly different (two-tailed t-test, $P < 0.01$)

Discussion

Google sites based on E-LKPD are said to be very interesting because they can change content material learning and become websites that contain E-LKPD elements, text, images, links, and videos. Participants provided easy access and flexibility through devices connected to the Internet. E-LKPD makes it easier for participants to learn about source reference-related problem system excretion through feature links and convenient internet access, so that they can dig information more broadly and deeply in a way independent. In addition, E-LKPD based on Google Sites provides opportunities for participants to educate various sources of scientific and educational videos and articles relevant trusted so that the learning process becomes more contextual and data-driven. Thus, participants educate not only on understanding material in a theoretical way, but are also capable of analyzing and relating information with real problems that occur in the excretion of human beings. According to Murgiyanti (2023), Google sites provide various supported-feature convenience users in the process of managing and publishing content on the website platform. E-LKPD-based Google sites designed with feature knob are easily interactively accessed, as well as equipped with YouTube videos that can directly watch Google sites. Views on Google sites can be made as creative as possible by combining color, image, video, or quiz interactions so that participants do not feel bored in

activity learning (Islanda & Darmawan, 2023; Zahroh & Juliani, 2021; Purnamasari, 2019).

Based on the data analysis conducted by the researcher, the questionnaire response participants educated overall obtained an average percentage of 87.0% with "very practical" criteria. In line with the study by Septiani et al. (2024), 82% of participants responded to education with very practical criteria. Google Sites web-based E-LKPD products with learning models problem-based learning system excretion men get a positive response from participant education. In addition, the contents of E-LKPD are considered in accordance with development knowledge and technology moment because they are based on Google sites. Google sites, as a stated medium, are worthy of use and can help participants educate themselves in the learning process. According to Novitawati (2023), the utilization of Google sites in learning can also increase the interaction between teachers and participants. In addition, the use of Google can also reduce the use of paper in learning, which can support the life and sustainability of environmental programs. In addition, the use of Google sites can also reduce the cost of purchasing printer paper and toner, which are usually needed in e-worksheet creation. Learning model procedures Problem-based learning makes stages materials and activities participants educate more directed and structured, and can increase their ability to think critically and motivationally.

Interactive digital activities such as E-LKPD based on Google sites using a learning model problem-based learning capable achievement literacy science participants educate in a way significant because capable increase ability participants educate in observe, reason, solve problems, and link concepts scientific with life daily in a way more meaningful compared to learning that does not use E-LKPD based on Google sites. This is in accordance with a study (Amalia et al., 2021; Suleang, 2020; Rakhmaningtyas, 2022) that found that using the problem-based learning model has an effect on ability literacy science with a mark size effect of 1.94. In addition, 93.18% of the participants were taught using the PBL model for the breakdown problem. Thus, it can be concluded that PBL can influence achievement literacy in science participants' education.

A study by Zamilah et al. (2024) also shows that E-LKPD based on Google sites can increase literacy science participants' education because E-LKPD fulfills the condition preparation of LKPD and covers aligned ideas and goals with aspect literacy science, in particular scientific inquiry, scientific knowledge, and problem-solving problems.

Conclusion

The developed E-LKPD based on Google Sites, which was compiled into three activities—text, video, and sheet work—supports independent and flexible learning processes. In terms of practiceness, the E-LKPD obtained a very positive response from participants, with scores of 87.0 and 91.5% from students and biology teachers, respectively. In addition, the E-LKPD was significantly (two-tailed t-test, $p < 0.01$) effective in increasing literacy in science participants' education. The N-gain class scores increased from 0.487 (control class) to 0.768 (experimental class). Thus, E-LKPD based on Google Sites is a practical and effective digital learning module to be used in learning activities to encourage active involvement and learning meaningful for participant education.

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Author Contributions

I.W.L.: conceptualized the research, research procedures, analyzed the data and wrote the article; A.H., H., Y.H., V.M.M.R., E.T.M.: supervised the writing of the article, reviewed and validated the research instruments used.

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Conflicts of Interest

The authors declare no conflict of interest.

References

Amalia, R. N., Pasani, C. F., & Yulinda, R. (2021). Development of a Circulatory System Module Based on Scientific Literacy and Containing Creative Characters. *Journal of Mathematics Science and Computer Education*, 1(1), 44. <https://doi.org/10.20527/jmscedu.v1i1.3371>

Amthari, W., Muhammad, D., & Anggereini, E. (2021). Pengembangan E-LKPD Berbasis Saintifik Materi Sistem Pernapasan pada Manusia Kelas XI SMA. *Jurnal Ilmiah Pendidikan Biologi*, 7(3), 28-35. <https://doi.org/10.22437/bio.v7i3.13239>

Aryani, F., & Hilttrimartin, C. (2011). Pengembangan LKS untuk Metode Penemuan Terbimbing pada Pembelajaran Matematika Kelas VII Di SMP Negeri 18 Palembang. *Jurnal Pendidikan Matematika*, 5(2), 129-144. Retrieved from <https://jpm.ejournal.unsri.ac.id/index.php/jpm/article/view/10.22342/jpm.5.2.578>.

Chusnahan, W., Ibnu, S., & Sutrisno. (2020). Pengembangan Bahan Ajar Kimia Materi Hidrolisis Garam dengan Pendekatan Scientific Inquiry Berbasis Problem Based Learning. *Jurnal Pendidikan*, 5(7), 980-990. <https://doi.org/10.17977/jptpp.v5i7.13778>

Fannie, R. D., & Rohati. (2014). Pengembangan Lembar Kerja Siswa (LKS) Berbasis POE (Predict, Observe, Explain) pada Materi Program Linier Kelas XII SMA. *Jurnal Sainmatika*, 8(1), 96-109. Retrieved from <https://media.neliti.com/media/publications/221053-none.pdf>

Gunawan, S., & Widiati, S. (2019). Demands and Challenges of Educators in Technology in the World of Education in the 21st Era. *Proceedings of the National Seminar on Postgraduate Education Programs*, 594-601. Retrieved from <https://jurnal.univpgri-palembang.ac.id/index.php/Prosidingpps/article/view/3089%>

Hartoyo, D. R. A. (2022). Portrait of Independent Curriculum, the Form of Independent Learning in Elementary Schools. *Basicedu Journal*, 6(4). <https://doi.org/10.31004/basicedu.v5i4.1230>

Hasanudin, F., & Rukmelia. (2020). Pengembangan Bahan Ajar Biologi Dasar Berbasis Mobile Learning Menggunakan Adobe Flash Cs6. *Jurnal Biotek*, 8(2), 154-165. Retrieved from <https://www.researchgate.net/publication/348707772>

Husniyah, R., Widiatsih, A., Fajarisman, F., Kunrozazi,

K., & Kurniawan, N. (2022). Website Development Using Google Sites on Production Materials in Plant and Animals for Smp/Mts During the Covid 19 Pandemic. *Education Journal: Journal Educational Research and Development*, 6(1), 47-58. <https://doi.org/10.31537/ej.v6i1.616>

Islanda, E., & Darmawan, D. (2023). Development of Google Sites as a Learning Media to Improve Student Learning Achievement. *Jurnal Teknодik*, 27(1), 51-62. Retrieved from <https://jurnalteknodik.kemdikbud.go.id/index.php/jurnalteknodik/article/view/991>

Ismawati, E. Y., Khoiri, N., Saefan, J., Ristanto, S., Prakosa, H. A., & Ristianti, S. (2023). Development of E-LKPD Based on Problem Based Learning to Improve Students' Decision-Making Ability. *Journal of Learning Innovation in Schools*, 4(2), 712-720. <https://doi.org/10.51874/jips.v4i2.174>

Lavtania, N., Nulhakim, L., & Utari, E. (2021). Development of Digital Student Worksheets Using A Creativity-Based Scientific Approach for Chemistry Subjects to Making Food in The Form of Colloids. *QUANTUM: Jurnal Inovasi Pendidikan Sains*, 12 (2), 172-184. <https://doi.org/10.20527/quantum.v12i2.11320>

Marisa, M. (2021). Curriculum Innovation "Independent Learning" in the Era of Society 5.0. *Sanhet: (Journal of History, Education and Humanities)*, 5(1), 72. <https://doi.org/10.36526/js.v3i2.e-ISSN>

Murgiyanti, M. (2023). "Development of Website Learning Media Based on Google Sites to Increase Global Diversity of Early Childhood at TK IT Almawaddah in the 2022/2023 Academic Year". *Journal of Education and Social Sciences (Jupendis)*, 1(2), 79-92. <https://doi.org/10.54066/jupendis-itb.v1i2.133>

Nugraheny, D. C. (2018). Penerapan Lembar Kerja Peserta Didik (LKPD) Berbasis Life Skills untuk Meningkatkan Keterampilan Proses dan Sikap Ilmiah. *Jurnal Visipena*, 9(1), 114-194. <https://doi.org/10.46244/visipena.v9i1.435>

Novitawati, H. Y. (2023). Utilization of Google Site Integrated E - Worksheet. *Communnity Development Journal*, 4(4), 8298-8303. <https://doi.org/10.20527/quantum.v12i2.11320>

Otani, M., Abudarin., & Asi, N. B. (2019). Pengaruh Pemberian Latihan Soal Terstruktur Setelah Pembelajaran Langsung Terhadap Pemahaman Konsep Ikatan Kovalen Pada Siswa Kelas X IPA SMA Negeri 4 Palangka Raya Tahun Ajaran 2018/2019. *Jurnal Ilmiah Kanderang Tingang*, 10(1), 95-103. <https://doi.org/10.37304/jikt.v10i1.24>

Pratiwi, S. N., Cari, C., & Aminah, N. S. (2019). 21st century science learning with students' scientific literacy. *Journal of Physics Materials and Learning*, 9, 34-42. Retrieved from <https://jurnal.uns.ac.id/jmpf/article/view/31612%0Ahttps://jurnal.uns.ac.id/jmpf/article/download/31612/21184>

Purnamasari, N. L. (2019). Metode ADDIE pada Pengembangan Media Interaktif Adobe Flash Pada Mata Pelajaran TIK. *Jurnal Pena SD*, 05(01), 23-31. <https://doi.org/10.29100/jpsd.v5i1.1530>

Puskur. (2007). *Panduan Pengembangan Pembelajaran IPA*. Jakarta: Balitbang Depdiknas.

Puspitasari, A., & Handziko, R. C. (2018). Development of mobile learning guided discovery LKPD to improve mastery of basic ecosystem competencies in the 2013 Curriculum. *Journal of Science Education Innovation*, 4(1), 83-97. <https://doi.org/10.21831/jipi.v4i1.17003>

Rahimah, R. (2022). Improving the Ability of Teachers of SMP Negeri 10 Tebingtinggi City in Compiling Independent Curriculum Teaching Modules Through Mentoring Activities for the 2021/2022 Academic Year. *ANSIRU PAI: Development of the Profession of Islamic Religious Education Teachers*, 6(1), 92. <https://doi.org/10.30821/ansiru.v6i1.12537>

Rakhmaningtyas, L. (2022). Pengembangan E-LKPD Interaktif pada Materi Pertumbuhan dan Perkembangan Tumbuhan untuk Melatih Keterampilan Berpikir Kritis Peserta Didik Kelas XII. *Jurnal BIOEDU*, 11(3), 527-536. Retrieved from <https://ejurnal.unesa.ac.id/index.php/bioedu>

Ramadhani, W., & Fitria, Y. (2021). Capaian Kemandirian Belajar Siswa dalam Pembelajaran Sains Tematik Menggunakan Modul Digital. *Jurnal BASICEDU*, 5(5), 4101-4108. <https://doi.org/10.31004/basicedu.v5i5.1391>

Ramdhani, E. P., Khoirunnisa, F., & Siregar, N. A. N. (2020). Effectiveness of Multiple Representation Integrated Electronic Module on Chemical Bonding Material. *Journal of Research and Technology*, 6(1), 162-167. <https://doi.org/10.55732/jrt.v6i1.152>

Sannah, I. N. (2015). *Pengembangan Lembar Kerja Siswa Berbasis Pendekatan Saintifik Dengan Model Discovery Learning Pada Materi Teori Atom Bohr*. Bandar Lampung: Fakultas Keguruan dan Ilmu Pendidikan Universitas Lampung.

Santi, I. K. L., & Santosa R. H. (2016). Pengembangan Perangkat Pembelajaran Menggunakan Pendekatan Saintifik pada Materi Pokok Geometri Ruang SMP. *Jurnal Pendidikan Matematika*, 11(1), 35-44. <https://doi.org/10.21831/pg.v11i1.9673>

Suleang, F. (2020). Analisis Kemandirian Belajar Siswa melalui Pembelajaran Daring pada Materi Pembelajaran Matematika. *Jurnal Ilmiah Matematika, Sains dan Teknologi*, 8(1), 29-35.

<https://doi.org/10.34312/euler.v8i1.10392>

Septiani & Sari, T. M. (2024). Development of E-LKPD on Circulatory System Material Using Google Site for Grade VIII Students. *BIODIK*, 10(3), 302-310. <https://doi.org/10.22437/biodik.v10i3.34825>

Suryani, K., Utami, I. S., Khairudin, K., Ariska, A., & Rahmadani, A. F. (2020). Development of STEM-based Digital Modules using 3D FlipBook Applications in Operating System Courses. *Mimbar Ilmu*, 25(3), 358-367. Retrieved from <https://ejurnal.undiksha.ac.id/index.php/MI/article/view/28702>

Sutrisna, N., & Anhar, A. (2020). An Analysis of Student's Scientific Literacy Skills of Senior High School in Sungai Penuh City Based on Scientific Competence and Level of Science Literacy Questions. *Journal of Research Innovation*, 1(12). Retrieved from <https://www.researchgate.net/publication/343709578>

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 the COVID-19 Pandemic. In *The 3rd International Conference on Language, Literature, and Education (ICLLE 2020)* (pp. 284-287). Atlantis Press. <https://doi.org/10.2991/assehr.k.201109.048>

Tegeh, I. M., & Kirna, I. M. (2013). Pengembangan Bahan Ajar Metode Penelitian Pendidikan dengan ADDIE Model. *Jurnal IKA*, 11(1), 12-26. <https://doi.org/10.23887/ika.v11i1.1145>

Toharudin, U., Hendrawat, S., & Runtaman, A. (2011). *Membangun Literasi Sains Peserta Didik*. Bandung: Humaniora.

Triana, Y., Enawaty, E., Sahputra, R., Muharini, R., & Sartika, R. P. (2021). Development of PBL-Based Student Worksheets with Liveworksheets on Thermochemistry Topics in Pontianak High Schools. *Pros. Sem. Nas. KPK*, 4, 38-43. Retrieved from <https://jurnal.fkip.unmul.ac.id/index.php/kpk/article/view/896>

Ummah, I., Saputra, E. E., Zibar, C., Parisu, L., & Wahyudi, A. V. (2022). National Seminar on Language, Literature, Arts, and Elementary Education 2 (SENSASEDA) 2 STKIP PGRI Banjarmasin Learning Tool Development in Digital Comics-Based Independent Learning Curriculum. *Proceedings of the National Seminar on Language, Literature, Arts, and Elementary Education (SENSASEDA)*, 2(11), 19-24. Retrieved from <https://jurnal.stkipbjm.ac.id/index.php/sensase da/article/view/1967>

Wahyuni, C., & Amini, R. (2021). Development of Student Worksheets Using Live Worksheets Based on Problem Based Learning in Integrated Thematic Learning in Grade V of Elementary School. *Journal of Basic Education Studies*, 4(1), 4055-4065. Retrieved from <https://ejurnalunsam.id/index.php/jbes/article/view/4732>

Yamin, M. (2008). *Desain Pembelajaran Berbasis Tingkat Satuan Pendidikan*. Jakarta: Gaung Persada Press.

Zahroh, D. A., & Yuliani. (2021). Pengembangan E-LKPD Berbasis Literasi Sains untuk Melatihkan Keterampilan Berpikir Kritis Peserta Didik pada Materi Pertumbuhan dan Perkembangan. *Jurnal BIOEDU*, 10(3), 605-616. Retrieved from <https://ejurnal.unesa.ac.id/index.php/bioedu>

Zamilah, Z., Djulia, E., & Lubis, K. (2024). Pengembangan Lembar Kerja Interaktif Berbasis Literasi Sains untuk Melatih Kemampuan Berpikir Kritis Peserta Didik Materi Fotosintesis. *Ideguru: Jurnal Karya Ilmiah Guru*, 9(1), 294-304. <https://doi.org/10.51169/ideguru.v9i1.821>