Effectiveness Test Digital Assessment based Moodle as a Digital Assessment Instrument for Measuring Science Literacy Skills for Junior High School Students

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ABSTRACT

Objective: This study aims to test the effectiveness of Moodle-based Digital Assessment as an assessment instrument to measure scientific literacy possessed by junior high school students in Jember and Probolinggo, Indonesia especially on environmental pollution. **Method:** This type of research is development research with a 4D model that Defined, Designed, Developed, and Disseminated. The data analysis technique used descriptive analysis and calculation of scientific literacy. **Result:** For the results small-scale trial, most students were in the high category. The results of the large-scale test for junior high school in Jember, Indonesia show most students in the medium category. The results of the large-scale test for junior high school in Probolinggo, Indonesia show most students in the high category. The results of this study prove Digital Assessment developed is very effective for measuring the scientific literacy of junior high school students, especially regarding environmental pollution. **Novelty:** Researchers have never previously conducted research that developed a Moodle-based Digital Assessment to measure the scientific literacy skills of junior high school students.

INTRODUCTION

Learning science is very necessary and very important for the development of knowledge globally, and of course it can be obtained by developing scientific literacy (Ploj Virtič, 2022). At the junior high school level science subjects are taught in an integrated manner which contains chemistry, biology and physics. Scientific literacy skills are the main focus that can build other skills in the 21st century (Pradini et al., 2022). The OECD in Strings and Supardi (2019) defines scientific literacy as scientific knowledge to identify problems, explain scientific phenomena, and draw conclusions. Thus, scientific literacy is in line with and supports the implementation of the Minimun Competence Assessment (i.e. AKM)-based independent curriculum (Pradini, et al. 2022). The international organization engaged in measuring scientific literacy is PISA (Sari, et al. 2021). The results of measuring the scientific literacy of Indonesian students by PISA in 2018 obtained a score 396 with ranked 70 from 78 countries (Arrohman, et al. 2022).

Education plays an important role in changing and creating humans to live in a more sustainable environment. Education needs to emphasize more attention to environmental issues, climate change and global warming (Handayani & Putra, 2019). Dangerous behaviors that cause global warming include the use of fossil fuels, deforestation, use of aerosols, littering and air pollution. All of these behaviors produce

a greenhouse effect and deplete the ozone layer which causes global warming (Handayani & Triyanto, 2022). People who may not understand the important role the greenhouse effect plays in the climate system are encouraged to reduce carbon emissions which emphasizes the amount of greenhouse gases present in it. Building students' awareness of climate issues must be a consideration to effectively minimize the causes and impacts of environmental problems (Handayani et al., 2021).

The application of assessment using a technology base has become a trend in 21st Century learning. Based onfeatures the Moodle become platform the most appropriate in making assessment instruments. Digital Assessment based Moodle developed with items that already contain aspects of scientific literacy, namely context, knowledge, competence, and attitude. Based on all these aspects, the preparation of question indicators can be done easily according to the science material to be developed. Through quiz feature in application Moodle the types of questions developed can vary and are not monotonous in multiple choice and description questions. All of these types of questions have fulfilled the AKM program implemented. Digital Assessment will also overcome the problem of manual assessment activities which tend to take more time and reduce more effort, besides that manual assessment. Digital Assessment is also in line with and supports the implementation of the AKM-based independent curriculum (Asyhari, 2019). The information obtained from the assessment is used to provide a child's stimulus so that it develops optimally (Maryanti et al., 2022).

The material in science subjects that will be studied in scientific literacy is environmental pollution. Environmental pollution is a topic of discussion in science subjects in class VII with a scope consisting of air pollution, water pollution and land pollution (Fitriani et al., 2018). Environment issues This is currently a topic of considerable discussionurgent among international organizations (Priscilla & Yudhyarta, 2021). United Nations (UN) through United Nations Educational, Scientific and Cultural Organization (UNESCO) put forward a program Environmental Education (EE) which is the integration of environmental understanding with formal education or informal education (Indahri, 2020). Based on the description above, an assessment of scientific literacy competencies, especially on Environmental Pollution material, must continue to be carried out so that students' scientific literacy competencies can continue to be trained and honed properly, besides that through assessment, of course, the achievement of aspects of scientific literacy abilities possessed by students can be measured more accurately. Therefore, researchers conducted a study to test the effectiveness of Digital Assessment to measure the science literacy skills of students.

RESEARCH METHOD

The type of research used is development research or Research and Development with The 4D model consist of Define, Design, Develop, and Disseminate (Thiagarajan, 1974). This development research was carried out in several schools in Jember Regency and Probolinggo City. Small-scale trials were carried out at State Junior High School 2

Jember and large-scale trials were carried out at State Junior High School 1 Jember, State Junior High School 2 Jember, State Junior High School 3 Jember and State Junior High School 1 Probolinggo, SMPN 5 Probolinggo, State Junior High School 7 Probolinggo. The subjects of this research were class VII students of junior high school.

Digital Assessment based Moodle it can be said to be effective if it is able to measure and rank scientific literacy skills into three categories namely low, medium and high in Table 1. The data analysis technique used is in the form of descriptive analysis and calculating the percentage of each category of scientific literacy skills as formula (1).

$$P = \frac{\Sigma \quad A}{\Sigma \quad N} \ x \ 100\%...................(1)$$

Notes:
P   = Percentage of scientific literacy skills
ΣA   = Total scientific literacy score
ΣN   = Total maximum score of scientific literacy

Table 1. Categories of Science Literacy Skills

Interval	Category
66,6% < P ≤ 100%	Height
33,3% < P ≤ 66,6%	Currently
0% < P ≤ 33,3%	Low

(OECD, 2019)

RESULTS AND DISCUSSION

Results

Stage of Define

At the defining stage the result that the characteristics of the students indicated the number of students who were in accordance with the ideal number of students in one class and the age range that was in accordance with the level of development of junior high school students. Students' visual and kinesthetic abilities also support the application of Digital Assessment to measure scientific literacy skills with questions that tend to have more reading and pictures. Task analysis is carried out based on Core Competency (KI) and Basic Competency (KD) on class VII junior high school environmental pollution material that is to be developed in the Digital Assessment. Concept analysis was carried out by compiling material concepts that are in accordance with the topic of Environmental Pollution at the seventh grade junior high school level. The specification of learning objectives in the form of objectives from indicators of scientific literacy skills to be achieved based on the results of student analysis, task analysis and concept analysis that has been carried out.

Stage of Design

The design stage is the stage for preparing an initial Digital Assessment prototype in Moodle and compiling scientific literacy questions based on indicators of scientific literacy skills. At the design stage the researcher designed the components contained in the Moodle-based Digital Assessment. These components are the login menu display which consists of a username and password that has been created in the Moodle database, My Course which consists of classes, subjects and material topics, then the display of scientific literacy questions. Visually, the display of the Digital Assessment prototype can be seen in the Figure 1.
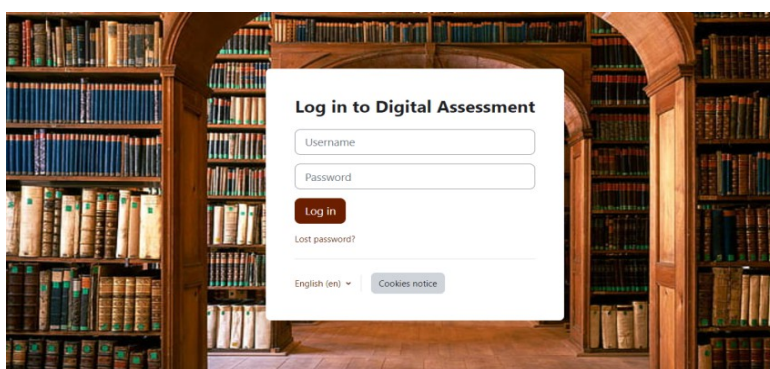

Figure 1. Login display *Moodle*

Dimensions of scientific literacy that have been determined by PISA, namely the dimensions of knowledge, context, competence, and attitudes. The type of questions used in Digital Assessment consists of examples of scientific literacy questions with multiple choice types. The effectiveness of the Digital Assessment is the result value obtained through working on scientific literacy questions in https://digitalassessment.moodlecloud.com/login. Assessment interpreted into 3 categories low, medium, and high. The examples of scientific literacy questions with multiple choice types are as follows.

Figure 2. Examples of Digital Assessment Multiple Choice Question Types

Stage of Develop

Validity analysis Digital Assessment carried out by 5 expert validators consisting of 2 lecturers from Master of Science Education at Jember University and 3 science teachers from State Junior High School 1 Probolinggo, State Junior High School 1 Jember, and State Junior High School 2 Jember using the validation sheet as an assessment and input for product improvement. Validation Digital Assessment carried out based on 5 assessment aspects, namely the development aspect which consists of 10 assessment points, the appearance aspect which consists of 10 assessment points, the content suitability aspect which consists of 10 assessment points, the linguistic aspect which consists of 10 assessment points, the function and benefits aspect which consists of 5 assessment points. The validation results show that the highest score is in the content feasibility aspect, while the lowest score is in the development and appearance aspects. Overall Digital Assessment is in the very valid category with a percentage of 94.1%.

Practicality analysis is carried out through use Digital Assessment based Moodle carried out by 3 science teachers from State Junior High School 3 Jember, State Junior High School 5 Probolinggo, and State Junior High School 7 Probolinggo using a practicality sheet which covers aspects of content presentation, ease of use, and time efficiency. The practicality results show that the highest score is in the time efficiency aspect, while the lowest score is in the ease of use. Overall Digital Assessment is in the very practical category with a percentage of 92.9%. Questions about scientific literacy in Digital Assessment Testing of the reliability of the questions, testing the level of difficulty of the questions and testing the differentiability of the questions using the SPSS version 23 program was also carried out. The results of the reliability test of the scientific literacy questions obtained a Cronbach's Alpha value of 0.781 so that the scientific literacy questions instrument was included in the high reliability category. The results of the question difficulty level test show that the majority of scientific literacy questions are in the easy category with a percentage of 47%. The results of the differential power test show that the majority of scientific literacy questions are in the good category with a percentage of 60%.

This effectiveness test is carried out by students. The effectiveness of an assessment instrument can be seen from the results after students use the given assessment instrument (Yumithasari, et al., 2022). The instrument is declared effective if it is able to measure students' scientific literacy skills (Firdaus & Mindyarto, 2021). When the target for evaluating each indicator item is achieved and you are able to classify scientific literacy skills into three categories, namely low, medium and high, it is proven that the assessment instrument is effectively used for assessment in learning (Rosmiati & Satriawan, 2022; Hasan et al., 2020).

The results of the effectiveness test were obtained from working on scientific literacy questions on Digital Assessment so that the final score of students from each school is obtained. The final score will be interpreted into 3 categories of scientific literacy skills according to PISA, namely low, medium and high categories. Test effectiveness Digital

Assessment carried out in two stages, namely small-scale trials and large-scale trials. The data on the results of the effectiveness test Digital Assessment as follows:

1)   Small Scale Trials

Test deployment Digital Assessment with a small scale conducted on 10 class VII students from State Junior High School 2 Jember. This small-scale trial aims to find out and identify various problems such as weaknesses and deficiencies Digital Assessment when used directly by students. The description of the results of small-scale trials at Table 2.

Table 2. Trial Results *Digital Assessment* Small Scale

Category	The number of students	Average Percentage of Science Literacy Skills
Height	7	71,4%
Currently	3	65,2%
Low	-	-

Table 2 shows the trial results Digital Assessment with a small scale based on the grouping of scientific literacy skill levels set by PISA. The majority of students are in the high category with an average percentage of scientific literacy skills acquired by students, namely 71.4%.

2)   Large-Scale Trials

Test deployment Digital Assessment with a large scale in class VII students at State Junior High School 2 Jember, State Junior High School 1 Jember, State Junior High School 1 Probolinggo, State Junior High School 3 Jember, State Junior High School 5 Probolinggo and State Junior High School 7 Probolinggo with 30 students each. The description of the results of the large-scale trial is presented in Table 3.

Table 3. Trial Results *Digital Assessment* in Jember Regency

Science Literacy Skills Category	State Junior High School 1 Jember		State Junior High School 2 Jember		State Junior High School 3 Jember		Total Averange
	Number of students	Average Student Score(%)	Number of students	Average Student Score(%)	Number of students	Average Student Score(%)	
Height	10	73,1%	13	69,7%	11	72,7%	71,8%
Currently	20	55,5%	17	60,9%	18	54%	56,8%
Low	-	-	-	-	1	28,2%	28,2%

Table 3 shows the trial results Digital Assessment on a large scale in 3 Jember State Junior High Schools based on the grouping of scientific literacy skill levels determined by PISA. The majority of students are in the medium category with an average percentage of scientific literacy skills acquired by students, namely 56.8%.

Table 4. Trial Results *Digital Assessment* in Probolinggo City

Science Literacy Skills Category	State Junior High School 1 Probolinggo		State Junior High School 5 Probolinggo		State Junior High School 7 Probolinggo		Total Averange
	Number of students	Average Student Score(%)	Number of students	Average Student Score(%)	Number of students	Average Student Score(%)	
Height	19	75,6%	27	80,5%	11	69,5%	75,2%
Currently	11	57,6%	3	65,6%	19	54,4%	59,2%
Low	-	-	-	-	-	-	-

Table 4 shows the trial results Digital Assessment on a large scale in 3 Probolinggo City Middle Schools based on the grouping of scientific literacy skill levels set by PISA. The majority of students are in the high category with an average percentage of scientific literacy skills acquired by students, namely 75.2%.

Stage of Disseminate

Dissemination Digital Assessment is the final stage after the product Digital Assessment declared valid, practical, effective and able to analyze the profile of students' scientific literacy skills. Digital Assessment which has been developed, distributed to several schools through the provision of user manualsDigital Assessment. As for the school that was given a user manual Digital Assessment including, State Junior High School 1 Jember, State Junior High School 2 Jember, State Junior High School 3 Jember, State Junior High School 1 Probolinggo, State Junior High School 5 Probolinggo, and State Junior High School 7 Probolinggo.

Discussion

Based on the research results it is known that Digital Assessment developed to be very effective because of the questions presented in Digital Assessment able to measure student learning outcomes very precisely through various types of questions that are arranged based on aspects of scientific literacy with the HOTS type of questions that can rank students' scientific literacy skills into 3 categories according to PISA low, medium and high categories. The instrument is declared effective if it is able to measure students' scientific literacy skills (Firdaus & Mindyarto, 2021). When the target for evaluating each indicator item is achieved and you are able to classify scientific literacy skills into three categories low, medium and high, it is proven that the assessment instrument is effectively used for assessment in learning (Hasan et al., 2020).

Application Digital Assessment with a small scale at State Junior High School 2 Jember which aims to find out and identify various problems such as weaknesses and deficiencies Digital Assessment when used directly by students has shown appropriate results where Digital Assessment able to level up scientific literacy skills according to PISA. Chasana, et al. (2022) states the fact that the various levels of students' scientific abilities require the development of scientific literacy-based instruments that are able to distinguish high-ability students from low-ability students. Assessment using *Digital* media has its own advantages and disadvantages (Hasanah et al., 2020). Teachers can

easily determine independently the indicators of questions that are in accordance with the learning objectives to be support the achievement of development, and the type of assessment for students (Sari et al., 2021). Apart from that, there is no ease in assessing through digital media for teachers need to buy a lot of paper to print, only need the final part of the assessment and the process of archiving data is easier (Satriawan & Rosmiati, 2022; Rawung et al., 2021).

Progress reports that still use manual handwriting take quite a long time and the effort required can be said to be more than using Digital media. However, behind the advantages that have been described there are also disadvantages that exist. The drawback of this Digital media assessment is that it is often error so that educators are hampered in entering student assessment results into applications and educators need to wait until the application can be used again (Helendra & Sari, 2021). Moodle also flexible, can be accessed anywhere and anytime through various devices both PCs and smartphones (Rosmiati et al., 2013; Fikriyah et al., 2022).

Moodle is a platform used to help a website-based learning model system using a PC. Moodle is also an online application. Where, for every learning action that is identified with access to material, conversation, question and answer, to assessment must be possible through the show site by utilizing the help of the program (Auliya & Latipah, 2021). Which says that Moodle is very suitable for building interactive learning, collaborative and active. Data that has been filled in but is affected by interference is not stored so the teacher repeats from the beginning to enter data when constrained by interference (Ploj Virtič, 2022). Another weakness occurs in educators who are stuttering about technology, of course, hindering the work on assessments and ultimately delegating tasks to young and technologically literate generations (Bening et al., 2022).

A test instrument or called a tool for evaluation is something that can be used to achieve goals more effectively and efficiently. In evaluating the function of the tool, it is also used to get better results according to the facts being evaluated (Awiria et al., 2022). The success of the effectiveness test is also shown in the implementation results Digital Assessment on a large scale in several junior high schools in Jember district and Probolinggo city consisting of State Junior High School 1 Jember, State Junior High School 2 Jember, State Junior High School 3 Jember, State Junior High School 1 Probolinggo, State Junior High School 5 Probolinggo and State Junior High School 7 Probolinggo.

Based on the description above then Digital Assessment based Moodle it can be said to be effective for measuring scientific literacy skills possessed by class VII junior high school students, especially on environmental pollution material. In addition, Moodle provides student statistical data that the teacher can use in analyzing which material the students have mastered or not mastered, so that in the implementation of remedial/enrichment programs it can be given right on target to students (Mutoharoh et al., 2022). So, through the Moodle application students' scientific literacy skills can be

measured by effective. This is in line with the concept that the effectiveness of an assessment instrument can be seen from the results after students use the assessment instrument provided (Yumithasari, et al., 2022). The instrument is declared effective if it is able to measure students' scientific literacy skills (Firdaus & Mindyarto, 2021).

CONCLUSION

Fundamental finding: Digital Assessment is very effective with the questions presented in the Digital Assessment being able to measure student learning outcomes very precisely through varied types of questions. In addition, scientific literacy questions in the Digital Assessment are prepared based on aspects of scientific literacy skills that have been determined by PISA using HOTS question types and can rank students' scientific literacy skills into 3 categories according to PISA, namely low, medium and high categories. **Implication:** This research product can be used to support digital assessment activities to measure students' scientific literacy skills, especially in the current independent curriculum. In addition, the results of this study can be used as a basis for developing Digital Assessments on other natural science materials. **Limitation:** In this study, students' digital literacy skills were not taken into account because the selection of schools where the research was conducted had been adjusted, namely schools that had implemented a computer-based Assessment Competence Minimum (AKM) so that they had support for the implementation of the Digital Assessment. **Future research:** Further research is needed on scientific literacy-based learning activities to support the achievement of aspects of scientific literacy skills in Digital Assessment.

REFERENCES

Arrohman, D. A., Wahyuni, A. L. E., Wilujeng, I., & Suyanta, S. (2022). Implementasi penggunaan LKPD pencemaran air berbasis STEM dan model learning cycle 6e terhadap kemampuan literasi sains. *Jurnal Pendidikan Sains Indonesia*, *10*(2), 279–293. https://doi.org/10.24815/jpsi.v10i2.23584

Asyhari, A. (2019). Pengembangan instrumen asesmen literasi sains berbasis nilai-nilai islam dan budaya indonesia dengan pendekatan kontekstual. *Lentera Pendidikan,* 22(1), 1-14. https://doi.org/10.24252/lp.2019v22n1i14

Auliya, A., & Latipah, N. (2021). The development of based evaluation instruments wordwall for science courses of junior high school class VII. *Tarbiyah: Jurnal Ilmiah Kependidikan,10*(2), 1-11. http://dx.doi.org/10.18592/tarbiyah.v10i2.4566

Awiria, A., Prawira, A. Y., Dariyanto, D., & Pujayanah, I. S. (2022). Pelatihan mengembangkan evaluasi pembelajaran inovatif menggunakan google form, kahoot dan quizziz di sekolah dasar. *Jurnal Penelitian dan Pengabdian Kepada Masyarakat*, *9*(1), 112–119. https://doi.org/10.32699/ppkm.v9i1.2173

Bening, T. P., Yusuf, H., Islamiah, R., & Wijayanti, P. (2022). Asesmen perkembangan anak usia dini di era digital. *Edukatif: Jurnal Ilmu Pendidikan*, *4*(5), 1-9. https://doi.org/10.31004/edukatif.v4i5.3171

Chasanah, N., Widodo, W., & Suprapto, N. (2022). Pengembangan instrumen asesmen literasi sains untuk mendeskripsikan profil peserta didik. *Pendipa: Journal Of Science Education*, *6*(2), 474–483. https://doi.org/10.33369/pendipa.6.2.474-483

Erniwati, E., Istijarah, I., Tahang, L., Hunaidah, H., Mongkito, V. H. R., & Fayanto, S. (2020). Kemampuan literasi sains siswa sma di kota kendari. *Jurnal Kumparan Fisika*, *3*(2), 99–108. https://doi.org/10.33369/jkf.3.2.99-108

Feriyanto. (2022). Strategi penguatan literasi numerasi matematika bagi peserta didik pada kurikulum merdeka belajar. 07(02). *GAMMATH: Jurnal Ilmiah Pendidikan Matematika.* https://doi.org/10.32528/gammath.v7i2.8439

Firdaus, H., & Mindyarto, B. (2021). Pengembangan instrumen soal berbasis *badge* dalam *moodle* pada materi gerak lurus. *UNNES Physics Education Journal*, *11*(01), 109-118. https://doi.org/10.15294/upej.v11i1.58788

Fikriyah, A. N., & Sukmawati, W. (2022). Pengembangan media pembelajaran learning management system (LMS) berbasis moodle pada materi perubahan energi. *Ideas: Jurnal Pendidikan, Sosial, dan Budaya*, *8*(3), 1-7. https://doi.org/10.32884/ideas.v8i3.869

Fitriani, U., Adisyahputra, A., & Komala, R. (2018). Eco-Friendly website development in biology learning based on project activities on environmental pollution. *Biosfer: Jurnal Pendidikan Biologi*, *11*(1), 33–47. https://doi.org/10.21009/biosferjpb.11-1.4

Fitriani, Y. (2022). Peningkatan kemampuan asesmen kompetensi minimum (akm) literasi siswa melalui pendekatan saintifik SMP negeri 2 payaraman. *Wahana Didaktika*, *20*(01), 128-139. https://doi.org/10.31851/wahanadidaktika.v20i1.7333

Fuadi, H., Robbia, A. Z., Jamaluddin, J., & Jufri, A. W. (2020). Analisis faktor penyebab rendahnya kemampuan literasi sains peserta didik. *Jurnal Ilmiah Profesi Pendidikan*. *5*(2), 108–116. 10.29303/jipp.v5i2.122

Hanafi, Y., Aprilia, N., Nurusman, A. A., Purwanto, A., Nadiroh, N., & Budi, S. (2021). Analisis kebutuhan pengembangan instrumen literasi lingkungan untuk mahasiswa pendidikan biologi fkip universitas ahmad dahlan. *Jurnal Eksakta Pendidikan (JEP)*, *5*(2), 174–180. https://doi.org/10.24036/jep/vol5-iss2/604

Handayani, R. D., & Putra, P. D. A. (2019). Student cognition in the context of a climate system: global warming and greenhouse effect. *Momentum: Physics Educational Journal*, *3*(2), 69-77. https://doi.org/10.21067/mpej.v3i2.3739

Handayani, R. D., Prastowo, S. H. B., Trapsilo, P., Putra, P. D. A., Bachtiar, R. W., Nuraini, L., Supriadi, B., Maryani, M., Bektiarso, S., Lesmono, A. D., & Mahardika, I. K. (2021). Students' thought pattern concerning the greenhouse effect. *Momentum: Physics Educational Journal*, *5*(1), 21-28. 10.21067/mpej.v5i1.5156

Handayani, R. D., & Triyanto. (2022). Seventh-grade students' conceptions of climate change, global warming, and the greenhouse effect. *Journal of Geosience Education*, *70*(4), 490-500. 10.1080/10899995.2021.1989941

Hasanah, U., Edwita, & Januar, A. (2020). Pelatihan pengembangan digital assesment bagi guru sekolah dasar di kepulauan seribu. *Bernas: Jurnal Pengabdian Kepada Masyarakat*, *1*(4), 338–346. https://doi.org/10.31949/jb.v1i4.448

Helendra, H., & Sari, D. R. (2021). Pengembangan instrumen asesmen berbasis literasi sains tentang materi sistem ekskresi dan sistem pernapasan. *Jurnal Ilmiah Pendidikan Profesi Guru*, *4*(1), 17–25. https://doi.org/10.23887/jippg.v4i1.29860

Humayra, F., Sulastri, & Gani, G. (2022). Persepsi pendidik terhadap pembelajaran ipa secara terpadu di SMP/MTS kota banda aceh. *Jurnal Pendidikan Sains Indonesia, 1*(4), 717-739. https://doi.org/10.24815/jpsi.v10i4.26013

Indahri, Y. (2020). Pengembangan pendidikan lingkungan hidup melalui program adiwiyata (studi di kota surabaya). *Aspirasi: Jurnal Masalah-Masalah Sosial*, *11*(2), 121–134. https://doi.org/10.46807/aspirasi.v11i2.1742

Martinah, A. A., Mubarok, V., Miarsyah, M., & Ristanto, R. H. (2022). Pengembangan instrumen tes literasi sains berbasis kontekstual pada materi pencemaran lingkungan. *Bioedusiana: Jurnal Pendidikan Biologi*, *6*(2), 192–218. https://doi.org/10.37058/bioed.v6i2.3251

Maryanti, S., Hartati, S., Trie Kurniawan, D., & Mukhtar, S. N. (2022). Development of assessment for learning (afl) through the educandy application for middle school biology learning. *Journal df Natural Science And Integration*, *5*(1), 1-12. http://dx.doi.org/10.24014/jnsi.v5i1.16627

Maulidia, U. (2022). Pengembangan modul ajar berbasis kurikulum merdeka. *Jurnal Tarbawi*, *5*(2), 1-10 https://doi.org/10.51476/tarbawi.v5i2.392

Muslih, M. (2021). Analisis pengembangan aplikasi ujian berbasis *moodle* di sekolah menengah kejuruan lestari cirebon. *NUSANTARA: Jurnal Ilmu Pengetahuan Sosial, 8*(7), 2390-2397. http://dx.doi.org/10.31604/jips.v8i7.2021.2390-2397

Mutoharoh, M., Muliyati, D., & Simanjuntak, B. R. (2022). Pengembangan modul pembuatan tes asesmen kompetensi minimum pada *platform e-learning* berbasis *moodle* untuk guru sekolah. *Parameter: Jurnal Pendidikan Universitas Negeri Jakarta*, *34*(1), 17–21. https://doi.org/10.21009/parameter.341.03

Narut, Y. F., & Supardi, K. T. (2019). Literasi sains peserta didik dalam pembelajaran ipa di indonesia. *Jurnal Inovasi Pendidikan Dasar,* 3(1), 61-69. https://doi.org/10.36928/jipd.v3i1.214

Nurgiyantoro, B., Lestyarini, B., & Rahayu, D. H. (2020). Konstruk asesmen literasi fungsional untuk siswa sekolah menengah pertama. *LITERA, 9*(2), 194-211 10.21831/ltr.v19i2.32977

OECD. (2019). *PISA 2018 assessment and analytical framework*. Paris: OECD Publishing. https://www.oecd.org/education/pisa-2018-assessment-and-analytical-framework-b25efab8-en.htm

Paridah, A. N., Susilawati, D., & Aeni, A. N. (2022). Pemanfaatan website *proprofs brain games* untuk mengukur pemahaman siswa dalam pembelajaran PAI kelas V SD. *Pedagogi: Jurnal Penelitian Pendidikan*, *9*(1) 65-81. https://doi.org/10.25134/pedagogi.v9i1.5758

Ploj Virtič, M. (2022). Teaching science & technology: components of scientific literacy and insight into the steps of research. *International Journal Of Science Education*, *44*(12), 1916–1931. https://doi.org/10.1080/09500693.2022.2105414

Pradini, N. L., Wijaya, B. R., & Jannah, A. N. (2022). Analisis literasi sains dalam upaya implementasi pendidikan abad 21. *EDUCTIUM, 1*(1), 1-10. https://doi.org/10.56480/eductum.v1i1.681

Priscilla, C., & Yudhyarta, D. Y. (2021). Implementasi pilar-pilar pendidikan UNESCO. *Asatiza: Jurnal Pendidikan*, 2(1), 64–76. https://doi.org/10.46963/asatiza.v2i1.258

Pursitasari, I. D., Permanasari, A., & Jaenudin, D. (2022). Pelatihan penyusunan *e-asesmen* literasi sains berbasis akm bagi guru IPA SMP di kabupaten bogor. *Jurnal Pemberdayaan Masyarakat, 1*(1), 26-33. https://doi.org/10.46843/jmp.v1i1.265

Rawung, N. N. V., Sambul, A. M., & Paturusi, S. D. E. (2021). Moodle based e-learning quiz application. *Jurnal Teknik Informatika, 16*(4), 429-436. https://doi.org/10.35793/jti.16.4.2021.34227

Ristiyana Puspita Sari, A., Sidauruk, S., Meiliawati, R., & Anggraeni, M. E. (2021). Development of digital literacy assessment scale to measure student's digital literacy. *Jurnal Ilmiah Kanderang Tingang*, *12*(2), 137–143. 10.37304/jikt.v12i02.128

Rosmiati, Jatmiko, B., & Madlazim. (2013). Pengembangan perangkat pembelajaran blended learning model cooperative. *Journal of Science Education Research, 3*(1), 294–298. https://doi.org/10.26740/jpps.v3n1.p294-298

Rosmiati, R., & Satriawan, M. (2022). Pengembangan modul digital materi kebumian untuk meningkatkan literasi iklim di indonesia. *OPTIKA: Jurnal Pendidikan Fisika*, *6*(2),177–189. https://doi.org/10.37478/optika.v6i2.2268

Satriawan, M., & Rosmiati, R. (2022). Simple floating ocean wave energy converter: developing teaching media to communicating alternative energy. *Jurnal Penelitian Pendidikan Sains)*, *12*(1), 1–13. https://doi.org/10.26740/jpps.v12n1.p1-13

Sopiansyah, D., & Masruroh, S. (2021). Konsep dan implementasi kurikulum MBKM (merdeka belajar kampus merdeka). *Religion Education Social Laa Roiba Journal*, *4*(1), 34–41. Https://Doi.Org/10.47467/Reslaj.V4i1.458

Suparya, I. K., I Wayan Suastra, & Putu Arnyana, I. B. (2022). Rendahnya literasi sains: faktor penyebab dan alternatif solusinya. *Jurnal Ilmiah Pendidikan Citra Bakti*, *9*(1), 153–166. Https://Doi.Org/10.38048/Jipcb.V9i1.580

Vonny, V., Nihlah, K., Miarsyah, M., & Ristanto, R. H. (2021). Mempromosikan literasi biologi kepada siswa sekolah menengah: pengembangan instrumen tes untuk kelas VII. *Bioedusiana: Jurnal Pendidikan Biologi*, 6(2), 251–265. https://doi.org/10.37058/bioed.v6i2.3249

Wulandari, A. N., Sutopo, S., & Kuswardi, Y. (2020). Aplikasi *moodle* sebagai authentic assessment pada pembelajaran matematika di SMK. *Journal of Mathematics and Mathematics Education*, *10*(2), 1-27. https://doi.org/10.20961/jmme.v10i2.47082

Yumithasari, R., Sunyono, S., & Munaris, M. (2022). Pengembangan instrumen asesmen portofolio untuk mengukur kemampuan berbahasa indonesia tulis peserta didik kelas IV sekolah dasar. *Edukatif : Jurnal Ilmu Pendidikan*, 4(3), 4713–4720. https://doi.org/10.31004/edukatif.v4i3.2796

Yuwono, M. R., Aribowo, E. K., & Firmansah, F. (2020). Pelatihan *anbuso, zipgrade,* dan *google form* sebagai alternatif penilaian pembelajaran di era digital. *MARTABE : Jurnal Pengabdian Masyarakat,* 3(1), 49-60. http://dx.doi.org/10.31604/jpm.v3i1.49-60

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