



## Validity Test of Moodle-Based Digital Assessment to Measure Science Literacy Skills in Environmental Pollution Material

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**Abstract:** This study aims to test the level of validity of Digital Assessment based Moodle as an assessment instrument to measure scientific literacy skills possessed by SMP/MTs students, especially on environmental pollution material. This method of research was development research with a 4D model consisting of a defining stage (Define), planning level (Design), development stage (Develop), and spread level Disseminate. At the development stage or development validation was carried out Digital Assessment based Moodle by expert validators consisting of 2 Lecturers in Science Education Master's Degree at the University of Jember and 3 Science Teachers from SMPN 1 Jember, SMPN 2 Jember and SMPN 1 Probolinggo. The data analysis technique used was descriptive analysis and percentage calculation of validation results. The validation results in Digital Assessment-based Moodle obtained an average of 94.1% with a very valid category so that Digital Assessment-based Moodle met the quality and could be applied to students of class VII SMP SMP/MTs to measure students' scientific literacy skills, especially on environmental pollution material.

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## Introduction

Learning Natural Sciences (IPA) in class requires students to have the basic concepts of science consisting of living things and their life processes, materials and their uses, energy and changes; students in everyday life can later apply all these concepts. Science learning in SMP/MTs is a curriculum implementation model that holistically links chemistry, physics, and biology studies (Humayra et al., 2022). Science learning plays an important role in the educational process in every country. It is evidenced by making science a basic skill in English Program for International Student Assessment (PISA) (Feriyanto, 2022). Science learning teaches students to actively find concepts, principles, and theories to develop (Nikmatin et al., 2022). Science learning in class is directly related to the school curriculum, so it must follow the latest curriculum, namely the independent curriculum, which is a transition from the 2013 curriculum. Changes in the curriculum from the revised 2013 curriculum to an independent curriculum change approaches, strategies, methods, models and even evaluation of learning (Nugraha, 2022).

Implementing the Merdeka Curriculum focuses on utilizing technology and learning communities to share good practices between teachers, students, and academics. Various strategies and platforms have been developed for implementing the Independent Curriculum (Sopiansyah & Masruroh, 2021). Implementation of the Independent Curriculum (IKM) has three categories: independent learning, independent change, and independent sharing (Rahmadayanti & Hartoyo, 2022). The independent curriculum contains four main programs,



namely the National Standardized School Examination (USBN) assessment was changed to an Assessment Examination, the National Examination (UN) was changed to a Minimum Competency Assessment (AKM) and a Character Survey, the preparation of Learning Implementation Plans (RPP) was changed to Teaching Modules (MA)) (Maulidia, 2022), Moreover, the zoning system in New Student Admissions (PPDB) is more flexible (Ratsyari & Ghufron, 2021).

Minimum Competency Assessment (AKM) is an assessment of the fundamental skills needed by all students to develop their capacity and participate positively in society. The basic skills measured in the AKM are literacy and numeracy (Fitriani et al., 2022). It is also relevant to the assessment of scientific literacy, which measures aspects of students' knowledge and emphasizes science skills (Pursitasari et al., 2022). In scientific literacy, numeracy ability is an essential dimension, so scientific literacy assessment can also be a benchmark for students' numeracy abilities (Pujawan et al., 2022). Regulation of the Minister of Education and Culture Number 23 of 2015 concerning the Growth of Character and Character became the basis for the emergence of national issues related to skills that must be mastered to face the 21st century (Siskawati et al., 2021). The skills that must be mastered in the 21st century are one of the main focuses and can build other skills, namely scientific literacy skills (Pradini et al., 2022).

*Programme for International Student Assessment (PISA)* is a program organized by an organization named Organization for Economic and Development (OECD); it aims to measure students' scientific literacy skills at the international level (Feriyanto, 2022). The results of measuring the scientific literacy of Indonesian students carried out by PISA in 2018 received a score of 396 (ranked 70 out of 78 countries) (Arrohman et al., 2022). The main factors that cause low scientific literacy in Indonesian students are that students are not used to working on scientific literacy test questions (Fuadi et al., 2020) and students' low interest in reading (Suparya et al., 2022). It is in line with empirical data obtained through distributing questionnaires to schools in Jember Regency and Probolinggo City that have implemented AKM literacy showing some difficulties experienced by students in carrying out AKM literacy-based learning, including a lack of motivation to hone literacy skills, students do not understand the meaning of the questions presented, students have not fully aware of the importance of literacy skills, there is no readiness for students to accept literacy learning and there is a reluctance of students to get out of their comfort zone when carrying out online learning during a pandemic.

Assessment is an integral part of the learning process (Jalal, 2020). The instrument is the central part of carrying out the assessment. Assessment instruments can provide information about learning achievements (Vonny et al., 2021). Various learning activities carried out led to the Digital era, namely relying on technology as the driving wheel of education. Therefore, teachers and students must be able to operate Digital devices, search for information, and process and interpret it (Sari et al., 2021).

Digital Assessment offers solutions that can train student skills according to developments in information and communication technology (Maryanti et al., 2022). Now teachers no longer need to provide progress reports by hand (Hasanah et al., 2020). The ease of assessing using the application is that the teacher can determine the indicators to be developed, types of activities, and assessments, and the data will be automatically recorded (Nurgiyantoro et al., 2020). In addition, the ease of assessment through *Digital media* is considered more environmentally friendly by reducing paper use (Hasanah et al., 2020). Manual assessment has a higher student cheating rate than Digital assessment because, with



Digital assessment, students must log in with the user name and password (Hasanah et al., 2020). Based assessment online can also improve the quality of learning outcomes (Nurgiyantoro et al., 2020). This assessment system is very effective and efficient because it can measure students' abilities objectively and validly (Vonny et al., 2021).

*Digital Assessment* instruments are in the form of the use of technology developed by several studies, such as the development of using assessment instruments google form (Yuwono et al., 2020), Kahoot (Awiria et al., 2022), Proprofs (Paridah et al., 2022), Moodle (Muslih, 2021) and Quiziz (Gunadi et al., 2020). Based on this research, it is known that all platform offers various features that support the creation of Digital assessment instruments. Based on these features, Moodle became the platform the most appropriate for making Digital assessment instruments for scientific literacy with the types of questions appropriate to AKM, namely consisting of multiple choice, complex multiple choice, matching, short answer, and description questions.

*Modular Object-Oriented Dynamic Learning Environment (Moodle)* is programming created for practice-based education and learning web and online (Rusdi et al., 2022). This application has essential learning support features such as assignments, quizzes, and chat. Moodle is also flexible and can be accessed anywhere and anytime through various devices, neither PC nor smartphone (Fikriyah et al., 2022). Application utilization Moodle as an assessment instrument is very effective. It is proven in research (Auliya and Latipah, 2021), who said that Moodle is suitable for building interactive, collaborative, and active learning. The effectiveness of using Moodle as an assessment instrument is also proven by (Muslih, 2021), which states that after conducting a based assessment, Moodle has a good impact on the administration and time efficiency of teachers and students. Students are more interested in exam-based Moodle because the features provided are beneficial in the assessment.

The material in science subjects that will be studied is environmental pollution. Environmental Pollution is a topic of discussion in science subjects in class VII with a scope consisting of air, water, and soil pollution (Fitriani et al., 2018). Environment issues are currently a topic of considerable discussion urgent among international organizations (Hanafi et al., 2021). United Nations (UN) through United Nations Educational, Scientific and Cultural Organization (UNESCO), put forward a program called Environmental Education (EE) which is the integration of environmental understanding with formal education or informal education. EE is expected to help students gain awareness and knowledge about the environment so that they can form attitudes, skills and abilities so that students can actively solve environmental problems (Indahri, 2020).

Based on the description above, developing Digital Assessment in learning, especially Environmental Pollution material, is essential to develop students' literacy skills. Assessment literacy is emphasized for reading and can be applied in the activity's writing, thinking and even analysis. This study aims to test the level of validity of Digital Assessment based Moodle to measure the scientific literacy skills of junior high school students on environmental pollution material.

## Research Method

The method of research used was research development or Research and Development. Development research was one type of research that was currently being developed to produce a particular product and test its effectiveness of the product (Setyosari, 2013). The products produced in this research were Digital Assessment-based Moodle to measure students' scientific literacy skills. The development research model was the 4D



model consisting of Define, Design, Develop, and Disseminate (Thiagarajan, 1974). The use of this 4D model was based on research procedures that are suitable for developing an assessment instrument.

*Digital Assessment* which was developed, was then validated by 2 Lecturers from the Science Education Masters Program at the University of Jember and 3 Science Teachers from SMP Negeri 1 Jember, SMP Negeri 2 Jember and SMP Negeri 1 Probolinggo using the validation sheet as an assessment and input which would then be revised. Qualitative data in comments and suggestions would be analyzed descriptively. In contrast, quantitative data from scores obtained from the validation sheet would be converted into a percent using the following calculation formula (Akbar, 2013):

$$V = \frac{Tse}{Tsm} \times 100\%$$

Information:

V = Expert validation (percentage value)

Tse = Total empirical score (value of validation results)

Tsm = Maximum total score (maximum expected value)

Data in the form of percentages will be used to determine the validity level of *Digital Assessment* based Moodle by interpreting the percentage results based on table 1 below:

**Table 1. Validity Test Criteria**

Interval Score	Category
85,01% - 100,00%	Very valid
70,01% - 85,00%	Valid
50,01% - 70,00%	Less valid
25,00% - 50,00%	Invalid

Source: (Akbar, 2013)

## Results and Discussion

Validity test Digital Assessment carried out by five expert validators consisting of 2 Lecturers from the Science Education Masters Program at the University of Jember and 3 Science Teachers from SMP Negeri 1 Probolinggo, SMP Negeri 2 Jember and SMP Negeri 1 Jember using validation sheets as assessments and input for product improvement. The result data obtained from the validity test Digital Assessment is as follows:

**Table 2. Quantitative Data Validation Results Digital Assessment**

Assessment Aspects	Validator					Average Score
	V1	V2	V3	V4	V5	
Development Aspect	39	35	38	35	40	37,4
Display Aspect	38	39	37	35	38	37,4
Content Qualifying Aspects	37	39	40	34	40	38
Linguistic Aspect	37	39	38	36	39	37,8
Aspects of Functions and Benefits	18	19	20	18	20	19
<b>Amount of Score</b>	<b>169</b>	<b>171</b>	<b>173</b>	<b>158</b>	<b>177</b>	<b>169,6</b>
<b>Results (%)</b>	<b>93,8%</b>	<b>95%</b>	<b>96,1%</b>	<b>87,7%</b>	<b>98,3%</b>	<b>94,1%</b>
<b>Validity Category</b>	<b>Very Valid</b>	<b>Very Valid</b>	<b>Very Valid</b>	<b>Very Valid</b>	<b>Very Valid</b>	<b>Very Valid</b>



Table 2 showed the validation results in Digital Assessment based on five aspects of the assessment, namely the development aspect, which consists of 10 assessment items, the appearance aspect, which consists of 10 assessment items, the content feasibility aspect, which consists of 10 assessment items, the linguistic aspect which consists of 10 assessment items, the function and benefits aspects which consist of 5 assessment item. The results of the validation showed that the highest score was found on the eligibility aspect of the content, while the lowest score was on the development and display aspects. Overall, Digital Assessments were in the very valid category with a percentage of 94.1%. The description of the assessment items for each aspect can be seen in Table 3 below.

**Table 3. Validation Assessment Items Digital Assessment based Moodle**

Assessment Aspects	Number of Assessment Items	Example
Development Aspect	10	<i>Digital Assessment</i> already described the alternative development of learning devices
Display Aspect	10	The attractiveness of the initial view <i>Digital Assessment</i> based <i>Moodle</i>
Content Qualifying Aspects	10	The truth of the material concept of environmental pollution on scientific literacy questions
Linguistic Aspect	10	The language used is communicative and easy to understand
Aspects of Functions and Benefits	5	Usage <i>Digital Assessment</i> based <i>Moodle</i> able to measure students' scientific literacy skills, especially on environmental pollution material

Digital Assessment-based Moodle has gone through the design or design stage where the aim is to prepare a prototype Digital Assessment by using the application Moodle as well as the preparation of scientific literacy questions based on the dimensions of scientific literacy that PISA has determined by utilizing the feature of the variety of question types on Moodle consisting of multiple choice questions, complex multiple choice questions, matching questions, short answer questions and essay questions. The login view from Moodle can be seen in the following Figure 1.



**Figure 1. Login Display Moodle**

The results of the validation carried out by the expert validator against Digital Assessment developed received a very positive response from the expert validator, and, based on the results of the validation sheet that had been analyzed, Digital Assessment obtained an average percentage of validation results, namely 94.1%. Digital Assessment was included in the very valid category. It can be applied to students to measure scientific literacy skills after



several revisions based on comments and suggestions from expert validators. An instrument is valid if it can measure what is desired and reveal data from the variables studied appropriately (Azizah & Budijastuti, 2022).

The results of comments and suggestions in general, the validator said that Digital Assessment became something new as an alternative to conducting an assessment. Digital Assessment was also very relevant and good for development and application, primarily to support the driving school program, namely digitization in the implementation of learning. Each item was also relevant and included a discussion of environmental pollution with various problem models that motivated students to develop their reasoning power and ability to work on each type of question.

Testing the validity of the research instrument can be declared valid if each assessment item in the questionnaire can be used to reveal something that the questionnaire will measure (Yuwono et al., 2020). The question items on the validation sheet were arranged based on the aspects used to reveal the validity of the Digital Assessment being developed. On the development aspect, Digital assessments have fulfilled each assessment item where. Digital assessments have become an alternative to the development of learning tools as assessment instruments that have met the needs of students. Assessment instruments that meet the standards must meet students' needs in terms of learning evaluation (Gunadi et al., 2020).

Student learning outcomes will be well detected and can be used as evaluation material for further learning programs (Savira & Gunawan, 2022). Learning outcomes measured using Digital Assessment are scientific literacy skills, especially in environmental pollution material. Each concept is presented on Digital Assessment based on the syllabus and learning objectives to be achieved. According to Haka et al. (2019), The assessment instrument was designed considering the developmental stage and level of student achievement. Each question's content was also presented according to indicators of learning material and the level of student development. It showed that the questions developed followed the independent curriculum, KI and KD, and the question indicators represented every aspect of the material students study. Hendra and Sari (2021) state that the criteria are valid for scientific literacy assessment instruments if the material to be measured follows the demands of basic competencies and indicators in the curriculum.

On the display aspect, Digital Assessment has been designed in an organized and attractive way for junior high school students. Each question's content and environmental issues raised have been adapted to the material concept of environmental pollution. According to Firdaus and Mindyarto (2021), the test will be meaningful if the test consists of items that test important objectives and represent a representative domain of knowledge, abilities and skills based on the topic of the material used. Assessment questions can be formulated using the latest media, such as pictures, to attract students' attention (Awiria et al., 2022). The images in the items are also relevant to support the content of environmental pollution material. The appearance of text and writing also follows the standards so students can see and read quickly.

Online assessment applications have a wide range of access speeds. The recommended bandwidth for ANBK online mode is 12 Mbps (Nugroho et al., 2021). The access speed to each feature and item question on Digital Assessment depends on the internet network or wifi. In contrast, the wifi network used in accessing the Digital Assessment reaches 20 Mbps. So far, there has not been any trouble anything, and it can be accessed quickly and smoothly.



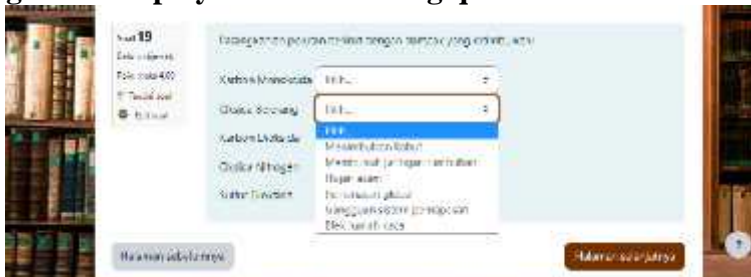
Utilizing Digital applications makes assessment activities in learning more interesting (Paridah et al., 2022). Selection of themes and color combinations on display Digital Assessment has been chosen as educative as possible, namely the library's theme. The presentation of each item is arranged randomly so that each student will present a different question. According to Chasanah et al. (2022), in carrying out student assessments, it is required to disclose students' abilities in mastering learning material honestly.

On the content eligibility aspect, Digital Assessment, the correctness of the concept in each scientific literacy question follows the material concept of environmental pollution. The number of items must be proportional to the area and importance of the subject matter (Awiria et al., 2022). The scientific literacy questions consist of 30 questions with the types of questions presented following AKM standards: multiple choice, complex multiple choice, matching, short answer, and description questions. These types of variations are intended so that the questions are not monotonous while also honing students' abilities to understand the method or technique of working on each type of question. According to Fitriani et al. (2022), The assessment instrument presented with various questions can motivate students' reasoning power so that it is easier for them to do it.

PISA assesses science knowledge as relevant to the science education curriculum in participating countries without limiting itself to general aspects of the national curriculum (Sopiansyah & Masruroh, 2021). The formulation of each scientific literacy item has been based on the four main dimensions of scientific literacy determined by PISA: knowledge, context, competency, and attitude. If knowledge, context, and competency can be adequately measured, the attitude dimension will be automatically achieved. The development of PISA-based test instruments can train reasoning abilities to increase so that in solving each problem, students can involve various basic skills, one of which is scientific literacy skills (Helendra & Sari, 2021). During the validation process, several things need improvement, one of which is related to the number of pairs of matchmaking questions that need to add one partner's answer as a distractor so that it looks in the figure as follows:



**Figure 2. Display of matchmaking questions before revision**



**Figure 3. Display of matchmaking questions after revision**

The procedure for writing test items is an important step in developing a good test instrument (Gunadi et al., 2020). On the linguistic aspect, Digital Assessment is prepared using



communicative language and easily understood by students; besides that, it also fulfils the coherence and integration between paragraphs in each reading text related to environmental issues. The sentences used in each item can be structured effectively and efficiently studied by students (Asyhari, 2019). In addition, the preparation of sentences also pays close attention to rules such as the accuracy of the SPOK sentence structure, the General Guidelines for Indonesian Spelling (PUEBI), and terms that follow the Big Indonesian Dictionary (KBBI). Sentences used as much as possible can encourage students' curiosity about environmental issues in the items, motivating students' awareness and concern for the environment around them. According to Mariani et al. (2022), Assessment questions must be presented in communicative sentences and adapted to the level of student development.

Regarding functionality and benefits of using Digital Assessment, this can measure students' scientific literacy skills, especially on environmental pollution material, with varied questions so that it is not monotonous for students. Multiple-choice questions have high objectivity and can measure cognitive level (Firdaus & Mindyarto, 2021). Complex multiple-choice questions measure students' ability to distinguish between facts and opinions (Pratiwi et al., 2022). Matching questions can measure students' ability to identify information based on simple relationships and the ability to connect between two things (Muslih, 2021). Shorten questions by writing brief responses following the instructions (Rawung et al., 2021). Problem descriptions students are free to express opinions according to their ability to answer questions with their systematics (Pratiwi et al., 2022).

Usage Digital Assessment on environmental pollution material can also encourage the growth of students' awareness and concern for the environment so that through their scientific literacy skills, they can help solve every problem in the surrounding environment. It is in line with the statement of Chasanah et al. (2022) that the discourse in the questions is displayed in context and must be applicable in everyday life. Each item of questions will be able to increase students' knowledge regarding environmental issues because it is in the trial Digital Assessment will be applied to several junior high schools in Jember and Probolinggo Regencies so that the environmental issues raised in the real questions occur in the Jember and Probolinggo regions. Expanding student knowledge regarding environmental conditions can foster students' creative ideas for solving environmental problems (Muadifah, 2019).

## **Conclusion**

Based on the research, it can be concluded that Digital Assessment-based Moodle has gone through the validation stages with the results obtained, namely the first validator lecturer obtaining a percentage of 93.8% in the validity category, which was very valid. The second validator lecturer got a percentage of 95% with a very valid validity category. The first validator teacher obtained a percentage of 96.1% with a very valid validity category. The second validator teacher obtained 87.7% with a very valid validity category. The third validator teacher obtained a percentage of 98.3% with a very valid validity category. From the validation results, Digital Assessment-based Moodle obtained an average of 94.1% with a very valid category, so Digital Assessment-based Moodle has met the quality and can be applied to students to measure students' scientific literacy skills, especially on environmental pollution material.

## **Recommendation**

Science teachers can apply digital assessments that have been valid to measure the scientific literacy abilities of junior high school students, especially in environmental pollution





material. In addition, Digital Assessment can also be used as a reference source for assessments to measure students' scientific literacy abilities and can be input for science teachers to develop Moodle-based Digital Assessments on other Science materials. The results of scientific literacy skills obtained through the application of Digital Assessment can be used as information and evaluation materials by science teachers to obtain higher-quality learning activities.

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