

# Development of a Digital Literacy Assessment Instrument for Junior High School Students Using Zep Quiz Media in Ecoprint Batik Learning

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## Abstract

Digital literacy has become an essential competency for students in the 21st century, particularly in science learning that integrates technology and contextual learning resources. However, appropriate assessment instruments to measure students' digital literacy skills are still limited. This study aimed to develop a valid and reliable instrument for assessing junior high school students' digital literacy skills using Zep Quiz media in the context of ecoprint batik learning. The research employed a Research and Development (R&D) method using the Borg and Gall model, which was modified into several stages: problem analysis, planning, product design, expert validation, product revision, small-scale testing, operational revision, and large-scale testing. The participants of this study were 125 junior high school students. Data were collected through observation, questionnaires, and digital literacy assessment tests. The results of expert validation indicated that the developed instrument was highly valid. Item validity analysis showed that all test items met the validity criteria. Furthermore, the reliability coefficient of the multiple-choice test in the large-scale trial reached 0.762, which is categorized as high reliability. These findings indicate that the developed instrument is valid, reliable, and feasible to measure students' digital literacy skills in science learning using Zep Quiz media integrated with ecoprint batik materials.

**Keywords:** Digital Literacy; Assessment Instrument; Zep Quiz; Ecoprint Batik; Science Learning.

## INTRODUCTION

Digital literacy has become an essential competency in science education, as it facilitates students' and teachers' access to, understanding of, and use of digital media, communication tools, and networks (Ilhami et al., [2021](#); Momani et al., [2023](#); Pahrudin et al., [2025](#); Vuorikari et al., [2022](#)). In the context of modern education, digital literacy is also one of the key characteristics of the Independent Learning Curriculum, which encourages the integration of digital media into the teaching and learning process (Durroh Nasihatul Ummah & Nadlir, [2023](#); Rachma, [2025](#)). Digital literacy encompasses various competencies related to communication technology, including the ability to understand and utilize information in multiple formats through computers, as well as knowledge of web platforms and search engines (Ng, [2012](#); Pangrazio et al., [2020](#); Spante et al., [2018](#)). In general, digital literacy refers to the ability to search for, evaluate, understand, and utilize information obtained from various digital sources (Ika Sari et al., [2024](#)). In the 21st century, the concept of literacy has undergone significant transformation in response to rapid technological and societal developments. Literacy is no longer limited to the ability to read and write but has expanded into a broader concept that includes numeracy literacy, digital literacy, financial literacy, and cultural literacy (Reddy et al., [2023](#); Zaid Budi Arifin et al., [2025](#)). Furthermore, digital literacy is not merely the ability to operate digital devices

or software but also involves complex competencies that include cognitive, motor, sociological, and emotional aspects (Eshet-Alkalai, [2004](#)).

Despite its importance, students' digital literacy skills are still considered relatively low. This condition may be caused by the limited integration of digital literacy in classroom learning activities. A study conducted by the Ministry of Communication and Information Technology in 2020 across 34 provinces in Indonesia reported a digital literacy index score of 3.49 on a scale of 5. Preliminary analysis conducted at SMP Negeri 7 Jember showed that the digital literacy score in the information and data literacy category reached 3.87, while the score in the digital device usage category was only 3.09. This difference indicates that students' digital literacy skills still require improvement (Arkan & Bal, [2025](#)). Similar findings were also observed among students at SMP Negeri 2 Tambakboyo, where students still experienced limitations in digital literacy. Several indicators reflecting this condition include students' limited ability to optimally utilize the internet to search for needed information and their difficulty in distinguishing between reliable and unreliable information obtained from online sources (Nurhasanah et al., [2025](#)). These limitations indicate that students do not yet possess sufficient digital literacy skills to effectively navigate the digital environment. Therefore, improving students' digital literacy is essential so that they can utilize technology more effectively to support their learning process and expand their knowledge in the digital era (Nur Wahyuni et al., [2025](#)).

In addition to these challenges, the assessment instruments commonly used in schools still tend to rely on conventional written examinations that primarily measure learning outcomes numerically (Levy-Feldman, [2025](#); Rudolph et al., [2019](#)). Such instruments often overlook the digital competencies that are increasingly important in contemporary education. In contrast, digital learning environments provide various alternative assessment approaches, including interactive quizzes and digital-based evaluation tools. However, students' limited digital literacy skills make them less prepared to engage with these types of assessments (Mohamed Shuhidan et al., [2022](#); Zhang, [2025](#)). Efforts to accurately assess students' digital literacy also face several challenges, particularly in developing effective assessment instruments that are oriented toward digital competencies (Alfian et al., [2025](#); Savitri et al., [2025](#); Zakir et al., [2025](#)). Teachers are required to design assessment items that not only measure students' understanding of written texts but also evaluate their ability to search for digital information, assess the credibility of sources, and utilize information from various digital platforms (Hahnel et al., [2020](#); Kiili et al., [2022](#); Marttunen et al., [2021](#)). Therefore, the development of assessment instruments should align with digital literacy indicators, for example through case-based questions or digital content analysis tasks that encourage students to think critically and reflectively (Falloon, [2020](#); OECD, [2021](#)).

One alternative approach to addressing these challenges is the use of interactive digital assessment media such as Zep Quiz. Zep Quiz-based instruments represent a form of interactive digital evaluation that is highly suitable for modern learning environments. These instruments present online questions in the form of engaging and competitive quizzes that can be accessed through various digital devices, including computers, tablets, and smartphones. In addition, the questions provided in Zep Quiz can be adapted to different cognitive levels according to the intended learning objectives (Wang, [2008](#); Wen & Sulaiman, [2026](#); Zhyhadlo, [2022](#)). Interactive learning media such as Zep Quiz can increase students' participation and motivation in learning activities while also serving as an effective tool for assessing conceptual understanding (Prasetya et al., [2025](#); Widyantari et al., [2025](#)). With features that promote active student engagement, this platform enables teachers to obtain more accurate information regarding students' cognitive abilities and digital literacy skills (Barata et al., [2025](#); Idika & Saihi, [2025](#); Novita Sari Hutapea et al., [2024](#)).

Integrating digital literacy with local wisdom-based learning can also enhance the relevance of science education. One example is the use of ecoprint batik as a contextual learning medium. Ecoprinting introduces students to environmentally friendly techniques for producing fabric patterns using natural materials such as leaves and plant pigments. Through this activity,

students not only learn scientific concepts related to substances and their changes but are also encouraged to develop environmental awareness and appreciation for local cultural heritage (Barata et al., 2024; Sari et al., 2023). Evaluation instruments developed within this context can assess students' ability to connect scientific concepts with real-life applications. For example, students may be asked to explain why the color of fabric changes after being boiled with certain leaves or to determine whether the observed change represents a physical or chemical change (Widarti et al., 2025).

Although previous studies have emphasized the importance of digital literacy in science learning, the availability of valid and reliable assessment instruments specifically designed to measure students' digital literacy skills remains limited. Furthermore, the integration of digital literacy assessment with digital platforms such as Zep Quiz and contextual learning based on local wisdom, such as ecoprint batik, has rarely been explored. Therefore, there is a need to develop an innovative assessment instrument that integrates digital literacy indicators, interactive digital media, and contextual science learning materials.

Based on these considerations, this study aims to develop and validate a digital literacy-based assessment instrument for junior high school students using Zep Quiz media in the context of ecoprint batik learning. The developed instrument is expected to provide a valid and reliable tool for evaluating students' digital literacy skills while also supporting more interactive and meaningful science learning.

## METHODS

This study employed a Research and Development (R&D) approach using the Borg and Gall development model to determine the feasibility of a digital literacy assessment instrument that meets the criteria of validity, reliability, discriminating power, and level of difficulty. The development procedure adapted the Borg and Gall model, which was modified into eight stages: (1) needs analysis, (2) planning, (3) instrument design, (4) expert validation, (5) revision of the initial product, (6) small-scale trial, (7) product revision, and (8) large-scale field testing. The purpose of this process was to ensure that the developed instrument met validity, reliability, and practicality standards for classroom assessment (Gall et al., 2003).



**Figure 1.** Borg and Gall model development design

This research was conducted at SMP Argopuro 1 Panti. The respondents were students from classes VIIA, VIIB, and VIIC, consisting of 20 students for the small-scale trial and 52 students for the large-scale trial. Before being tested on students, the instrument was validated by three validators consisting of two science education lecturers and one science teacher.

The following is an explanation of research data collection techniques:

### 1. Expert Validity

Expert validity was calculated using the following formula (Sugiyono, [2016](#)):

$$V_{ah} = \frac{Tse}{Tsh} \times 100\%$$

Description:

$V_{ah}$  = expert validation

$Tse$  = raw score obtained

$Tsh$  = highest score on the validation sheet

The validity criteria are as follows:

**Tabel 1.** Validity Criteria

No	Validity Criteria	Validation Level
1.	$84 < V \leq 100$	Very valid
2.	$68 < V \leq 84$	Valid
3.	$52 < V \leq 68$	Sufficiently valid
4.	$36 < V \leq 52$	Less valid
5.	$20 < V \leq 36$	Not valid

### 2. Item Validity

Item validity was calculated using the point-biserial correlation formula (Arikunto, [2021](#)):

$$y_{pbi} = \frac{Mp - Mt}{St} \sqrt{\frac{p}{q}}$$

Description:

$y_{pbi}$  = point correlation

$Mp$  = average score of correct answers

$Mt$  = average total score

$St$  = standard deviation of total scores

$p$  = proportion of students who answered correctly

$q$  = proportion of students who answered incorrectly

The validity criteria for the questions are as follows:

**Tabel 2.** Criteria for Item Validity

No	Criteria	Validation Level
1.	0,00 – 0,19	Not valid
2.	0,20 – 0,39	Less valid
3.	0,40 – 0,59	Sufficiently valid
4.	0,60 – 0,79	Valid
5.	0,8 - 1	Very valid

### 3. Reliability

The reliability of the test instrument was calculated using the following formula (Sugiyono, [2016](#)):

$$r_{11} = \left(\frac{n}{n-1}\right) \left(\frac{SB^2 - \Sigma pq}{SB^2}\right)$$

Description:

$r_{11}$  = overall test reliability

$n$  = number of items

$p$  = proportion of subjects who answered correctly

$q$  = proportion of subjects who answered incorrectly

$SB$  = standard deviation of the test

The reliability criteria are as follows:

**Table 3.** Reliability Index Criteria

No	Criteria	Reliability Level
1.	$0,80 < r_{11} \leq 1,00$	Very Reliable
2.	$0,60 < r_{11} \leq 0,80$	Reliable
3.	$0,40 < r_{11} \leq 0,60$	Fairly Reliable
4.	$0,20 < r_{11} \leq 0,40$	Less Reliable
5.	$0,00 < r_{11} \leq 0,20$	Not Reliable

#### 4. Discriminant Power

The discriminating power of the test items was calculated using the following formula (Arikunto, 2021):

$$DP = \frac{2(B_A - B_B)}{N}$$

Description:

$DP$  = discriminating power of questions

$B_A$  = average score of students in the upper group

$B_B$  = average score of students in the lower group

$N$  = number of participants

The distinguishing criteria are as follows:

**Table 4.** Discriminating Power Criteria

No	Criteria	Category
1.	$< DB \leq 0,2$	Less
2.	$0,2 < DB \leq 0,4$	Good Enough
3.	$0,4 < DB \leq 0,7$	Good
4.	$0,7 < DB \leq 1$	Very Good

#### 5. Level of Difficulty

The discriminating power of the test items was calculated using the following formula (Arikunto, 2021):

$$P = \frac{B}{J_s}$$

Description:

$P$  = difficulty index

$B$  = number of participants who answered correctly

$J_s$  = total number of participants

The difficulty level criteria are as follows:

**Table 5.** Criteria Level of Difficulty

No	Index	Category
1.	$P < 0,30$	Difficult
2.	$0,30 \leq P \leq 0,70$	Moderate
3.	$P > 0,70$	Easy

## RESULT AND DISCUSSION

This development research produced an assessment instrument in the form of multiple-choice questions designed to measure junior high school students' digital literacy skills. The material used in the instrument concerned substances and their changes. This study followed the Borg and Gall development framework, which was modified into eight stages: problem analysis, planning, product design, product validation, product revision, small-group testing, product revision, and large-group testing. The researchers did not reach the final stages of product revision and dissemination due to time constraints and the focus of the development process. The following describes the results of the modified Borg and Gall development stages.

### 1. Problem Analysis

Problem analysis was conducted through literature review and field observations at Argopuro 1 Panti Junior High School to obtain information and identify existing problems. The literature review was carried out to collect information from previous studies, including articles and journals, in order to strengthen the foundation of the research. Several issues were identified, particularly the use of assessment instruments that were still inadequate for assessing students' abilities fairly and accurately, as well as the limited availability of questions specifically designed to measure digital literacy skills. In addition, the topic of substances and their changes was selected because it requires more creative learning strategies. Therefore, the use of the Zep Quiz application was considered a potential tool to increase student engagement, especially by integrating the context of ecoprint batik, which utilizes local resources in the form of leaves as natural dyes. This stage served as the initial step for developing an instrument to assess junior high school students' digital literacy skills using Zep Quiz media in the context of ecoprint batik.

### 2. Planning

The product planning process began with collecting information about the needs that could support product development. The development of the test items was based on an analysis of the Grade VII science textbook used in the Independent Curriculum. The questions were designed to include digital literacy indicators as well as indicators of learning outcomes and learning objectives, and were also related to the local potential of ecoprint batik. The material used focused on substances and their changes. The small-group test was conducted in class VII A, while the large-group test was conducted in classes VII A, VII B, and VII C. A total of 50 multiple-choice questions were developed for the small-group test. The valid items obtained from this stage were then used in the large-group test, which consisted of 22 multiple-choice questions delivered through the Zep Quiz platform to measure the expected learning outcomes.

### 3. Product Design

The product design stage was the initial stage of developing the assessment instrument used in this research. The design process resulted in products in the form of question grids and assessment rubrics. The question grid consisted of learning indicators, digital literacy indicators, question indicators, cognitive domains, and question types. Meanwhile, the assessment rubric included the questions, answer keys, scoring criteria, and completion time. The design of the digital literacy assessment instrument using Zep Quiz in the context of ecoprint batik is illustrated in Figures 1-3.

44.		Menyelesaikan dan merefleksikan informasi yang telah diketahui sebelumnya	Disajikan kalimat eksperimen, peserta didik dapat menyimpulkan penyebab perubahan massa jenis yang terjadi	C6	Pilihan Ganda
45.	Siswa dapat mendeskripsikan perubahan wujud zat	Menelola dan menyampaikan informasi yang telah dibaca sebelumnya	Disajikan pertanyaan mengenai zat yang digunakan dalam proses pembuatan ecoprint, peserta didik dapat menyebutkan contoh dari zat	C1	Pilihan Ganda
46.	Siswa dapat mendeskripsikan perubahan wujud zat	Menelola dan menyampaikan informasi yang telah dibaca sebelumnya	Disajikan pertanyaan mengenai zat pelarut dalam proses ecoprint, peserta didik dapat menyebutkan contoh larutan zat	C1	Pilihan Ganda
47.	Siswa dapat mengidentifikasi perubahan zat sebagai perubahan fisika dan kimia	Mengidentifikasi informasi penting dari teks untuk menemukan informasi yang relevan	Disajikan pernyataan mengenai peristiwa sehari-hari mengenai perubahan fisika dan kimia, peserta didik dapat menganalisis perubahan fisika atau kimia yang terjadi dalam peristiwa tersebut	C4	Pilihan Ganda
48.	Siswa dapat mengidentifikasi perubahan zat sebagai perubahan fisika dan kimia	Menyelesaikan dan merefleksikan informasi yang telah diketahui sebelumnya	Disajikan salah satu peristiwa dalam membuat ecoprint, peserta didik dapat menentukan perubahan apa yang terjadi dalam proses tersebut	C3	Pilihan Ganda
49.	Siswa dapat mengidentifikasi perubahan zat sebagai perubahan fisika dan kimia	Menevaluasi informasi dari sumber digital yang baik dan benar	Disajikan link video proses membuat ecoprint menggunakan Teknik pukul, peserta didik dapat menganalisis perubahan fisika atau kimia dalam proses tersebut	C4	Pilihan Ganda
50.	Siswa dapat mengidentifikasi perubahan zat sebagai perubahan fisika dan kimia	Menyelesaikan dan merefleksikan informasi yang telah diketahui sebelumnya	Disajikan pernyataan Teknik dalam membuat ecoprint, peserta didik dapat	C5	Pilihan Ganda

Figure 1. Assessment Rubric Design Display

11.	Silahkan peserta didik mengamati video berikut ini sebelum menjawab soal: <a href="#">Video Air Rendaman Daun dan Bung Ecoprint</a> Dalam proses pembuatan ecoprint, larutan pewarna alami seperti air rendaman daun atau bunga sering digunakan untuk menghasilkan motif pada kain. Ketika larutan tersebut dituangkan ke dalam berbagai wadah, bentuknya akan berubah mengikuti bentuk wadah, namun volumenya tetap. Berdasarkan hal tersebut, bagaimana anda menjelaskan sifat zat cair yang dimanfaatkan dalam proses ecoprint tersebut? a. Zat cair bentuk dan volumenya selalu berubah b. Zat cair volumenya tetap karena partikel-partikelnya diam dan tidak bergerak c. Zat cair volumenya tetap meskipun bentuknya berubah karena partikel dapat bergerak bebas d. Zat cair bentuknya tetap karena partikel tersusun sangat rapat dan tidak dapat berpindah	c. Zat cair volumenya tetap meskipun bentuknya berubah karena partikel dapat bergerak bebas	2	2 menit
12.	Seorang siswa memanaskan es batu dalam gelas ukur. Beberapa menit kemudian, es mencair dan volume air bertambah. Berdasarkan sifat partikel zat, bagaimana analisis anda terhadap perubahan tersebut? a. Es mencair tanpa perubahan susunan partikel b. Es mencair, partikel menjadi lebih rapat dan volume berkurang c. Es mencair, partikel menjadi lebih bebas dan volume bertambah d. Es mencair, partikel tetap diam di tempatnya	c. Es mencair, partikel menjadi lebih bebas dan volume bertambah	2	2 menit
13.	Peserta didik dianjurkan untuk mengamati video berikut ini: <a href="#">Video Proses Pengukusan Kain Ecoprint</a> Dalam proses pembuatan ecoprint, setelah kain diberi larutan pewarna alami dan dibungkus rapat, kain kemudian dikukus dalam suhu tinggi. Ketika proses pengukusan selesai dan kain dikeluarkan, serine terlihat uap menempel dan membentuk tetesan air pada permukaan logam penutup. Bagaimana konsep perubahan wujud zat dapat diterapkan untuk menjelaskan peristiwa tersebut? a. Uap air menyublim menjadi cair karena suhu tinggi b. Uap air menguap menjadi gas karena logam dingin c. Uap air mengalami kondensasi menjadi cair karena suhu logam lebih rendah d. Air mendidih dan langsung membeku karena proses pendinginan	c. Uap air mengalami kondensasi menjadi cair karena suhu logam lebih rendah	2	2 menit

Figure 2. Question Grid Design Display



Figure 3. Design Display on the Zep Quiz Website

#### 4. Product Validation

The initial design of the instrument was first validated by experts before being tested on students to ensure its validity. The digital literacy instrument was validated by three validators consisting of two science lecturers with expertise in the subject matter and one science teacher. The results of the expert validation are presented in Table 6:

Tabel 6. Result of Expert Validation

Question Number	Categori
1, 5, 14, 21, 25, 36, 37.	Valid
2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 15, 16, 17, 18, 19, 20, 22, 23, 24, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50.	Very valid

Based on the validation results, 7 items were categorized as valid and 43 items were categorized as highly valid. Therefore, the digital literacy assessment instrument was considered suitable for implementation. However, revisions were still made according to suggestions provided by the validators before proceeding to the testing stage.

## 5. Product Revision

The validated product was revised by improving the design based on the input and suggestions provided by the validators. The researchers corrected several weaknesses and errors found in the instrument. Revisions included shortening questions that were considered too long and adjusting the cognitive domains of several items so that they were consistent with the indicators and question statements. These revisions were carried out to ensure that the instrument was clearer and more appropriate for testing. The revisions made based on the validators' recommendations are presented in Table 7.

**Table 7.** Product Revision

Revised Questions	Before Revision	After Revision
1, 2, 3, 9, 14, 23	There are questions with explanations that are long-winded or too long	Shorten the sentence even more so that it is easier to understand
4, 19, 21, 27, 29	There are several questions whose cognitive domain is not in line with the indicators and sentences in the questions	Revise by adjusting the cognitive domain of questions and indicators

## 6. Small Group Test

The small-group trial involved 20 students from class VII A at Argopuro 1 Panti Junior High School. The digital literacy assessment instrument consisted of 50 multiple-choice questions that had been validated by experts. The results of this trial were analyzed to determine item validity, reliability, level of difficulty, and discriminating power.

**Table 8.** Validity Results of Small Group Test Items

Question Number	Categori	Total
1, 2, 4, 5, 10, 12, 13, 14, 16, 17, 18, 19, 21, 26, 28, 30, 32, 34, 35, 36, 38, 39, 41, 45, 47, 48, 49, 50	Not Valid	28
3, 6, 7, 8, 9, 11, 15, 20, 22, 23, 24, 25, 27, 29, 31, 33, 37, 40, 42, 43, 44, 46	Valid	22

The results of the item validity test showed that 22 items were valid because the calculated Pearson correlation coefficient was higher than the table value. Meanwhile, 28 items were declared invalid because the calculated  $r$  value was lower than the  $r$  table value. Valid items could be reused in the next testing stage, while invalid items were removed if they could not be improved. These findings are consistent with the study by Ambarwati & Ismiyati (2021), which states that valid items can be reused in the next trial stage, while invalid items should be discarded if they cannot be revised.

The reliability test was calculated using Cronbach's Alpha with the help of SPSS. The reliability coefficient obtained was 0.884, which is categorized as very high because it falls within the range of  $0.80 < r \leq 1.00$ . Therefore, the instrument was considered reliable.

**Table 9.** Small Group Test Reliability Results

Question Type	Reliability	Categori
Multiple Choice	0.884	Very Reliabel

**Table 10.** Small Group Test Discrimination Power Results

Question Number	Categori	Total
5, 10, 14, 18, 19, 21, 32, 35, 36, 38, 39, 41, 45, 47, 49, 50	Poor	16
1, 4, 8, 13, 15, 17, 26, 28, 30, 34, 48	Fair	11
2, 3, 6, 11, 12, 16, 22, 24, 29, 40, 44	Good	11
7, 9, 20, 23, 25, 27, 31, 33, 37, 42, 43, 46	Excellent	12

The discrimination index analysis showed that 12 items had excellent discriminating power, 11 items had good discriminating power, 11 items had fair discriminating power, and 16 items had poor discriminating power.

**Table 11.** Small Group Test Difficulty Level Results

Question Number	Categori	Total
4, 6, 8, 10, 14, 18, 19, 20, 21, 22, 25, 26, 28, 32, 36, 40, 41, 42, 47, 48	Easy	20
1, 2, 3, 5, 7, 9, 11, 12, 13, 15, 16, 17, 23, 24, 27, 29, 30, 31, 33, 34, 35, 37, 38, 39, 44, 45, 46, 49, 50	Moderate	29
43	Difficult	1

The analysis of the difficulty level indicated that 20 items were categorized as easy, 29 items were categorized as moderate, and 1 item was categorized as difficult. These results indicated that the distribution of difficulty levels was not yet proportional.

## 7. Product Revision

After analyzing the results of the small-group test, the instrument was revised by eliminating invalid items. A total of 28 items were categorized as invalid and therefore were not used in the large-group test. This revision process aimed to improve the quality of the remaining items so that they would have better validity, discrimination power, and appropriate difficulty levels.

## 8. Large Group Test

The large-group test involved 52 students from three classes: VII A, VII B, and VII C. This test was conducted after the product had undergone revisions based on the small-group test results.

**Table 12.** Validity Results of Large Group Test Items

No.	Pearson Correlation	Sig. (2 tailed)	Criteria	No.	Pearson Correlation	Sig. (2 tailed)	Criteria
1	0,289	0,037	Valid	12	0,324	0,019	Valid
2	0,388	0,004	Valid	13	0,299	0,031	Valid
3	0,328	0,018	Valid	14	0,367	0,007	Valid
4	0,437	0,001	Valid	15	0,332	0,016	Valid
5	0,301	0,030	Valid	16	0,348	0,012	Valid
6	0,363	0,008	Valid	17	0,319	0,021	Valid
7	0,294	0,034	Valid	18	0,311	0,025	Valid
8	0,319	0,021	Valid	19	0,302	0,029	Valid
9	0,363	0,008	Valid	20	0,294	0,034	Valid
10	0,344	0,012	Valid	21	0,439	0,001	Valid
11	0,340	0,014	Valid	22	0,314	0,023	Valid

The validity analysis showed that all 22 items had Pearson correlation values greater than the r table value, indicating that all items were valid. Item validity was tested using the point biserial correlation technique, which measures the relationship between each item score and the total test score.

**Table 13.** Large Group Test Reliability Results

Question Type	Reliability	Categori
Multiple Choice	0,622	Reliable

The reliability test produced a Cronbach's Alpha value of 0.622, which falls within the reliable category. Therefore, the digital literacy assessment instrument was considered reliable.

**Table 14.** Results of Large Group Test Discrimination Power

No	Distinguishing power	Description	No.	Distinguishing power	Description
1	0,21	Enough	12	0,64	Good
2	0,36	Enough	13	0,21	Enough
3	0,21	Enough	14	0,36	Enough
4	0,43	Good	15	0,36	Enough
5	0,29	Enough	16	0,36	Enough
6	0,50	Good	17	0,36	Enough
7	0,29	Enough	18	0,43	Good
8	0,36	Enough	19	0,21	Enough
9	0,29	Enough	20	0,21	Enough
10	0,36	Enough	21	0,57	Good
11	0,36	Enough	22	0,36	Enough

The discrimination index analysis showed that five items had good discriminating power, while seventeen items had sufficient discriminating power. This indicates that the instrument was able to differentiate between students with different levels of ability.

**Table 15.** Large Group Test Difficulty Level Results

No.	Difficulty Level	Description	No.	Difficulty Level	Description
1	0,92	Easy	12	0,62	Moderate
2	0,67	Moderate	13	0,29	Difficult
3	0,85	Easy	14	0,25	Difficult
4	0,25	Difficult	15	0,27	Difficult
5	0,90	Easy	16	0,48	Moderate
6	0,67	Moderate	17	0,65	Moderate
7	0,85	Easy	18	0,67	Moderate
8	0,65	Moderate	19	0,63	Moderate
9	0,90	Easy	20	0,65	Moderate
10	0,65	Moderate	21	0,67	Moderate
11	0,63	Moderate	22	0,81	Easy

The difficulty level analysis showed that 6 items (27%) were categorized as easy, 12 items (54%) were categorized as moderate, and 4 items (18%) were categorized as difficult. Although the distribution was not perfectly balanced, it was still considered acceptable for use. Ideally, a good test instrument should have a balanced distribution of item difficulty, commonly following a 2-6-2 ratio (20% easy, 60% moderate, and 20% difficult).

The results of this development research indicate that the digital literacy assessment instrument developed using the Zep Quiz platform is valid and reliable for measuring junior high school students' digital literacy skills in science learning. The development process followed the modified Borg and Gall model, which ensures that educational products are systematically designed, tested, and refined through several stages. According to Borg and Gall, research and development methods are widely used in educational research to produce effective and validated learning products through iterative testing and revision processes. Therefore, the use of this model in the present study ensured that the developed instrument underwent a rigorous validation and testing process before implementation.

The results of the expert validation showed that most of the items were categorized as highly valid, while several items were categorized as valid. This indicates that the instrument has good content validity, meaning that the items are appropriate for measuring students' digital literacy skills and are aligned with the learning objectives. According to Ramadhan et al., (2024), content validity refers to the extent to which an instrument represents the entire domain of the construct being measured. In this study, the involvement of experts consisting of science lecturers and teachers helped ensure that the developed items were relevant, accurate, and suitable for junior high school students.

The results of the small-group test revealed that out of 50 multiple-choice questions, 22 items were valid, while 28 items were invalid. Invalid items were removed during the revision stage before proceeding to the large-group test. This process is essential in instrument development because it helps eliminate items that do not effectively measure the intended construct. According to Arikunto (2021), item validity analysis is necessary to determine whether each test item can accurately measure the competencies that the test intends to assess. Therefore, the removal of invalid items helps improve the overall quality of the instrument.

In addition, the reliability test in the small-group stage produced a Cronbach's Alpha value of 0.884, which falls into the very high reliability category. Reliability refers to the consistency of an instrument in measuring a particular construct. According to Sugiyono (2016), an instrument is considered reliable if it produces consistent results when used repeatedly under similar conditions. The high reliability value obtained in this study indicates that the developed instrument has strong internal consistency and can produce stable measurement results.

The discriminating power analysis also plays an important role in determining the quality of test items. The results of the small-group test showed that several items had excellent, good, and sufficient discriminating power. According to Sugiyono (2016), the discrimination index indicates the ability of a test item to differentiate between students with high ability and those with low ability. Items with good discrimination power are considered effective because they can clearly distinguish students' levels of understanding.

Furthermore, the difficulty level analysis showed that most items were categorized as moderate, while some were categorized as easy, and only one item was categorized as difficult. According to Nitko & Brookhart (2011), a good test instrument should include items with varying levels of difficulty to accurately measure students' abilities. Ideally, the distribution of difficulty levels follows a balanced composition, commonly referred to as the 2-6-2 proportion, which consists of 20% easy items, 60% moderate items, and 20% difficult items.

After the revision stage, the instrument was tested again in a large-group test involving 52 students. The validity analysis showed that all 22 items were valid, indicating that the revision process successfully improved the quality of the instrument. In addition, the reliability test in the large-group stage produced a Cronbach's Alpha value of 0.622, which is categorized as reliable. According to Hair et al. (2019), a reliability coefficient above 0.60 is generally considered acceptable for educational research instruments.

The results of the discriminating power analysis in the large-group test showed that several items had good discriminating power, while the remaining items had sufficient discriminating power. This indicates that the instrument is capable of distinguishing students with different levels of digital literacy skills. According to Sugiyono (2016), test items with adequate discrimination indices are effective in identifying differences in students' levels of mastery.

The integration of the Zep Quiz platform in the assessment process also supports the development of digital literacy skills. Digital learning platforms can enhance student engagement and provide interactive learning experiences. According to Law et al. (2018), digital literacy refers to the ability to understand and use information from various digital sources effectively. In the context of education, digital literacy also involves the ability to access, analyze, evaluate, and create information using digital technologies.

Furthermore, the integration of the ecoprint batik context in the instrument contributes to contextual learning. Contextual learning connects learning materials with real-life situations so

that students can better understand the concepts being studied. According to Sari et al. (2023), contextual teaching and learning helps students construct knowledge by linking academic concepts with real-world applications. In this study, the use of ecoprint batik as a local cultural context allows students to understand scientific concepts related to substances and their changes while also appreciating local wisdom.

Overall, the findings of this study indicate that the developed instrument meets the essential criteria of a good assessment instrument, including validity, reliability, discriminating power, and appropriate difficulty levels. Therefore, the instrument can be used as an alternative assessment tool for measuring students' digital literacy skills in science learning, particularly when integrating digital media such as Zep Quiz.

## CONCLUSION

Based on the results of this study, it can be concluded that the development of a digital literacy assessment instrument using the Zep Quiz platform in the context of ecoprint batik learning has successfully produced a valid and reliable instrument for measuring junior high school students' digital literacy skills in science learning. The development process followed the modified Borg and Gall model, which involved several stages, including problem analysis, planning, product design, product validation, small-group testing, product revision, and large-group testing. The results of expert validation indicated that the majority of the developed items were categorized as highly valid, demonstrating that the instrument has good content validity and is appropriate for assessing students' digital literacy skills. The results of the small-group test showed that 22 out of 50 items were valid and were subsequently used in the large-group test. The reliability analysis showed a Cronbach's Alpha value of 0.884 in the small-group test and 0.622 in the large-group test, indicating that the instrument has acceptable reliability and can consistently measure students' digital literacy abilities.

Furthermore, the analysis of discriminating power and difficulty levels showed that the developed instrument has the ability to distinguish between students with different levels of ability and includes items with varying levels of difficulty. The integration of the Zep Quiz platform also supports the development of digital literacy skills by providing an interactive digital assessment environment. In addition, the integration of the ecoprint batik context contributes to contextual science learning by connecting scientific concepts with local cultural practices. Therefore, the digital literacy assessment instrument developed in this study can be used as an alternative assessment tool for evaluating junior high school students' digital literacy skills in science learning. Future research is recommended to further develop and test similar instruments on a larger scale and in different learning contexts in order to improve the effectiveness of digital literacy assessment in education.

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