

Development of Class V Literacy and Numeration Questions Based on ESD on The Theme The Environment is Our Friend at SDN 2 Kuta

Dyah Indraswati*

Education of primary school teachers, University of Mataram, Indonesia

Khairun Nisa

Education of primary school teachers, University of Mataram, Indonesia

Hikmah Ramdhani Putri

Education of primary school teachers, University of Mataram, Indonesia

Aisa Nikmah Rahmatih

Education of primary school teachers, University of Mataram, Indonesia

Ilham Syahrul Jiwandono

Education of primary school teachers, University of Mataram, Indonesia

*Correspondence author: dyahindraswati@unram.ac.id

Abstract:

This research is motivated by the idea that the implementation of Education for Sustainable Development (ESD)-based learning can be a solution for teachers to instill awareness of the importance of preserving the environment. The purpose of this study was to produce test questions based on ESD literacy and numeracy based on the environmental theme of our friends, the sub-theme of humans and the environment. The research method used is Design Based Research (DBR) with the Reeves Model stages. The design of the test questions of 30 multiple choice questions was validated by 2 teachers. The validation results were then used as a guideline for revising which was then continued with trials on fifth grade students at SDN 1 Kuta. The results of the data analysis showed that based on the different test with Ms Excel, there were 2 questions that were rejected, 11 questions that were accepted and 17 questions that needed to be revised. Based on the results of the analysis of the level of difficulty, there are 3 questions in the easy category, 6 questions in the difficult category and 21 questions in the medium category. Based on the results of the validity analysis of the 30 questions tested, 15 questions were declared valid and 15 questions were declared invalid. Furthermore, valid questions were used as evaluation questions for fifth grade students at SDN 2 Kuta.

Keywords: Education for Development (ESD); Literacy; Numeracy

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Introduction

Sustainable Education for Development (ESD) is education that empowers students to be responsible for making decisions based on the information they obtain in order to always support environmental, economic and societal sustainability for current and future generations, as well as existing cultural diversity (Ardellea & Hamdu, 2022). This is based on environmental problems which have become global issues and are a priority scale to be addressed (Santika et al., 2022). ESD integrates sustainability principles and practices in all aspects of education and learning to encourage change, knowledge, values, and vision that enable sustainable and fair attitudes (Listiwati, 2011). ESD has four thrusts, including: (1) access and retention based on quality education; (2) reorientation of existing education for sustainable development; (3) increasing public awareness of sustainability; (4) establishing training for all sectors (Laurie, Nonoyama-Tarumi, Mckeown, & Hopkins, 2016). In 2002, the United Nations declared 2005–2014 as the decade for Sustainable Education for Development (ESD) and highlighted the differences between environmental education and ESD.

Environmental education is an established discipline, which focuses on the relationship between humans and the natural environment and ways to conserve and manage its resources well (Prima & Lestari, 2018; Sholeh et al., 2021). ESD covers the basis of education but places it in a broader socio-cultural context, there are social and political factors and issues of equality, poverty, democracy, and quality of life. According to the UN, ESD equally addresses the three pillars of sustainable development of society, environment, and economy with culture as an additional important and underlying dimension (Rohmah et al., 2014). By embracing these elements in a holistic and integrated manner, ESD enables all individuals to fully develop the knowledge, perspectives, values, and skills necessary to take part in decisions to improve the quality of life both locally and globally that are most relevant to their daily lives. (Tare, 2020). Indonesia is a developing country that makes literacy competency a program that is implemented on an ongoing basis (Supriyati & Muqorobin, 2021). The implementation of the 2013 curriculum also contains literacy competencies with 6 basic literacy aspects, namely reading and writing literacy, numeracy literacy, scientific literacy, financial literacy, digital literacy, and cultural literacy (Ekowati, Astuti, Utami, Mukhlisina, & Suwandayani, 2019). Literacy and numeracy skills enable students to think rationally, systematically, critically, in solving problems and making decisions (Lamada, Rahman, & Herawati, 2020).

Based on the 2018 PISA results, the literacy and numeracy abilities of students in Indonesia are in the very low category. Students are used to carrying out learning through procedural skills such as reading but not understanding the meaning, and calculating only using formulas (Amin, Ibrahim, & Hartatik, 2021). The results of the Program for International Student Assessment (PISA) survey in 2018 placed Indonesia in 74th place, or sixth from the bottom. The three basic competencies surveyed by PISA include science, mathematics and reading competencies. In the Mathematics category, Indonesia is ranked seventh from the bottom (Mahmud & Pratiwi, 2019). The low ability of students to solve numeracy questions on the PISA test is influenced by: 1) Students are not used to solving numeracy questions in a HOTS context which requires the ability to reason, think creatively and be reflective; 2) Students consider mathematics to be a difficult subject and tend to avoid it. This psychological factor also influences success in learning; 3) Students have difficulty understanding the question text, making representations, and developing problem solving strategies (Rahmawati, 2021).

In learning, students need to get used to acquiring knowledge, attitudes, and values of sustainable development (Simanjuntak, 2017). Education for sustainable

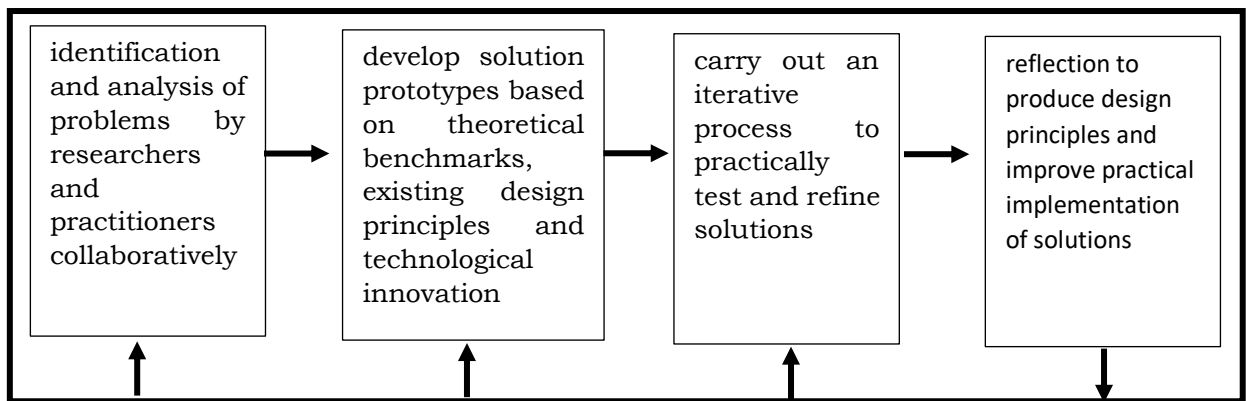
development (ESD) is an important aspect of supporting the Sustainable Development Goals (SDGs) program (Hák et al., 2016). The ability to interpret problems in everyday life is closely related to assessment through literacy and numeracy test questions (Stacey & Turner, 2015). The problem found by researchers in the field is that the majority of the test questions used do not familiarize themselves with literacy and numeracy-oriented learning. Most teachers also do not know the context of ESD, so there are not many ESD-based learning tools such as test questions that contain indicators of the importance of contributions to sustainable living, or interpreting phenomena on the impact of sustainable living. In this research, researchers will develop ESD-based literacy and numeracy questions. The material contained in the Environmental Theme Our Friends was chosen to develop ESD-based literacy and numeracy questions for class V students at SDN 2 Kuta. The material on this theme teaches students to care for the environment, build character through caring for the environment, instill attitudes and actions in preventing environmental damage. The material on this theme is very relevant to ESD.

Assessment using numeracy literacy test questions is believed to be able to develop students' high-level problem-solving skills (Ardellea & Hamdu, 2022). However, teachers at school have not been able to create appropriate questions. Learning from an ESD perspective trains students to ask critical questions, assess norms or their actions that will impact the future and learn to predict a more positive future with the aim of sustainable development (Marwa & Hamdu, 2021). The 2013 curriculum implemented in Indonesia does not explicitly explain the concept of ESD, but it implicitly leads to the concept of sustainable development which is oriented towards human resource development in accordance with the demands of sustainable development goals. Thus, with the implementation of ESD it is hoped that it will be able to increase human competence to create a sustainable life which is implemented in the form of real action (Ardellea & Hamdu, 2022). ESD is a dynamic concept through education that has noble values for the realization of a sustainable future (Susilawati et al., 2019).

There are three main perspectives in ESD, namely socio-cultural, environmental, and economic perspectives. Education as an approach used in ESD means the role of the teacher and the learning process within it is very important (Indrati & Hariadi, 2016). Research conducted by Rakhmayani & Hamdu (2021) shows that ESD-based learning is not yet conceptually understood but implementation in the field has been realized. The level of ability of elementary school teachers in developing ESD-based test questions is also still low and requires guidance. The novelty of this research compared to previous research is that this research seeks to develop ESD questions based on literacy and numeracy, so the questions will be packaged with contextual narratives based on real data that occurs in the field and adapting to the theme taken, namely our environment.

Research Method

This research uses a design-based research method or Design Based Research (DBR) with a form of development which aims to design and develop literacy and numeracy questions based on the focus of the research carried out. This research develops literacy and numeracy questions by designing, developing, and evaluating products. This research uses the Revees model procedure:



Picture 1. Reeves Design Based Research Model Diagram

1. Identification and analysis of problems by researchers and practitioners collaboratively

At this stage the researcher identifies and analyzes various problems through literature study.

2. Develop solution prototypes based on theoretical benchmarks, existing design principles and technological innovation

Researchers designed literacy and numeracy test questions for fifth grade elementary school students related to the theme Our Friendly Environment by paying attention to the rules for preparing questions with the aim of measuring ESD-based literacy and numeracy skills as a sustainable development effort in facing global issues through HOTS type questions. The test questions developed will be consulted with pedagogical experts and educational practitioners in group discussion forums (FGD), then researchers will make improvements according to the expert team's input.

3. Carry out an iterative process to practically test and refine solutions

After researchers design and develop the product, the next stage is testing, to find out whether the product being developed is suitable or not. After the trial, the questions will be analyzed using item analysis. If there are still deficiencies, the researcher will revise the test questions developed.

4. Reflection to produce design principles and improve practical implementation of solutions

After repeated trials, the researcher reflected on the results obtained. The final product is ESD-based literacy and numeracy test questions on the theme of Our Friendly Environment. As a step to improve the final product, researchers carried out an FGD with a team of experts.

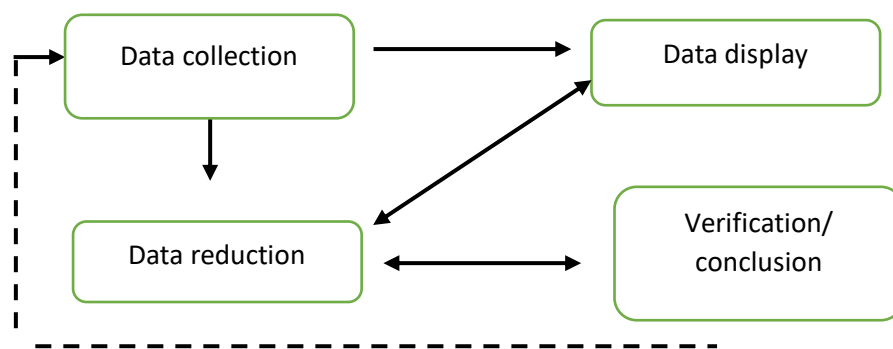
The subjects in this research were fifth grade students at SD Negeri 2 Kuta, Kuta Village, Pujut District, Central Lombok Regency, West Nusa Tenggara Province. The data collection technique carried out by the researcher was an interview with the class V homeroom teacher at SD Negeri 2 Kuta to analyze problems related to student conditions, understanding of assessment in the 2013 curriculum, development of literacy and numeracy test questions, development of expected ESD-based test questions. A documentation study was carried out to determine the extent to which students were able to answer the ESD-based literacy and numeracy test questions that had been developed.

Expert Judgment was carried out to assess the appropriateness of ESD-based literacy and numeracy test questions for class V of Our Friends' Environmental

Theme Elementary School. This validation is needed to determine the strengths and weaknesses of the questions being developed so that they are suitable for testing on students. Interviews were conducted with class V teachers at SD N 1 and 2 Kuta as resource persons. The interview grid includes an understanding of assessment in the 2013 curriculum, an understanding of the development of test questions, the development of ESD-based literacy and numeracy test questions, the environmental theme of our friends, the implementation of processing test results.

A validation sheet is needed to measure the strengths and weaknesses as well as the feasibility of the test questions. The form of multiple-choice questions is an option that will be developed by researchers. The multiple-choice question validation sheet grid includes material, construction, language.

This research uses analysis techniques according to Miles & Huberman with stages:



Picture 2. Miles and Huberman Data Analysis Model

Data Collection was carried out by researchers to collect information through interviews with Class V elementary school teachers at SD Negeri 2 Kuta, product trials, namely numeracy literacy test questions that had been developed. Data Reduction is data that has been collected and collected by researchers, studied, analyzed, and described in a more focused manner according to the research focus. Data Display is the presentation of data in the form of descriptions supported by graphs or tables which will be discussed in a more in-depth discussion. Conclusion is carried out to draw conclusions and verify according to the research focus.

Results and Discussion

1. Identification and analysis of problems by researchers and practitioners collaboratively

Elementary school teachers still have difficulty creating and developing HOTS questions. The teacher's ability to create questions is in the sufficient category, because teachers have difficulty determining differences in the cognitive level of a question (Rakhmayani & Hamdu, 2021). In line with the results of problem identification and analysis by researchers, the problems found by researchers are that the majority of test questions used do not yet familiarize themselves with literacy and numeracy-oriented learning, test questions and assessments do not require students to think at a high level (HOTS), most of the new test questions measure abilities. students think at a low level or Low Order Thinking Skills (LOTS). Most teachers also do not know the context of ESD, so there are not many ESD-based learning tools such as test questions that contain indicators of the importance of contributions to sustainable living, or interpreting phenomena on the impact of sustainable living. In relation to ESD, teachers at

SDN 2 Kuta do not yet know the concept of ESD but indirectly learning with the context of the surrounding environment has been implicitly carried out. Apart from the learning side, the test development carried out is also less accurate and detailed, even though in developing the questions it is necessary to analyze the quality of the test questions starting from the different power, level of difficulty, effectiveness of distractors, and the validity of each item.

2. Develop solution prototypes based on theoretical benchmarks, existing design principles and technological innovation

After identifying and analyzing the problem, the researcher then developed a solution to the problem found, namely the development of ESD-based literacy and numeracy test questions which aimed to measure ESD-based literacy and numeracy skills which were analyzed using the help of Ms. software. Excell. Steps for preparing good questions according to (Umroh et al., 2023) include: 1) analyzing KD; 2) create a question grid; 3) choose contextual stimuli; 4) write the question items according to the question grid; 5) create scoring guidelines.

In this research, the steps in preparing the questions included: 1) determining the level of literacy and numeracy competency based on ESD; 2) mapping KI and KD; 2) determine material based on KD; 3) determine learning objectives and indicators of competency achievement and question indicators; 4) create a grid; 4) create test questions; 5) create an answer key. The evaluation questions developed also need to include literacy and numeracy competencies. Literacy competency will train students to discover, understand, evaluate. and reflect on information. Students' numeracy competencies are expected to be able to understand, apply and reason through calculations and data interpretation.

a. Determining Literacy and Numeracy Competency Levels and ESD Pillars

In designing ESD-based numeracy literacy questions, start by determining literacy and numeracy competencies. The following are literacy and numeracy competencies that are integrated into the ESD concept.

Table 1. Literacy and Numeracy Competencies

Level	Competency
Literacy	Finding information Understanding Evaluating and reflecting
Numeracy	Understanding Application Reasoning

After determining literacy and numeracy competencies, the next step is to determine the components of the ESD pillars, of which in this research there are three ESD pillars used, namely environmental, social and economic.

Table 2. ESD Pillar Components

ESD pillar	Components
Environment	Natural resources Climate change Rural development Sustainable urbanization Disaster prevention and management
Social	Human rights Cultural diversity and understanding
Economy	Poverty reduction

b. Determining Basic Competencies

Researchers took the environmental theme, with the sub-theme of humans and the environment. The basic competency used is KD 3.3 in the PPKN subject content, namely examining the social and cultural diversity of society and KD 3.8 in the science subject content, namely analyzing the water cycle and its impact on events on earth and the survival of living things.

c. Determining Competency Achievement Indicators and Question Indicators

After the researcher determined KD, he then analyzed the competency achievement indicators which were developed into question indicators.

Table 3. Indicators of Competence Achievement

No.	Subjects	Indicators of Competence Achievement	Question Indicator
1.	PPKN (Civic Education)	3.3.1 Examining the social and cultural diversity of society	There are 15 multiple choice questions that contain various social and culturally influenced human actions related to the environment
2.	IPA (Natural Science)	3.8.1 Analyze the water cycle and its impact on events on earth and the survival of living things.	Presented are 15 multiple choice questions containing events on earth, impacts and sustainability of living things.

d. Arranging Question Grids

The next step is to compile a grid of test questions consisting of basic competencies, competency achievement indicators, question indicators, material, ESD pillars, question numbers, question types, literacy and numeracy competencies.

e. Arranging Question Items According to the Question Grid

The type of questions created in this research were multiple choice questions with a total of 30 items.

f. Create an Assessment

There is only 1 correct answer for each question item, so if the student answers correctly they get 1 point and if the student answers wrong they get 0 points for each item. How to find out student grades is done in the following way:

$$\text{Grades} = \frac{\text{Total Point}}{\text{Maximum Point}} \times 100$$

g. Description of Product Validation Stages Test Questions

Validation was carried out by 2 class V teachers from SDN 1 Kuta and SDN 2 Kuta. Based on the validation results, there are still several test questions that need to be improved because the language is still too high for class V students, apart from that it also needs to be adjusted to literacy and numeracy as well as the ESD pillars.

3. Carry out an iterative process to practically test and refine solutions

a. Description of Trial Implementation 1

A trial of ESD-based literacy and numeracy test questions was carried out on Wednesday, July 17 2023 on 36 class V students at SDN 1 Kuta. The questions tested were 30 multiple choice questions. Before the test, students

have received material related to the environmental theme of our friends, the sub-theme of humans and the environment.

b. Description of the Results of Analysis of Question Items Using Microsoft Excel

Good quality tests can be analyzed from four criteria, namely 1) validity, meaning it can measure what it wants to measure; 2) reliability means that the test can show consistent results even though the test has been carried out many times; 3) the level of discriminating power means that the test can differentiate students according to their level of ability; 4) level of difficulty means having a balance between difficult, medium and easy questions (Hanifah, 2014).

1) Differentiator

The differentiator between questions is the difference in the proportion of correct answers between groups of students with high ability and low ability. The question differentiation index has a value of - 1.00 to 1.00, the higher the D value on a question, the better the question is at differentiating students with high abilities from students with low abilities. Questions that have a value of D = 0.40 are considered very effective in distinguishing students with high ability and low ability. Questions that have a D value between 0.20 and 0.39 are considered satisfactory. Questions that have a D value lower than 0.39 must be corrected (Hanifah, 2014).

Table 4. Results of Differentiator Analysis of Questions

No Item	Differentiator						Information	
	Questions	A	B	C	D	Answer Key		
1	0,167	0,000	-2,000	0,364	0,667	C	Fixed	Distraction revision A and D
2	0,333	0,500	0,000	-1,200	0,000	A	Accepted	Distraction revision B and D
3	0,222	-0,500	-2,000	-0,400	0,364	D	Fixed	
4	0,278	-0,667	0,476	2,000	-1,200	B	Accepted	Distraction revision C
5	0,389	-0,182	-0,667	1,077	-1,333	C	Accepted	
6	0,111	-0,667	-0,667	0,154	2,000	C	Fixed	Distraction revision D
7	0,444	-1,333	0,667	-2,000	-0,667	B	Accepted	
8	0,222	-0,400	0,000	-0,286	0,571	D	Fixed	Distraction revision B
9	0,222	-1,333	0,400	-0,667	0,286	B	Fixed	Distraction revision D
10	0,056	-0,857	0,105	-0,667	0,857	B	Fixed	Distraction revision D
11	0,389	-0,667	-0,400	-0,667	1,273	D	Accepted	
12	0,000	0,000	-0,857	0,667	0,667	A	Rejected	
13	0,278	-0,667	-2,000	0,435	0,000	C	Accepted	Distraction revision D
14	0,222	-0,182	1,000	-0,857	-0,222	B	Fixed	
15	0,444	-0,857	-0,667	-1,000	0,800	D	Accepted	
16	0,278	-0,400	-0,400	0,667	0,000	C	Accepted	Distraction revision D
17	0,111	-2,000	-0,667	0,125	0,000	C	Fixed	Distraction revision D

18	0,500	-1,200	-0,545	-2,000	1,059	D	Accepted	
19	0,111	0,133	-2,000	-2,000	0,000	A	Fixed	Distraction revision D
20	0,111	0,000	-1,000	0,200	-2,000	C	Fixed	Distraction revision A
21	-0,056	-0,286	0,000	-0,154	0,500	C	Rejected	Rejected
22	0,056	0,222	0,545	-0,333	-1,000	A	Fixed	Distraction revision B
23	0,278	0,476	-2,000	0,000	-2,000	A	Accepted	Distraction revision C
24	0,278	2,000	-0,286	-1,200	0,588	D	Accepted	Distraction revision A
25	0,056	0,182	0,400	-0,222	-0,182	B	Fixed	Distraction revision A
26	0,167	-2,000	-0,316	0,462	0,667	C	Fixed	Distraction revision D
27	0,056	-0,353	0,286	1,200	-0,286	B	Fixed	Distraction revision C
28	0,167	0,000	-0,400	0,286	-2,000	C	Fixed	Distraction revision A
29	0,056	1,000	-0,333	0,182	-0,222	C	Fixed	Distraction revision A
30	0,111	0,200	-0,571	0,000	2,000	D	Fixed	Distraction revision A and C

Based on the results of processing the questions with Microsoft Excel concluded that 2 questions were rejected, 11 questions were accepted and 17 questions needed to be revised.

2) Difficulty Level

After the differentiating questions are obtained, the next step is to determine the level of difficulty. The level of difficulty is divided into 3 categories, namely difficult, medium and easy questions. The following are the results of data processing on trial questions. Interpretation of the level of difficulty of the questions is 0.00 – 0.30, including the difficult question category, in the interval 0.31 – 0.70, including the medium question category, and in the interval 0.71-1.00, including the easy question category (Susanto et al., 2015).

Table 5. Results of Difficulty Level Analysis

No Item	Difficulty Level	Conclusion
1	0,5833	Medium
2	0,6667	Medium
3	0,6111	Medium
4	0,5833	Medium
5	0,3611	Medium
6	0,7222	Easy
7	0,6667	Medium
8	0,3889	Medium
9	0,5556	Medium
10	0,5278	Medium
11	0,3056	Medium

12	0,5556	Medium
13	0,6389	Medium
14	0,2222	Difficult
15	0,5556	Medium
16	0,4167	Medium
17	0,8889	Easy
18	0,4722	Medium
19	0,8333	Easy
20	0,5556	Medium
21	0,3611	Medium
22	0,2500	Difficult
23	0,5833	Medium
24	0,4722	Medium
25	0,1389	Difficult
26	0,3611	Medium
27	0,1944	Difficult
28	0,5833	Medium
29	0,3056	Medium
30	0,0556	Difficult

Based on the results of the analysis, there are 3 questions in the easy category, 6 questions in the difficult category and 21 questions in the medium category. A question is said to be good if it is in the medium category, meaning it is not too difficult and not too easy, meaning that of the 30 questions that have been made, 21 questions are in the good category.

3) Validity of the Questions

Good evaluation requires tools/instruments that are valid or accurately measure what should be measured. A question item is said to be valid if $r_{count} > r_{table}$ (Riyani et al., 2017). The questions developed are in accordance with basic competencies and indicators and the main questions have been formulated clearly. In this research, the r table is 0.3291.

Table 6. Item Validity

No Item	Calculated r Score	Conclusion
1	0,1743	Invalid
2	0,4166	Invalid
3	0,3429	valid
4	0,3165	valid
5	0,4027	Invalid
6	0,1592	Invalid

7	0,4910	valid
8	0,4052	valid
9	0,4328	valid
10	0,2119	Invalid
11	0,4631	valid
12	0,0800	Invalid
13	0,3127	valid
14	0,3824	Invalid
15	0,5316	valid
16	0,1671	Invalid
17	0,4166	valid
18	0,4765	Invalid
19	0,2541	valid
20	0,2493	Invalid
21	0,1107	Invalid
22	0,1012	Invalid
23	0,4161	valid
24	0,3922	valid
25	0,0591	Invalid
26	0,1691	Invalid
27	-0,1934	Invalid
28	0,1885	valid
29	0,2652	valid
30	0,4644	valid
	Total Valid	15
	Total Invalid	15

Based on the results of the analysis of the 30 questions tested, 15 questions were declared valid and 15 questions were declared invalid. Furthermore, valid questions can be used as evaluation questions for class V students at SDN 2 Kuta. Researchers ensure that valid questions must be able to represent each indicator and include literacy and numeracy skills. This research carried out 1 x trial and can be used as a valid evaluation tool.

4. Reflection to produce design principles and improve practical implementation of solutions

The environmental-themed ESD-based literacy and numeracy test product has been improved twice based on validation results and trial results.

ESD is placed at the core of the sustainable development agenda and has been widely recognized as a key factor in sustainable development and an integral element of quality education (Waltner et al., 2018). Quality education can be achieved from planning, implementing, and evaluating learning in schools (Rusman, 2015). In line with efforts to support ESD-based learning, this research seeks to develop a valid evaluation tool in the form of ESD-based literacy and numeracy questions which can later be used by teachers to test students' literacy and numeracy skills and measure sustainability awareness.

Conclusion

The initial design for developing ESD-based literacy and numeracy test questions was prepared based on the question preparation steps, namely 1) determining the level of ESD-based literacy and numeracy competency; 2) mapping KI and KD; 2) determine material based on KD; 3) determine learning objectives and indicators of competency achievement and question indicators; 4) create a grid; 4) create test questions; 5) create an answer key. The final form of the ESD-based literacy and numeracy test questions are questions that have undergone two revisions or improvements based on expert team validation and analysis of the test questions using Ms Excel software. The test questions developed help teachers test literacy and numeracy skills and have been integrated with the ESD context so that students have concern for environmental, social, and economic preservation. Based on the results of the analysis of the 30 questions tested, 15 questions were declared valid and 15 questions were declared invalid. Furthermore, valid questions can be used as evaluation questions for class V students at SDN 2 Kuta. Researchers ensure that valid questions must be able to represent each indicator and include literacy and numeracy skills. This research carried out 1 x trial and can be used as a valid evaluation tool.

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