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E-Module Based on Blended Learning Type Flipped Classroom on Climate Change Materials to Train Students' Digital Literacy Ability

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ABSTRACT

Objective: E-modules are teaching materials integrated with technological advances using digital applications that are more attractive to students. One of the problems in learning science is the low ability of students' digital literacy. Efforts to increase digital literacy skills include using an e-module based on a flipped classroom type of blended learning. This study aims to describe the validity of teaching materials consisting of syllabi, lesson plans, student worksheets, blended learning-based flipped classroom-type e-modules on climate change material, digital literacy ability questionnaires, and knowledge test instruments. **Method:** The method used in this research is limited to the validity of teaching materials. The developed teaching materials were tested on students of class VII JHS. Data collection was carried out using the validation method, and data analysis was carried out quantitatively. **Results:** The results of the data analysis concluded that the syllabus was in the very valid category, the lesson plans were in the valid category, the e-module was in the valid category, the student worksheets were in the valid category, the digital literacy ability questionnaire sheet was in the valid category, and the knowledge test instrument was in the valid category. **Novelty:** Flipped classroom-based blended learning-based e-modules can be used as an alternative to electronic modules in learning to improve students' digital literacy skills. This e-module can be used for varied learning both online and offline so that students are expected to gain learning experiences that can later be used to solve problems encountered in real life.

INTRODUCTION

Technological progress is one of the supporting factors in the student learning process. Sukmawati (2018) argued that the application of technology in learning has an impact on improving the quality of learning and changing the learning process to be more effective and practical and can increase knowledge and skills for educators and students in utilizing technology in the learning process both in the classroom as well as outside the classroom. Print modules are rarely in demand by students; they prefer to view material via cellphones rather than printed books or printed modules. Therefore, e-modules are teaching materials integrated with technological advances using digital applications that are more attractive to students—based on the research results of Rahayu et al. (2020) demonstrated the effectiveness of using e-modules based on blended learning based on an increase in learning outcomes and able to train students in independent learning.

Blended learning is an alternative to learning activities that utilize digital technology. Blended learning embodies learning methods that eliminate the barriers of place, situation, and time and allows for high-quality interactions between teachers and students while implementing long-distance learning practices that emphasize the flexibility of students' time, place, and learning speed (Prayitno, 2015). One type of blended learning model is the flipped classroom. The blended learning model of the

flipped classroom type divides independent study sessions and face-to-face sessions with teachers. Based on the research results of Sukayanti et al. (2018) regarding flipped classroom-type blended learning, there is a significant difference between learning outcomes before and after using blended learning, so it can be concluded that flipped classroom-type blended learning improves student learning outcomes.

Learning Natural Sciences in the 2013 curriculum, according to process standards at the JHS/*MTs* level, is carried out on an integrated basis. Science learning is no longer studying physics, biology, and chemistry separately but is being developed as an integrative science subject, combining knowledge, skills, and attitude. Climate change is one of the materials contained in integrated science subjects in class VII JHS. Climate change material is included in Basic Competency 3.9. namely "analyzing climate change and its impact on ecosystems" (Kemendikbud, 2016). Setiawan (2022) suggests that Natural Sciences are closely related to phenomena and events in students' daily lives; therefore, learning science will be more meaningful if there is an association of Science material with relevant natural phenomena in Science learning materials. At this time, digital literacy is needed to participate in this modern world. The results of research by Sutrisna (2020) show that the younger generation already has expertise in accessing digital media. However, this ability still needs to be aligned with the ability to find information to benefit self-development. One's skills in digital literacy also play a role in recognizing, understanding, and using the right application or media to support online learning.

The developments in the last two years cannot be denied as extreme, fast, and rapid changes. The COVID-19 pandemic forces us and the world of education to be familiar with technology and the internet so that learning can still be carried out even though it is done online (Nurkhasanah, 2020). The children are already familiar with the internet, cyberspace, and social media such as Facebook (FB) and WhatsApp (WA). FB and WA are platforms that can make teenagers more expressive; self-existence increases, so teenagers become addicted. According to Suherdi (2021), digital literacy is the knowledge and skills of users in utilizing digital media, such as communication tools, internet networks, and so on. User proficiency in digital literacy includes the ability to find, work on, evaluate, use, create, and utilize it wisely, intelligently, carefully, and precisely according to its use.

Preliminary studies conducted by researchers in class VII *MTs* Nurul Huda Sedati show that the level of students' digital literacy skills on climate change is in a low category, with a percentage of around 22.00%. Overall, the low digital literacy skills of *MTs* Nurul Huda students are due to the learning system, which the teacher still dominates, and the learning methods and models used do not maximize students' active role and thinking potential. The results of these observations are by the research of Nisak et al. (2017), which states that conventional learning models in which teachers apply direct learning are less effective in improving students' thinking processes. Therefore, teachers must use appropriate teaching strategies to achieve learning objectives and create a pleasant teaching and learning atmosphere.

Many studies show that students perceive science as a conceptual lesson that is difficult, abstract, and uninteresting and are of the view that science is an elite discipline that is only suitable for study by very gifted students. To solve this problem, a learning model should be developed in a learning process so that the expected goals can be

achieved optimally, especially in digitalized conditions. From these various opinions, one model that can be used is the blended learning model of the flipped classroom type dividing independent study sessions and face-to-face sessions with teachers.

E-module is feasible if it meets the valid, practical, and effective elements. Learning devices are declared suitable for use if the minimum level of validity reaches a valid category with a minimum of 2.60 (Ratumanan & Laurens, 2014). The device is practical if the implementation of the learning process is at least in the good category, able to deal with the obstacles that arise during the learning process, and student activities during learning are in the implemented category. Based on the research results of Sukayanti et al. (2018), the mathematics e-module developed using the flipped blended learning model is valid and feasible to apply in learning Mathematics.

According to Sa'diyah (2021), other research shows that digital flipbook-based e-modules are included in the valid and feasible category. This research focuses on analyzing the validity of the device used to develop an e-module based on a flipped classroom-based blended learning to train junior high school students' digital literacy skills. In line with the results of research by Nurhayani et al. (2023) showed that the expert team's assessment of the acid-base titration e-module based on blended learning with the kvisoft flipbook maker application based on National Education Standards Agency (NESA) on the content feasibility aspect had an average percentage value of 86.00%, language feasibility 88.00%, and presentation feasibility analysis 85.00% and concluded that the media is very feasible to use and does not need to be revised. Based on the description, the authors developed science learning in the research title "E-Module Based on Blended Learning Type Flipped Classroom on Climate Change Materials to Train Students' Digital Literacy Ability." This research aimed to produce a feasibility of an e-module based on flipped classroom-type blended learning on climate change material to train students' digital literacy skills. The benefits of this research are expected to be a reference for teachers to utilize e-modules based on flipped classroom-type blended learning to train students' digital literacy skills on climate change material. In addition, using e-modules is expected to create an active, creative, innovative, and effective learning atmosphere to motivate students learning, especially in climate change material.

RESEARCH METHOD

General Background

This type of research is development *research* which refers to the Dick and Carey Model. According to Borg and Gall, what is meant by a research and development model is "a process used to develop and validate an educational product." That development research attempts to develop and validate the products used in the learning process (Purnama, 2016).

Sample / Participants / Group

Implementation of learning device development research at the UNESA Postgraduate Study Program Master of Science Education Study Program and testing of devices at *MTs* Nurul Huda Sedati, which will be held in June 2022. This e-module was tested on a limited number of 24 class VII-1 *MTs* Nurul Huda Sedati students in the even semester of the 2021/2022 academic year.

Instrument and Procedures

The subject of this research is an e-module created using a book creator application based on the blended learning model flipped classroom type on climate change material, learning implementation plans, student worksheets, and learning outcomes assessment sheets. The development design in this study adapted the model from Dick and Carey, which was adapted to the 2013 curriculum. The use of the Dick and Carey model in the development of a subject is intended so that: (a) at the beginning of the learning process, students or students can know and be able to do things matters related to the material at the end of learning, (b) there is a link between each component, especially learning strategies and desired learning outcomes, (c) implementing the steps that need to be taken in planning learning designs (Aji, 2016). The stages of developing this model are presented in Figure 1.

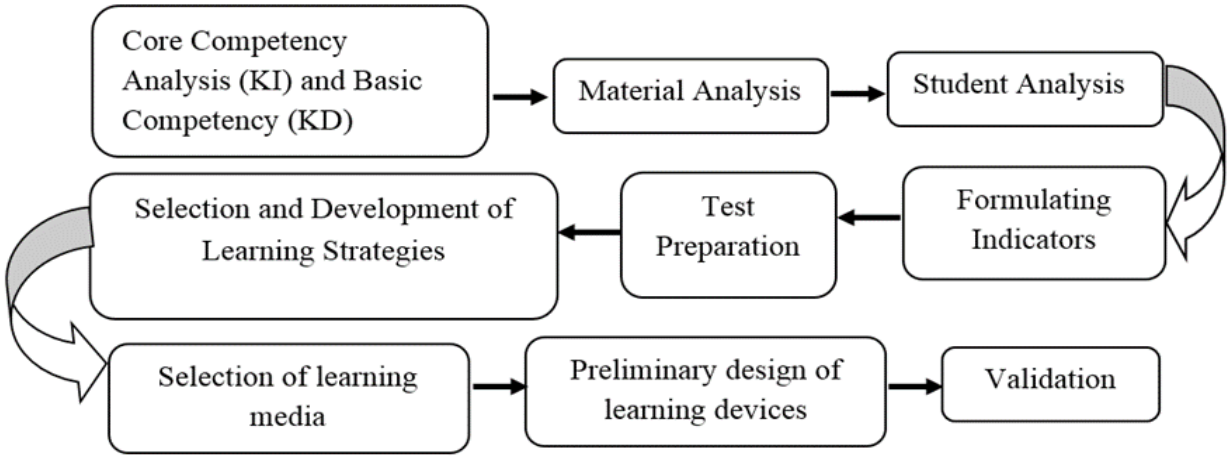

Figure 1. Dick and Carey model e-module development flowchart.

Data Analysis

Data collection techniques are carried out using the validation method. At the same time, the assessment instrument uses a validation sheet. The devices developed are then reviewed by the supervisor and validated by the validator to assess the feasibility of being used as a learning tool. This research is limited to the validity of teaching materials in e-modules using the book creator application, which contains syllabi, lesson plans, worksheets, learning achievement tests, and digital literacy ability questionnaires.

This study uses the passing grade average score (P) from the results of the validators' assessment, then adjusted with the following device assessment criteria in **Table 1**.

Table 1. Criteria for validity assessment results.

Average value	Category
3.60 ≤ X ≤ 4.00	Very Valid
2.60 ≤ X ≤ 3.50	Valid
1.60 ≤ X ≤ 2.50	Less Invalid
1.00 ≤ X ≤ 1.50	Invalid

(Ratumanan & Laurens, 2014)

The instrument's reliability is determined based on the assessment data from the validator. The level of reliability is calculated using the following formula:

$$R = \left(1 - \frac{A - B}{A + B}\right) x\ 100\%$$

Information:
R = Percentage of instrument reliability
A = The average number of scores that are higher than the validator
B = Average number of scores that are lower than the validator
The instrument is said to be reliable if it has a reliable value ≥ 0.75 or 75.00%.

RESULTS AND DISCUSSION

Results

This research produces teaching materials based on blended learning flipped classroom type on climate change material. The learning materials developed include a syllabus, learning implementation plans, e-modules, student worksheets, learning outcomes assessment sheets, and student digital literacy ability questionnaires.

Syllabus Validation

The syllabus that has been developed is validated by three validators. Validation results can be seen in **Table 2**.

Table 2. Syllabus validation results.

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
A	**Contents presented**						
1	Basic competencies	4.00	4.00	4.00	4.00	Very Valid	100.00
2	Selection of teaching materials	4.00	4.00	4.00	4.00	Very Valid	100.00
3	Learning Activities	4.00	4.00	3.00	4.00	Very Valid	86.00
4	Learning Resources/media	4.00	4.00	3.00	4.00	Very Valid	86.00
5	Indicators of Competence Achievement	4.00	3.00	4.00	4.00	Very Valid	86.00
B	**Language**						
6	Use of language according to EYD	4.00	4.00	4.00	4.00	Very Valid	100.00
7	The simplicity of sentence structure	3.00	3.00	4.00	3.00	Valid	86.00
C	**Time**						
8	Appropriateness of the time allocation used	4.00	4.00	3.00	4.00	Very Valid	86.00
9	Selection of time allocation according to basic competence	4.00	3.00	4.00	4.00	Very Valid	86.00
	All Aspect Modes A, B, C					**Very Valid**	**94.00 Reliable**

Validation of Learning Implementation Plans

Lesson plans that have been developed are validated by three validators. Validation results can be seen in **Table 3.**

Table 3. The results of the validity of the lesson plans.

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
A	**Conformity of Purpose, Material, and Media**						
1	Formulation of goals	3.00	4.00	4.00	4.00	Very Valid	86.00
2	Material selection	4.00	4.00	4.00	4.00	Very Valid	100.00
3	Organizing teaching materials	4.00	4.00	3.00	4.00	Very Valid	86.00
4	Selection of learning media	4.00	3.00	4.00	4.00	Very Valid	86.00
B	**Learning Activities**						
5	Activity clarity	3.00	4.00	4.00	4.00	Very Valid	86.00
6	Details of learning scenarios	3.00	4.00	3.00	3.00	Valid	86.00
7	Model fit	4.00	3.00	4.00	4.00	Very Valid	86.00
C	**Instrument Completeness**						
8	Problems according to the learning model	3.00	4.00	3.00	3.00	Valid	86.00
9	There is an answer key	3.00	3.00	3.00	3.00	Valid	100.00
	All Aspect Modes A, B, C					**Very Valid**	**96.00 Reliable**

Information:

V_1 : Validator 1, V_2 : Validator 2, V_3 : Validator 3

E-Module Validation Results

The e-module that has been developed is validated by three validators. Validation results can be seen in **Table 4**.

Table 4. Validity results from e-module.

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
A	**Content Component**						
	Material Coverage						
1	Material breadth	4.00	3.00	3.00	3.00	Valid	86.00
	Material Accuracy						
2	Fact accuracy	4.00	4.00	4.00	4.00	Very Valid	100.00
3	Concept accuracy	3.00	4.00	3.00	3.00	Valid	86.00
4	Theory accuracy	4.00	3.00	3.00	3.00	Valid	86.00
	Up to date						
5	Conformity with the development of science	4.00	4.00	4.00	4.00	Very Valid	100.00
6	Recent	4.00	3.00	3.00	3.00	Valid	86.00
	Stimulate Curiosity	4.00					
7	Cultivate curiosity	4.00	4.00	3.00	4.00	Very Valid	86.00
8	Encouraged to seek further information	4.00	4.00	3.00	4.00	Very Valid	86.00

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
	Develop Life Skills						
9	Develop personal skills	4.00	4.00	3.00	4.00	Very Valid	100.00
10	Develop social skills	3.00	4.00	3.00	3.00	Valid	100.00
11	Develop academic skills	4.00	3	3.00	3.00	Valid	100.00
	Developing Insights						
12	Presents an example	3.00	4.00	4.00	4.00	Very Valid	86.00
B	**Language**						
	The development of students						
13	Appropriateness of the development of students' thinking	4.00	4.00	4.00	4.00	Very Valid	100.00
14	Conformity with the social-emotional development of students	4.00	3.00	4.00	4.00	Very Valid	86.00
	Communicative						
15	Student understanding	3.00	4.004	3.00	3.00	Valid	86.00
16	Conformity of illustration with substance	4.00	3.00	3.00	3.00	Valid	86.00
	Dialogic and interactive						
17	Motivate students to respond to messages	4.00	4.00	3.00	4.00	Very Valid	86.00
18	Encouragement of critical thinking in students	3.00	3.00	3.00	3.00	Valid	100.00
	Straightforward						
19	Accurate sentence structure	3.00	4.00	3.00	3.00	Valid	86.00
20	Terminology	3.00	3.00	4.00	3.00	Valid	86.00
	Coherence and coherence flow of thought						
21	Links between chapters/subchapters/ paragraphs	3.00	3.00	4.00	3.00	Valid	86.00
22	Wholeness of meaning	4.00	3.00	3.00	3.00	Valid	86.00
	Compliance with the correct rules of language						
23	Grammatical accuracy	3.00	3.00	4.00	3.00	Valid	86.00
24	Spelling accuracy	3.00	4.00	3	3.00	Valid	86.00
	Presentation Serving Technique						
25	Consistency of serving	4.00	3.00	3.00	3.00	Valid	86.00

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
	systematics in chapters						
26	Presentation logic	4.00	4.00	3	4.00	Very Valid	86.00
27	Concept confusion	4.00	3.00	3.00	3.00	Valid	86.00
	Support for the presentation of material						
28	The suitability of the illustration with the material	3.00	3.00	4.00	3.00	Valid	86.00
29	Advanced Organizer (A generator of learning motivation)	3.00	4.00	3.00	3.00	Valid	86.00
30	The most recent references/sources for text, tables, figures, and attachments	4.00	3.00	3.00	3.00	Valid	86.00
	Presentation of Learning						
31	Student engagement	4.00	3.00	4.00	4.00	Very Valid	86.00
32	Centered on learners	4.00	4.00	3.00	4.00	Very Valid	86.00
33	Creating interactive communication	4.00	3.00	3.00	3.00	Valid	86.00
34	Conformity with the characteristics of the subjects	4.00	4.00	3.00	4.00	Very Valid	86.00
35	Ability to generate feedback	4.00	3.00	3.00	3.00	Valid	86.00
All Aspect Modes A, B, C						**Valid**	**94.00 Reliable**

Information:
V_1 : Validator 1, V_2 : Validator 2, V_3 : Validator 3

Student Worksheet Validation Results

Student worksheets that have been developed are validated by three validators. Validation results can be seen in **Table 5**.

Table 5. Validity results in student worksheets.

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
A	**Material**						
1	Compatibility with indicators of achievement of learning outcomes	3.00	4.00	3.00	3.00	Valid	86.00
2	Clarity of answers asked	3.00	4.00	3.00	3.00	Valid	86.00
3	Clarity of work instructions	3.00	3.00	4.00	3.00	Valid	86.00
B	**Activity**						
4	Compatibility with indicators	3.00	4.00	3.00	3.00	Valid	86.00

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
5	Benefits to learning	4.00	4.00	4.00	4.00	Very Valid	100.00
6	Readability/clarity of language	4.00	4.00	3.00	4.00	Very Valid	86.00
7	Image/graphic functions, tables /diagrams	4.00	4.00	4.00	4.00	Very Valid	100.00
8	The role of student worksheet	3.00	3.00	3.00	3.00	Valid	100.00
C	**Language**						
9	sentence clarity	4.00	4.00	3.00	4.00	Very Valid	86.00
10	language use	4.00	4.00	4.00	4.00	Very Valid	100.00
11	Use of words known to students	4.00	3.00	3.00	3.00	Valid	86.00
D	**Time**						
12	Rationalize time allocation	4.00	3.00	3.00	3.00	Valid	86.00
	All Aspect Modes A, B, C, D					**Valid**	**89.00 Reliable**

Information:
V_1 : Validator 1, V_2 : Validator 2, V_3 : Validator 3

Digital Literacy Instrument Validation Results
Three validators validate the student digital literacy ability questionnaire sheets developed. Validation results can be seen in **Table 6**.

Table 6. Validity results questionnaire sheet digital literacy ability of students.

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
A	**Instruction**						
1	Instrument instructions are clearly stated	4.00	4.00	3.00	4.00	Very Valid	86.00
2	Score criteria are clearly stated	4.00	4.00	3.00	4.00	Very Valid	86.00
B	**Material Coverage**						
3	The statement points are clearly stated	3.00	4.00	3.00	3.00	Very Valid	86.00
4	Conformity of statements with indicators of student digital literacy	3.00	3.00	4.00	3.00	Valid	86.00
C	**Language**				0		
5	Use language according to good and correct Indonesian rules	3.00	4.00	3.00	3.00	Valid	86.00
6	Formulation of communicative statements	3.00	4.00	4.00	4.00	Very Valid	86.00
7	Use words and sentences that are easy to understand	4.00	3.00	3.00	3.00	Valid	86.00
	All Aspect Modes A, B, C					**Valid**	**86.00 Reliable**

Knowledge Test Instrument Validation Results

Test instrument knowledge that has been developed is validated by three validators. Validation results can be seen in **Table 7**.

Table 7. Knowledge test instrument validation results.

	Assessment Aspects	Rating Score V1	V2	V3	Average	Category	Reliability (%)
A	**Material**						
1	Items according to indicators	3.00	4.00	3.00	4.00	Valid	86.00
2	Fill in the material according to the purpose	3.00	4.00	3.00	3.00	Valid	86.00
3	The contents of the material are asked according to the indicators	3.00	3.00	3.00	3.00	Valid	100.00
B	**Activity**						
4	Items are formulated clearly	3.00	4.00	3.00	3.00	Valid	86.00
5	Statement of firmness	3.00	4.00	4.00	4.00	Very Valid	86.00
6	Discourses, pictures, or graphs work	3.00	4.00	4.00	4.00	Very Valid	86.00
7	Between items are not dependent	4.00	3.00	4.00	4.00	Very Valid	86.00
C	**Language**						
8	Formulation of communicative sentences	4.00	4.00	3.00	4.00	Very Valid	86.00
9	Sentences use the correct language	4.00	4.00	3.00	4.00	Very Valid	86.00
10	The formulation does not give rise to multiple interpretations	3.00	4.00	4.00	4.00	Very Valid	86.00
11	Use common language	4.00	3.00	3.00	3.00	Valid	86.00
	All Aspect Modes A, B, C					**Valid**	**87.00 Reliable**

Discussions

This research produced an e-module based on a blended learning type flipped classroom on climate change material to train students' digital literacy. Apart from e-module, it also produces other devices: syllabi, learning implementation plans, student worksheets, learning outcomes assessment sheets, and student digital literacy ability questionnaires. A syllabus is a set of plans that contain an outline for implementing systematic learning (Yulaelawati, 2014), in line with what was stated by Fadilah (2014) that the syllabus can help an educator find ways to carry out good, effective, and efficient learning so that the specified graduate competencies can be achieved. According to the Minister of Education and Culture of 2016 No. 22, the syllabus is the reference used in compiling a learning framework for each subject matter.

Based on the results of the syllabus validation assessment in **Table 2**, the components assessed in the preparation of the syllabus consist of content, language, and time which

are further broken down into several assessment aspects for each of these components. The overall average category for various validated aspects is very valid, with a reliable level between the three validators of 94.00%. The results of this validation indicate that the developed syllabus can be used as a reference in preparing plans for implementing learning in the classroom. The developed syllabus has revisions to formulating competency achievement indicators adapted to essential competencies and sentence simplification. Several suggestions from the validator have been revised according to suggestions from the validator so that the syllabus is valid and suitable for use as teaching material (Agustin et al., 2022).

A learning implementation plan is a design that describes the learning process and the implementation of learning in achieving basic skills that are applied in content standards and contained in the syllabus. The preparation of the lesson plan used in this study is based on the 2013 curriculum format and adapted to the learning steps based on blended learning flipped classroom using the PBL model (Bernawi & Arifin, 2016). Learning flipped classroom learning combines online and face-to-face learning (Hobri et al., 2021). Online activities are carried out outside the classroom using madrasah e-learning media as a preparation for face-to-face learning conducted in the classroom. Learning in the classroom uses the PBL model. According to Assegaf & Sontani (2016), PBL starts with meaningful real-life problems where students can choose and carry out any investigation inside and outside of school as far as necessary to solve the problem.

Based on **Table 3**, the validated components consist of the instrument's content, activities, and completeness. The average of all aspects assessed is very valid, with an average reliable test between the three validators worth 96.00%. The learning implementation plans that were prepared received several inputs from the assessment instrument adjusted to the learning objectives to be achieved. The learning implementation plan used during the research implementation stage has been revised according to the validator's suggestion. The learning implementation plans developed have revised assessment instruments adapted to the learning objectives to be achieved and revised according to suggestions from the validator. Based on these results, it can be said that the developed lesson plan has good validity with appropriate learning steps, mentions the methods and media used in learning, allows students to be involved optimally, and allocates time for each step (Akbar et al., 2016).

Technological progress is one of the supporting factors in students' learning process. Lately, printed modules have rarely been found because students prefer to view material on their cell phones rather than printed books or printed modules. E-modules were born due to teaching materials integrated with technological capabilities (Balqis & Sunaryo, 2019). This study uses the E-Module using the Book Creator application. According to Fikrah (2022), Book Creator is application software that can be used to make digital teaching materials; the resulting teaching materials are interactive and exciting and can be added with sound, images, videos, and links. The advantages of Book Creator are that it is straightforward for novice teachers, it can be used as online or face-to-face teaching materials, and digital Book Creator teaching materials are easy to distribute by teachers to students (Hashanah, 2021).

Based on **Table 4**, the results of the validation of all aspects of the evaluation of the e-module of students are in the valid category, with an average percentage of agreement of the three validators of 94.00%. This indicates that the developed student e-module is

valid regarding content, language, and presentation. In the validation instrument, the presentation characteristics are included in the format where the mode of the validation criteria is categorized as valid. In addition, e-modules must also be communicative and student-centered oriented (Akbar, 2016). According to Piaget's theory, several principles in teaching can be applied in programs that emphasize: 1) learning through discovery and real experience using tools, materials, and other learning media and 2) the role of the teacher as someone who prepares an environment that allows students to acquire a wide variety of learning experiences. Based on this theory, it is necessary to have learning media prepared by the teacher in the learning process so that students get a learning experience that is appropriate to their era.

According to Hasanah (2021), the advantages of book creation are that it is straightforward to make for novice teachers, it can be used as online or face-to-face teaching materials, and digital book-creator teaching materials are easily distributed by teachers to students. Another advantage of digital books is the features of the digital bookmaker application, which provides interactive learning that can increase students' enthusiasm to learn (Divayana et al., 2016). A student worksheet is a form of stimulus or teacher guidance in sheets containing learning material and concept material for tasks carried out by students as a learning process. According to Agustin et al. (2022), student worksheets have structured directions so that students can complete tasks related to learning objectives. A few things to note in the preparation of student worksheet is the suitability of the material with the characteristics of students, presenting material that is interesting for students, and using clear and straightforward language (Astuti et al., 2019).

Based on **Table 5**, the student worksheet developed in this study has valid criteria in terms of material, activity, and language, with an average compatibility test between the three validators reaching 89.00% — the developed Student Worksheet stage. Through student worksheets, it is expected that students can interpret, analyze, and evaluate the knowledge and skills they have. The Student Worksheets developed are arranged according to the PBL model, which starts with real-life problems related to climate change. PBL encourages students to be active in discussion activities and solve problems given (Asyari et al., 2016).

In addition, the presentation of the developed student worksheet is also interesting, fun, and exciting because the student worksheet is prepared with attention to integrating colors and designs suitable for junior high school students. The grammar used has been adapted to the national language. The sentences used are also per students' level of thinking, do not contain double meanings, instructions, and directions are clearly stated, and the language is communicative. This is shown from the results of most groups' maximum student worksheet work during learning. In line with Prastowo (2015), the clarity of directions and the language used in student worksheets will provide maximum results for student worksheet work. Overall, the student worksheet that has been developed has been improved according to the validator's suggestions so that it can be used in classroom learning. According to Hazmi et al. (2021), Blended Implementation Learning spurs students to increase digital literacy because students participating in learning will be independent and process information independently. Indicators of digital literacy skills consist of (1) creativity, (2) collaboration, (3) effective communication, (4) working according to ethical rules, (5) understanding when and

how technology must be used to achieve goals effectively, (6) critical thinking and evaluation, (7) productive (Kemendikbud, 2017). In this study, students' digital literacy indicators were achieved using a digital literacy ability questionnaire after applying flipped classroom-type blended learning. The indicators measured are use skills, critical thinking, communication, collaboration, and creativity.

Based on the results of the validation assessment of students' digital literacy instruments in Table 6 below, the average rating in the valid category and the average Percentage of agreement of the three validators was 86.00%. Thus the digital literacy assessment instrument that has been developed can be used to assess students' digital literacy after the learning process. Digital literacy provides students with information on learning materials from various sources in an era of rapidly developing technology (Shiyamsyah & Yuliani, 2022). Digital literacy is very important for students because, in the 21st century, there are demands for digital-era proficiency in learning. So students must have digital literacy from an early age in school.

The developed instrument is a knowledge test instrument. Overall the test instruments developed amounted to 10 questions with the type of description questions. Questions can assess students' level of understanding at a higher level; they give freedom to students to choose, prepare, and present ideas in their own words; and description questions can show students' ability to organize thoughts and create ideas, methods, and solutions. The essay test certainly has weaknesses, one of which is that the score can be different when assessed by the same rater at different times or by different raters at the same time. Therefore, scoring guidelines or assessment rubrics must be developed simultaneously for the essay test to have high reliability in determining student scores. Based on **Table 7**, the validation results of the knowledge outcome test instrument are in the valid category, with an average percentage of agreement among the three validators of 87.00%. Aspects validated in this test instrument include material, construction, and language. Overall, the suggestions from the validator kept the questions and the purpose of the questions the same. However, only some questions did not match their cognitive level, and some information needed to be revised. In preparing a description test, the question maker must avoid words that can be interpreted differently. To compile a description test, the active verbs must also be stated clearly and according to the indicators to be achieved. According to Ramadhan et al. (2022), the utilization of existing technology is needed as an effort to improve student achievement. Media presence in learning can also help increase students' understanding, present data or information more exciting and reliable, and facilitate data interpretation and condense information.

CONCLUSION

Fundamental Finding: Based on the research, the e-module based on blended learning type flipped classroom on climate change material to train junior high school students' digital literacy skills is likely appropriate for learning activities. This is because the e-module validation results are valid and very valid. **Implication:** The implications of this research can be used as an alternative to electronic modules in learning to improve students' digital literacy skills. This e-module can be used for various learning, both online and offline, so students are expected to gain learning experience, which can later be used to solve problems encountered in real life. **Limitation:** The limitations of this

research are that the e-modules developed only on a few indicators of digital literacy, namely use skills, critical thinking, communication, collaboration, and creativity, and the applications used are limited to book creator applications. **Future Research:** This e-module can be used or repeated by future researchers to train students' literacy with the same or different indicators using varied and innovative applications. For other researchers who want to research using blended learning-based e-modules of the flipped classroom type, it should be adjusted to student abilities, teacher professionalism, learning media, and infrastructure owned by each school.

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