Jurnal Biolokus: Jurnal Penelitian Pendidikan Biologi dan Biologi
Vol. 7, Issue 2, December 2024
Pages : 237 - 250

p-ISSN: 2621-3702
e-ISSN: 2621-7538

Designing general biology practicum e-modules using canva to enhance science process skills of pre-service teachers

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ABSTRACT

This study aims to produce a valid and feasible practical e-module for used during distance assisted by the Canva application, in order to develop the science process skills of students at STKIP Budidaya Binjai. This research was a R&D study using the ADDIE development model, which includes the stages of analysis, design, initial product development, implementation, and evaluation. The instruments used in this research were feasibility test questionnaires which were distributed to expert validators to validate the products that had been developed and product quality instruments which were distributed to students to determine the quality of the products being developed. After the validity test and product quality test have been measured, the product is revised according to the input provided during the trial stage and then ready to be published. The results of the feasibility test showed that this e-module received a score of 89%, categorized as very feasible. The results from the student response questionnaire indicated of 90%, categorized as very good. The results of the test indicate that the e-module for biology practicum using the canva application on students' science process skills is deemed valid and suitable for use in the science practicum learning process for students at STKIP Budidaya. The implication of this research is that using this e-module can make the learning process more interactive, there is an e-module practicum guide makes it possible to prepare students to face real experiences, too savings in equipment procurement and maintenance costs, location flexibility, learning and practice time.

Keywords: Biology practicum, canva, e-module, science process skills

INTRODUCTION

The science learning process tends to emphasize providing direct experiences to develop competencies and foster thinking skills. Science process skills are described as physical skills for problem-solving which begins with mental processes in the form of thinking (Harlen & Özgelen in Senisum, 2022). The formation of a scientific attitude, as demonstrated by scientists, can be developed through Science Process Skills (SPS). Science Process Skills (SPS) are essential in modern education as they empower students to develop critical thinking, problem-solving, and scientific inquiry abilities. Recent studies emphasize the effectiveness of various teaching models in fostering SPS through hands-on and inquiry-based activities.

The main issue in the implementation of science practicum lies in the lack of optimization in the learning process. Practicum activities are often carried out merely as a formality without genuinely focusing on developing scientific process skills, material comprehension, and scientific attitudes. Moreover, the limitations of laboratory

facilities also pose significant obstacles, while virtual laboratories, which could serve as an alternative solution, are not yet utilized optimally. As a result, the objectives of practicum-based learning are not achieved effectively, and students miss the opportunity to gain meaningful learning experiences and acquire the necessary skills.

Science process skills can be used as an approach in learning. In fostering science process skills in students, a treatment is applied such as conducting simple experiments during the learning process so that students can construct their own understanding.

Key issues to address include how SPS-based e-modules can help students construct understanding through direct experiences, the challenges of integrating SPS into an experiment-based curriculum, and systematic evaluation methods to measure their success. These efforts are vital for not only enhancing students' conceptual understanding but also fostering deeper scientific attitudes essential for 21st-century education.

The process skills approach is very important to apply because it has several advantages, including the fact that students are directly involved with real objects, which can facilitate their understanding of the subject matter. Students discover the concepts they are learning on their own, train themselves to think more critically, learn to ask questions and engage more actively in learning, encourage them to find new concepts, and provide opportunities for students to learn using scientific methods (Azis & Yulkifli, 2021).

In the era of globalization, science education should be able to foster a fundamental scientific attitude that possesses the ability to think scientifically in order to solve individual problems and societal issues, so that individuals can become valuable human resources demonstrated by a scientific literacy attitude. One of the keys to facing the challenges of the 21st century is science literacy, which is the individual's ability to understand and apply scientific concepts in real life (Kimianti & Prasetyo, 2020).

In the cognitive domain, practical work benefits students by aiding their understanding of the material taught in class. In the affective domain, practical work can train students' scientific attitudes. In the realm of psychomotor skills, practical training can enhance students' abilities to use tools and materials correctly. Anita (2022) explains that practical activities are actually conducted as an effort to provide real experiences to students in implementing theoretical studies and to validate existing theories, with the aim of making practical work an integral part of science.

The virtual world is a realm created by digital illusions to provide a sense of time and space filled with phenomena that have a connection to "reality." The phenomena or "things" that make up the content of the virtual world are imitations of reality, representations of what is real and ideal. With Thus, a virtual laboratory can be defined as a space or building in the digital world that can be used for scientific research, experiments, and tests, providing a sense of time and location that feels real and genuine. A virtual laboratory is a practice space in the digital world or a social space where scientists interact in the virtual realm (Afsas et al., 2023). The relationship between virtual laboratories and e-modules are two different learning media, but both can be used to support the learning process. Virtual laboratories can be used as an alternative to practical work if they cannot be carried out directly in the laboratory. in activities with the help of the e-module developed can help this process.

According to Budhu in Nana (2020), the similarity of tool characteristics in virtual

laboratories allows students to explore without needing to go to a physical lab, thus facilitating learning transfer, expanding the range of testing, and enabling the application of previously acquired knowledge. Virtual laboratories are a medium used to help understand a subject matter and can overcome the limitations or absence of laboratory equipment (Nirwana in Zaturrahmi, Festiyed, & Ellizar, 2020). Meanwhile, another definition of a virtual laboratory according to Chin in Páez-Avilés et al. (2018) is a computer-based medium that contains simulations of activities to illustrate reactions that may not be visible in real-life situations. On the other hand, a virtual laboratory is a simulation or experiment conducted on a computer to present natural phenomena that play an important role in the science learning process. Similarly, Sitepu (2019) states that, in principle, the effective use of audiovisual media can assist the teaching and learning process by capturing students' attention to engage more in the lessons. According to Pane (2024), the virtual laboratory is described as a form of interactive multimedia learning media, where the virtual laboratory is defined as a type of interactive multimedia object.

The reality in the field is that in science practical activities in this activity, namely biology practicum activities, which hold significant importance in learning, are still not optimal. Where the instructor conducting the practicum only carries it out without informing the students of the learning objectives to be achieved, the assessment provided by the instructor is not fully understood by the students regarding what will be evaluated, especially concerning the three aspects involved. Additionally, the criteria or assessment rubric used by the teacher for the students has not been implemented transparently and objectively. Textbooks are one of the supporting elements of the teaching and learning process. Based on the research by Nuraningsih & Suchyadi (2024), it is found that the low scientific process skills (SPS) of students are due to the insufficient development of teaching materials designed to enhance these skills. The main factor contributing to the low SPS of students is that the modules used are sourced from textbooks that do not train scientific process skills.

The textbook contains the material that will be provided to the students. A good textbook is one that meets content standards and refers to the competencies that students are expected to achieve. In addition to textbooks, students also need a practical guide so that when they engage in practical work, they can first study the material that will be practiced. As a book, the preparation of the practical guide must pay attention to several aspects, namely: the content of the book, the organization of the book, the clarity of sentences and the level of readability, as well as the physical appearance of the book (Doyan, Susilawati, & Hardiyansyah, 2021).

The availability of teaching materials can assist teachers in designing lessons and help students master the learning material. Teaching materials are a compilation of learning materials sourced from various learning resources that are well-organized. In order to create effective teaching materials, teachers must be able to understand the elements contained within those materials. The development of the teaching materials used can influence students' science literacy skills, as to this day, the materials used are still in the form of printed materials such as teacher's guides and student books (Harefa & Manurung, 2023). The e-module, which is based on science process skills, focuses on the direct involvement of students in understanding concepts (Suryani, 2022).

One of the learning materials that aligns with the development of science and technology is the electronic module or e-module. The use of e-modules tailored to the learning approach employed in education will assist in achieving learning objectives.

Electronic modules also represent a form of self-study material that is systematically organized into the smallest learning units to achieve specific learning goals, presented in an electronic format (Azis & Yulkifli, 2021; Mardiah, 2023) also state that e-modules have advantages over printed modules, including that e-modules make learning more interactive, while printed modules consist only of material and images.

This is also noted by Puspitasari (2019), who mentions that with e-modules, the learning process does not depend on space and time, especially if the e-module has been designed for individual use. Yulkifli, Yohandri, & Azis (2022) provide a different opinion, stating that unlike regular modules, this digital e-module not only contains material in the form of Word or PDF, but can also display videos and animations that allow users to learn more actively.

The Canva application greatly facilitates educators in designing learning media, thereby simplifying the technology-based learning process, skills, creativity, and other benefits. This is due to the fact that designs created using Canva can enhance the appeal of teaching materials, making students more interested in the materials produced (Irkhamni et al., 2021). The development and use of e-modules bring about changes in the process of skill activities that are usually conducted directly in the laboratory, making them more effective and efficient. The novelty in this research lies in the presence of an e-module practical guide, which prepares students to face real experiences, as well as saving costs on procurement and maintenance of equipment, providing flexibility in location, and learning and practice time (Muhajarah & Sulthon, 2020).

The novelty in developing this practicum e-modules that make it possible to increasing science process skills in laboratory experiments, motivating and enrich students' experiences and develop skills activities experiment in carrying out experiments. Moreover, there are many advantages to using e-modules android-based practicums include virtual laboratories equipped with tools and materials to carry out simulations or experiments like in a real laboratory, very practical, that is, you can used anywhere, does not depend on data networks. This also presents opportunities and challenges for virtual laboratories as an overview of a pedagogical framework.

The development of Android-based e-modules for practicum shows significant potential in enhancing students' science process skills through interactive and practical virtual laboratory experiences. A 2020 study highlights the effectiveness of Android-based virtual laboratories in chemistry education, particularly on reaction rate topics, demonstrating a significant improvement in students' analytical skills through problem-based learning approaches (Muchson et al., 2020). Similarly, research by Wijaya et al. (2021) found that Android-based virtual laboratories not only enhance students' understanding of complex scientific concepts but also provide an engaging and flexible learning environment that supports independent learning. Furthermore, a study by Rahmawati and Nugroho (2022) indicated that the use of virtual labs in science education increased students' motivation and engagement, ultimately improving their problem-solving abilities and conceptual understanding.

Research by Purnama and Dewi (2021) also supports these findings, showing that virtual laboratories in physics education fostered greater collaboration among students and improved their critical thinking skills. In addition, research by Sari and Marjohan (2020) emphasized that virtual laboratories equipped with Android-based e-modules led to better practical skills and a deeper understanding of experimental procedures. These studies indicate that the integration of technology into education, specifically through virtual laboratories, plays a key role in improving students' science process skills, motivation, and overall academic performance.

METHOD

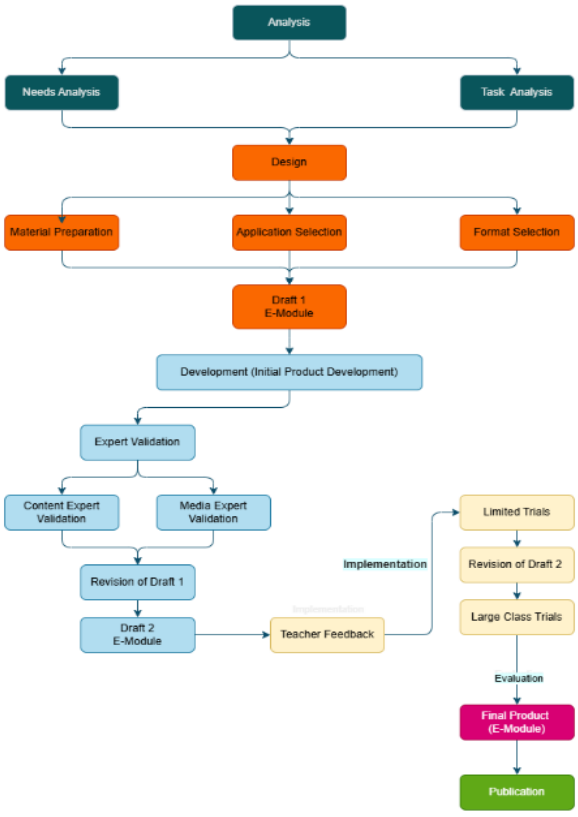

Figure. 1. ADDIE development model

This research is a research and development (R&D) study using the ADDIE development model (Sugiyono., 2020) with stages of analysis (data and information collection), design (product planning), initial product development, implementation (initial field trials), and evaluation (Figure 1). The reason researchers use the ADDIE Model is because it has a structured and consistent approach that can increase development efficiency and quality. Moreover, it can be used in a variety of industries, disciplines, and learning environments.

The subject of the research here is second-year students of the mathematics education study program. The practicum material presented in this practicum Emodule is General Biology Practicum material. With Sub-Main Materials: 1. Microscope, 2. Cell Observation, 3. Blood Types, and 4. Photosynthesis and Respiration.

This research subject was chosen because it makes it easier for researchers to conduct research in the study program considering that the researcher is also a teacher in the study program. Meanwhile, the biology course was chosen because to measure process skills, the appropriate course for this measurement is a science course, in this case cell biology, as well as making it easier for researchers to teach using this material. Meanwhile, the object of this research is the practical e-module, which will be validated by 2 material validators and 2 media experts, as well as feedback from instructors.

Data collection instruments

The main instrument used to collect data in this research is a questionnaire. The questionnaires needed are as follows: (1) a 19 questionnaire for assessment or feedback from subject matter experts; (2) a 10 questionnaire for assessment or feedback from media experts; and (3) a 16 questionnaire for assessment or feedback from students.

Data analysis techniques

The assessment of this EModule product consists of descriptive data through questionnaire evaluations, small group trial assessments, and large group trial assessments using a Likert scale. With the category of very good answers (VG) receiving a score of 4; Good (G) a score of 3; Fair (F) receiving a score of 2; and Poor (P) receiving a score of 1. Then the data is analyzed using descriptive statistics (average score and percentage), which involves calculating the percentage of indicators.

$$\text{PSC} = \frac{\text{total score obtained}}{\text{total ideal score}} x100\ \%$$

Note:
PSC = Percentage Sustainable Score

Using the formula above will result in calculations expressed as percentages. The score classification is then converted into a classification in percentage form (Sugiyono, 2020). Next, it is interpreted with qualitative sentences listed in Table 1.

Table 1. Percentage of criteria suitability of indicators

Score	Percentage Interval	Criteria
A	81% ≤X ≤100%	Very Good
B	61% ≤ x ≤ 80%	Good
C	41% ≤ x ≤ 60%	Average
D	21% ≤ x ≤ 40%	Not Good
E	0% ≤ x ≤ 20%	Very Not Good

(Source: Sugiyono, 2020)

The focus of this research is only measuring the validity (feasibility) and quality of the product, the product being made only focuses on these two things in terms of process skills material. However, if this research requires data to measure product effectiveness in terms of process skills, further research can be carried out later. Meanwhile, the calculation of the feasibility level in the e-module is as in Table 2.

Table 2. Criteria for instrument feasibility

Feasibility Level	Value	Score
Not Feasible	1	< 65%
Less Feasible	2	65% - 74%
Feasible	3	75% - 84%
Very feasible	4	85% - 100%

(Source: Sugiyono, 2020)

RESULTS AND DISCUSSION

The following are the results and discussion on the general biology practicum e-modules using canva to enhance pre-service students' science process skills for mathematics education students STKIP Budidaya Binjai:

Analysis

The analysis stage is the initial phase carried out by the researcher. In this early stage, the researcher analyzes the needs and problems occurring in the field. At this stage, it is inseparable from the initial observation activities, which aim to understand the activities carried out during the science practical learning process. During the field observation, it was found that the lecturer had never used a practical module; practical work had only been conducted through direct instruction, and students did not have their own practical guidelines.

The Emodule product development process took 3 months, starting from needs analysis to field trials. Based on the findings in the field, students really need this practicum Emodule because it can be accessed easily anywhere using a cellphone, its use is more practical, and it can help students carry out practicums because each stage is presented in a more interesting way. When studying, this Emodule can be accessed independently using a cellphone or can also be presented using infocus which is facilitated by the campus.

Design

After analyzing the needs and issues that arose, the researcher concluded that lecturers require practical guidelines in the form of an engaging online module (e-module) so that students can access this e-module anywhere and anytime, even when practical assignments are carried out at home. Therefore, the researcher developed a Science Practical E-Module using an application that can be accessed via mobile phones, making it easier for both lecturers and students to use. The application chosen by the researcher to develop the biology practicum practical e-module is Canva.

At this stage, the researcher designs the product that will be developed. The activities carried out by the researchers in this stage are:

a. Downloading the Canva application from a phone or laptop and logging in through a Google account.
b. Selecting materials that are appropriate for what will be taught in class. The practicum material presented in this practicum Emodule is general biology practicum material. With Sub-Main Materials: 1. Microscope, 2. Cell Observation, 3. Blood Types, and 4. Photosynthesis and Respiration.
c. Compiling the content of the E-Module, including an opening statement, learning outcomes, sub-learning outcomes, images or animations that are relevant to the science practical material, and others.
d. Choosing a template and design for the learning display that is suitable through the Canva application.
e. After the process of creating the biology practicum E-Module is complete, it can be displayed offline in the form of images, or in the download section, there will be a menu link that can be copied or shared.

Development

Digital modules designed interactively can significantly improve students' science process skills, especially in biology learning, as they support more effective self-paced learning (Saputra et al., 2021). Sofyan et al. (2019) demonstrated that the development of interactive E-Modules in biology learning can help improve students' critical thinking skills through the presentation of more engaging materials.

The development stage is the phase where the product design, which is still conceptual, is realized into a product that is ready for implementation.

The steps are :

Product creation

The product consists of a biology practicum practical E-Module that includes a front cover, Course Learning Outcomes, and Sub Course Learning Outcomes containing practical material, exercises or practical assignments, and a back cover. The practicum material presented in this practicum Emodule is General Biology Practicum material. With Sub-Main Materials: 1. Microscope, 2. Cell Observation, 3. Blood Types, and 4. Photosynthesis and Respiration.

Figure 2. Front and back cover

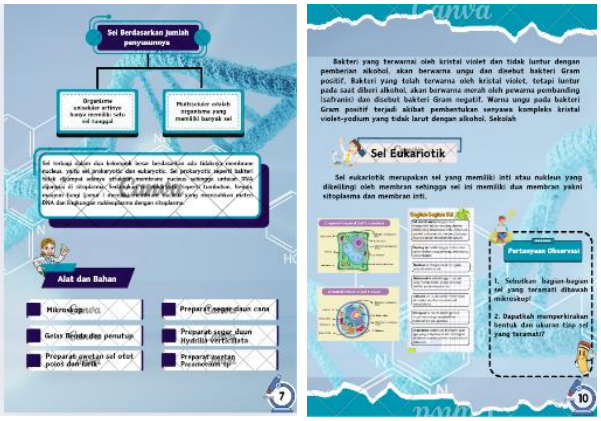

Figure 3. Contents page

Figure 4. Page of practical guidelines and assignments

Product evaluation

Assessment of the science practicum E-Module through the validity aspect. This validation was made to assess the science practicum E-Module that had been created by the researcher. At this stage, each validator is asked to fill out a questionnaire that has been given previously to assess the E-Module that the researcher has designed. This science practicum e-module was tested by experts who are experienced in their field. Material validators and media validators consist of 4 people who have qualifications in accordance with their fields.

a. Material expert validation

The results of the assessment by material expert validators are displayed in Table 3.

Table 3 Material expert validation results

Aspects assessed	%	Criteria
1. The suitability of the task material with CPMK and SubCPMK	85	Very Feasible
2. Discussion and Writing Instrument	88	Very Feasible
3. Accuracy of Material	83	Very Feasible
4. Supporting Material	88	Very Feasible
Average	83	Very Feasible

Based on the accumulated scores from the 2 validators (2 material validators) for each aspect assessed, a percentage result of 83% was obtained in the very feasible category. From these results it can be concluded that the biology practicum E-Module using the Canva application is very feasible and can be used without revision.

b. Media expert validation

The results of the validity assessment on the media aspect are presented in the following table 4:

Table 4. Media expert validation results

	Aspects assessed	%	Criteria
1.	eModul presentation technique	94	Very Feasible
2.	Language and Writing eModule	87	Very Feasible
3.	Presentation of eModules	100	Very Feasible
4.	Completeness	100	Very Feasible
	Average	95	Very Feasible

Based on the accumulated scores from the 2 validators (2 media experts), a percentage score of 95% was obtained in the very feasible category. This means that the biology practicum e-module using the Canva application is very feasible and can be used without revision. Based on the validation results, it shows that the biology practicum E-Module using the Canva application to develop student process skills is very suitable for field trials provided that it carries out slight

revisions.

In enhancing science process skills through interactive simulations that closely resemble real laboratory experiences, this study emphasizes the importance of product validation by media and material experts to ensure the quality of the developed e-modules (Darmaji et al., 2019).

Implementation

The results of validation by expert validators are used as a reference for revising the biology practicum E-Module. E-Modules that have been validated by media expert validators and material experts are declared feasible. The next step is to test them on students in a limited trial 1 time include revision and then a large group trial 1 time include revisi. The results of this trial will later be analyzed as an assessment of the quality of the biology practicum E-Module with the Canva application on students' science process skills and also provide responses in the form of questions to improve understanding.

Evaluation

To measure the level of success of the developed product, an evaluation is conducted at this stage. The evaluation of the developed E-Module involves data collection through the analysis of a questionnaire containing student responses as an assessment of the developed E-Module. In this research, there is a product quality test where the results can see the success of the product being developed.

The purpose of collecting data through this questionnaire is to obtain information from students by having them fill out the questionnaire prepared by the researcher. The purpose is to evaluate the quality of the E-Module based on the responses and feedback from the students regarding the E-Module created by the researcher.

Based on the accumulated scores obtained from the student response questionnaire, a score of 90% was achieved. Thus, it can be concluded that the developed E-Module meets the criteria of being very good. This indicates that the developed E-Module has very high quality, as reflected in the feasibility questionnaire responses. Based on these results, this research meets the necessary requirements to be used as material for the biology Practicum E-Module using the Canva application on students' process skills. This is confirmed by the feasibility test results, which indicate that this E-Module received a score of 89%, categorized as very feasible. In addition, the results of the student response survey assessment also show a percentage of 90% with very good criteria.

Overall, the validation results indicate that the biology Practicum E-Module Using the Canva Application for Students' Science Process Skills is suitable for use in the biology practicum learning process for students at STKIP Budidaya. Based on the research by Mayasri (2024), it explains that the E-module can be accessed anytime and anywhere, allowing students to learn independently and without being limited by location or time. The E-Module serves as an alternative teaching material that can enhance knowledge about the subjects being studied in a sequential and systematic learning activity (Sidik & Kartika, 2020). A systematic arrangement can facilitate students' understanding of the lesson material, thereby assisting in the process of achieving learning objectives (Fardiana et al., 2022; Hasanah et al., 2021).

E-modules created with Canva can enhance the effectiveness of the learning process in a more interactive and engaging way, thereby improving students' process skills. According to Afni (2019), animation can be used to capture the attention of learners when

used appropriately, and the cognitive learning process of students can be aided by animation, whereas without animation, the cognitive process cannot be carried out. Students with a low educational background and knowledge tend to require assistance, one of which is animation, to grasp the concepts being conveyed.

The Canva application, which is fully integrated into one module, helps teachers in teaching and hones their skills in utilizing IT in response to the demands of educational development and the current curriculum requirements. This is part of teachers' ability to develop learning skills in the 21st century (Sahil, 2023). Additionally, Puspita (2021) also explained in her research that the presence of e-modules for basic chemistry practicals can enhance students' knowledge regarding the implementation of practicals in the laboratory, even though it cannot fully replace hands-on practicals. This is in line with (Nuraningsih & Suchyadi, 2024) that electronic modules or e-modules are innovative learning media that can enhance students' interest in learning. The development of e-modules using Canva can be utilized in thematic learning as it adds a technological touch in the form of moving images, colorful text, animations, and the ability to include evaluation links and educational video links. This can enhance students' motivation to learn.

Canva-based e-modules can enhance students' science literacy in a more interactive and visual way, making it easier for them to understand complex scientific concepts. This is in line with the opinion of (Dari & Nasih, 2020) that e-modules are ICT-based modules. E-modules have their own advantages compared to printed modules; they are interactive, making it easier to display or include images, audio, video, and animations, and are equipped with formative tests or quizzes that can provide feedback to assist users.

E-modules have their own advantages compared to printed modules; they are interactive, making it easier to display or include images, audio, video, and animations, and are equipped with formative tests or quizzes that can provide feedback to assist users. Next, in the research by Kurniawati (2021) it is explained in the findings that a teacher must train young people in basic knowledge and equip students with critical and creative thinking. The competency-based curriculum for science learning aims to provide learning experiences to understand scientific concepts, scientific process skills, and solve everyday problems, highlighting the need for the use of e-modules in learning to improve learning outcomes.

Meanwhile, (Herdiana, 2021) wrote in her research that the development of inquiry-based e-modules in science, utilizing local potential learning resources, is necessary for enhancing science process skills. As many as 93% expressed the need and agreement for the development of electronic modules (e-modules) to support learning. The development of e-modules is expected to facilitate students' understanding of learning materials and also to foster or even enhance students' science process skills. Education must participate in the development of science and technology. Therefore, a lot of innovations based on scientific thinking are needed so that individuals with science process skills can emerge to meet the challenges of the society 5.0 era.

Thus, the development of biology practical e-modules using the Canva application can help enhance students' process skills in various effective and interactive ways. The feasibility of the E-Module based on aspects of content, presentation, and language can be

useful for helping students learn independently (Hasanah et al., 2021; Rofidah et al., 2020). The results of the E-Module's feasibility also indicate that the developed E-Module is easy for students to understand because it is easily accessible and includes clearly organized usage instructions (Adi & Sujana, 2021).

The Canva-based e-modules have proven effective in enhancing student engagement and skills through interactive multimedia content, including videos, infographics, and case-based exercises that promote critical thinking. Additionally, these e-modules support the development of 21st-century skills, such as creativity, critical thinking, communication, and collaboration (Kurniawan et al., 2024; Suputra et al., 2024).

CONCLUSION

From the development and discussion results in this research, an e-module for science practicals was produced using the Canva application for the process skills of STKIP Budidaya students. The limitations of this research lie in that the focus of this research only measures the validity (feasibility) and quality of the product, the product being made only focuses on these two things in terms of process skills material. The feasibility test results indicate that this e-module received a score of 89%, categorized as very feasible. The assessment results from the student response questionnaire show a percentage of 90%, categorized as very good. Therefore, overall, the validation results indicate that the E-Module for biology Practicals Using the Canva Application for Student Science Process Skills is valid and suitable for use in the biology practical learning process for students at STKIP Budidaya.

The implication of this research is that using this e-module can make the learning process more interactive, there is an e-module practicum guide makes it possible to prepare students to face real experiences, too savings in equipment procurement and maintenance costs, location flexibility, learning and practice time. This research suggests is requires data to measure product effectiveness in terms of process skills, further research can be carried out later.

ACKNOWLEDGMENTS

This research is supported and funded by a grant from the Directorate of Research and Community Service (DRTPM) of the Ministry of Education, Culture, Research, and Technology of the Republic of Indonesia. We would like to express our gratitude to the Chairman of STKIP Budidaya and the Head of the Mathematics Education Study Program at STKIP Budidaya for their encouragement and valuable contributions throughout the research and writing process of this journal. Without the extraordinary support and cooperation from all parties, this achievement would not have been realized.

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