Vol 12(2) (2023): 111-122
DOI: http://dx.doi.org/10.24235/sc.educatia.v12i2.13586

SCIENTIAE EDUCATIA: JURNAL PENDIDIKAN SAINS

https://www.syekhnurjati.ac.id/jurnal/index.php/sceducatia

Development of Cucurbitaceae family-based e-module in Kudus Regency for learning Spermatophyta

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article info

Article history:
Received: 05 April 2023
Received in revised form: 20 May 2023
Accepted: 01 June 2023
Available online: 30 December 2023

Keywords:
Cucurbitaceae family
Spermatophyta
Local potential
Electronic module
Digital learning

abstract

This study aims to 1) determine the validity of the e-module based on the Cucurbitaceae family in the Spermatophyta Class X IPA sub-material. 2) Knowing students' responses as a result of the practicality test on the Cucurbitaceae Family-Based e-module on the Spermatophyta Class X IPA sub-material. This research and development uses a model adopted from the Branch, namely ADDIE, which consists of the Analyze, Design, Development, Implementation, and Evaluation stages. This research was conducted at MA NU Raudlatus Shibyan Peganjaran Bae Kudus. This study used three material expert validators, three media expert validators, and one Biology educator. A limited-scale trial was carried out on all members of class X, totaling 28 people. The results showed that for the validation test by material experts, a score percentage of 91.85% was included in the very valid category, media experts 94.42% were in the very valid category, and Biology educators 78.7% were included in the valid category. The results of the e-module trial for students obtained a score with an average percentage of 78.5%, which was in the feasible category. The local potential-based e-module can be used in the learning process.

1. Introduction

Education is a very important component in improving superior human resources. The most important factor in an education is the learning process. Where in this learning process, educators and students are required to realize the objectives of a learning process, namely students' understanding of the material presented. Therefore, educators must be more creative in teaching so that students are able to master the material presented comprehensively. Teachers do not just provide information, but must build knowledge (Alexander, 2022). Learning must also be effective, because in addition to the material delivered on time, students also get memorable experiences (Lancaster, 2022; Wahid & Fikri, 2022). The knowledge and experience students gain from biology teachers can be used as a means of restoring a balanced relationship with nature (van der Klink, 2023).

The knowledge gained is not only from the ability to think of students, but educational facilities must also support it. The ability of students to master the material is inseparable from the quality of the learning process, supporting facilities and infrastructure and the ability of educators to teach

so that students can easily understand the material. Good mastery of learning material by students will make the foundation for receiving and mastering further material. That is why in the teaching and learning process there must be a meaningful impression not only increasing cognitive abilities but also increasing the skills of students. As a result, an interesting learning process makes a separate experience for students which makes the material taught by educators more lasting and not quickly forgotten (Choiriyati, 2018; Spencer, 2020). Learning Biology is synonymous with phenomena that exist in the natural environment. Starting from plants, animals, and humans can be used as a source of learning. Moreover, in areas that have abundant natural resources, the potential to develop learning resources is enormous.

Indonesia is famous for its very high natural wealth, flora and fauna, which is included in the number two megabiodiversity country in the world (Suryaningsih, 2018). This biodiversity is widespread throughout the archipelago. Kudus is one of the areas that has the potential for abundant plant diversity. The reason is, Muria Regency has mountains and hills as well as land that is still preserved. Mount Muria is a place where flora and fauna are abundant. The mountain is located on the north coast of Central Java, about 66 kilometers northeast of the city of Semarang. This mountain is flanked by three districts, namely Jepara Regency on the west side, Kudus District on the north side, and Pati Regency on the east and southeast sides. Mount Muria has an altitude of 1602 m above sea level. The forest area at the foot of Mount Muria, especially those located in the Kudus District area, is a protected forest area managed by Perhutani. The area of the Protected Forest in the Muria Mountains Region is 2,334.8 Ha (Widjanarko & Wismar'ein, 2011). The existence of this protected forest makes Kudus Regency has a very abundant biodiversity. Apart from the mountainous areas, diversity can also be found in the mainland, ranging from wild plants and cultivated plants. One of the plants found in the Kudus District is a plant from the Cucurbitaceae family.

Cucurbitaceae is a type of pumpkin plant that can grow well in the highlands and lowlands (Zufahmi et al., 2019). The species are diverse and have a wide distribution in the tropics. Consists of 130 genera, and 800 species. The Cucurbitaceae family in general is widely used by the community as a food ingredient (Prayogi et al., 2022). The part that is widely used by the family as food is the fruit. This family is among the most widely used as a food ingredient based on the results of previous ethnobotanical studies (Fatchurrohman, 2017).

The diversity of Cucurbitaceae in Kudus disctrict, whether cultivated or wildly grown, has the potential for researchers to serve as a source of research. Later, the existing natural wealth can be used as a source of learning. Can support knowledge for students, especially in Biology subjects. Learning resources are everything that can be found in the environment, both inanimate and living objects, which can be used as a tool to help apply teaching and learning activities between educators and students. Learning resources obtained from the environment are still raw, and must be modified and simplified so that students can easily digest and understand them as Biology teaching materials (Aprisiwi & Sasongko, 2014). Teaching materials obtained from the environment can be directly used as learning media directly, but this will take up a lot of time, costs, facilities and infrastructure so it is less efficient. In order to be more practical, varied, interesting, and of course efficient, it is necessary to process these teaching materials. When teaching materials are not used directly in classroom learning, these teaching materials only become learning resources.

Teaching materials are a collection of teaching materials arranged systematically that apply concepts so as to be able to direct students in achieving a competency (Magdalena et al., 2020). According to Kosasih, teaching materials are anything that is used by educators and students in order to facilitate the learning process in various forms that are seen as capable of enhancing the cognitive and experience of students (Kosasih, 2021). Another opinion says that teaching materials are anything to complement the needs of the learning process which can be in the form of print

media, audiovisual, computer-based or integrated technology (Cahyadi, 2019). The conclusion from all the above understandings is that teaching materials are everything that is arranged systematically which can be used as a completeness in teaching by educators to students which are processed in a systematic manner that is adjusted to the achievement of competencies so as to be able to increase the knowledge and experience of students in learning.

One way to create educators who have professional competence is to be creative and innovative in learning activities (Yulaika et al., 2020). The ability to process teaching materials to suit the needs expected of students is inseparable from the pedagogic capacity of an educator. Educators who have good pedagogic abilities can certainly apply teaching materials that are in accordance with the potential of students. The pedagogics of a good educator are those who are able to understand the characteristics, and the development and abilities of students, so that educators can easily design learning, related to learning processing which includes the implementation of learning, and evaluation of learning that is educational and logical (Akbar, 2021). Teaching and learning activities are said to be successful if students are able to master the material well and even implement it (Rahayu, 2016). The pedagogic state of a qualified educator should be able to help create a media or teaching material that is successful, in the sense that it is in accordance with the needs of students. One manifestation of professional educators is the ability of educators to develop teaching materials.

Teaching materials are generally grouped into two types, namely, first, printed teaching materials such as books (textbooks), modules, worksheets, handouts, brochures, and leaflets (Hadi & Agustina, 2016). The second teaching material is in the form of non-printed or electronic teaching materials such as TV, radio, interactive media (Nurafni et al., 2020). Electronic teaching materials are a collection of material that is arranged systematically which is loaded in electronic form which can be in the form of audio, audio-visual, or in the form of interactive multimedia. Electronic teaching materials such as e-books, e-module, e-magazines, interactive multimedia CDs/DVDs, flash models or interactive slides, HTML5, e-learning, and others (Sriwahyuni et al., 2019).

The problems that were obtained by researchers from the results of observations and interviews on August 1, 2022, namely at MA NU Raudlatus Shibyan Kudus. The result is that teaching materials on Plantae or Plants material only use worksheets as learning resources for students. Apart from that, for other facilities such as the biology laboratory there is no special room, and the equipment is also very minimal, the delivery of material is more frequent by the lecture method, and the lack of practical activities, so that in practice learning seems monotonous and less interesting. The results of the questionnaire that the researchers gave to class X IPA students with a total of 28 respondents, in general they explained that in learning activities they quickly get bored and bored because the teaching materials used are less innovative and interesting. The carrying capacity of the school environment for learning Plantae Biology material is very minimal. The school environment which is only limited to rice fields with minimal plant variations is not enough to support Biology learning. This research is different from previous research because it explores local potential, namely the Cucurbitaceae family and nothing has been developed previously. Penelitian sebelumnya telah memanfaatkan potensi lokal, namun tidak berbasis eksplorasi tanaman Cucurbitaceae (Kasman & Suhartini, 2022; Masing & Sila, 2023; Yunita et al., 2022).

According to the researchers, the right solution for the problems above is to create teaching materials that are efficient, interesting and interactive so that active class conditions are created, and students are enthusiastic about participating in learning. The teaching materials are in the form of e-module. In this all-digital era, educators should be smarter in utilizing existing technology, for example, to make teaching materials in the form of e-module. The use of this e-module will make

Biology material, especially Plantae material which is very complex, into a material that is simple, interesting and easy to understand.

Researchers use the Heyzine application as a container for researchers' creativity in making e-module. Against the background of the complex Plantae material, the researchers made the material smaller but more interesting by displaying several types of plants from the Cucurbitaceae family. This seems very interesting because the existing e-module are packaged in such a way as efficient, interactive and innovative teaching materials that can display colorful images and many other features so that later it is hoped that they will be able to make students interested and interested, and not easily bored in learning. follow learning. If students are interested and interested, there is a great opportunity to capture and understand the material easily.

The development of teaching materials which is carried out by integrating local potential refers to Indonesian government regulations contained in the Constitution of the Republic of Indonesia No. 20 of 2003 article 36 that the curriculum is prepared according to the level of education by taking into account one of them, namely the diversity of regional and environmental potentials (Kasman & Suhartini, 2022). One of the objectives of developing this teaching material is to identify local potential in each area so that later learning becomes more applicable and meaningful (Hasanah et al., 2022). The development of teaching materials based on local potential is also an effort to mitigate ecosystem damage and create a sense of care for the environment so that students are encouraged to maintain its sustainability (Fitriyani et al., 2021). Integrating local potential into Biology learning makes students more respectful of local potential and culture, knowing the diversity of flora and fauna, ways of preserving and utilizing them (Salamah et al., 2023).

The use of this e-module makes it easier for students to access biology subject matter anywhere and anytime. It is different with print media in the form of textbooks and so on which are difficult to carry and also easily damaged if not cared for properly. In line with the statement above, Novitasari argued that this e-module is a web-based ICT teaching material, which has advantages over print media. The interactive nature makes it easier for students to find what they want. The e-module also allow for display of images, audio and video animations along with formative tests that enable rapid feedback (Putri et al., 2015).

Regarding the explanation above, there are a number of previous studies regarding the development of e-module which received positive responses, like previous research, who developed a product in the form of an e-module based on the Flip PDF Professional software on the subject matter of plantae. The resulting product has a good to very good quality percentage (Aqmar, 2022). Subsequent research was also carried out by Basaroh et al. (2021) they developed a product in the form of an e-module experiential model for exploring the surrounding nature on plantae material. The product is validated by media experts at 99%, material experts at 100%, learning device experts at 98%, and field practitioners at 97%. The practical test results after implementing the product get a percentage of 88%. These results indicate that the e-module created is very valid and very practical (Basaroh et al., 2021). From several previous studies, it can be concluded that e-module is considered effective in increasing understanding and learning outcomes of students and has a strong interest so that this learning media can be used as a learning tool for delivering material by educators.

Based on the description above, researchers were motivated to develop e-module based on local potential, namely the development of e-module based on the Cucurbitaceae family in the Spermatophyta sub-material for class X IPA SMA/MA. The purpose of this study is to determine the validity of the e-module that has been made and its practicality level. So that the e-module can be widely disseminated to students, especially class X IPA SMA/MA. The hope is that with this e-module, students can find out the natural potential that exists in their area, namely Kudus

District. Students can make maximum use of existing natural resources and can also maintain and preserve existing biodiversity.

2. Method

The type of research used is research and development. The research model used is ADDIE adopted from Branch (2009), which consists of analysis, design, development, implementation, evaluation. At the development stage validation was carried out by three material experts, three media experts, and one Biology educator as a user/facilitator. The trial was carried out on a limited basis to all members of class X IPA MA NU Raudlatus Shibyan as many as 28 people. Data collection was carried out by means of structured interviews, observation, and questionnaires. Retrieval of validation data and student responses was carried out from March 16 to April 2, 2023. The data obtained was in the form of qualitative data in the form of comments and suggestions, as well as quantitative data in the form of assessment results with a predetermined scale. The assessment guidelines in data analysis techniques to test validity and practicality are based on Figure 1.

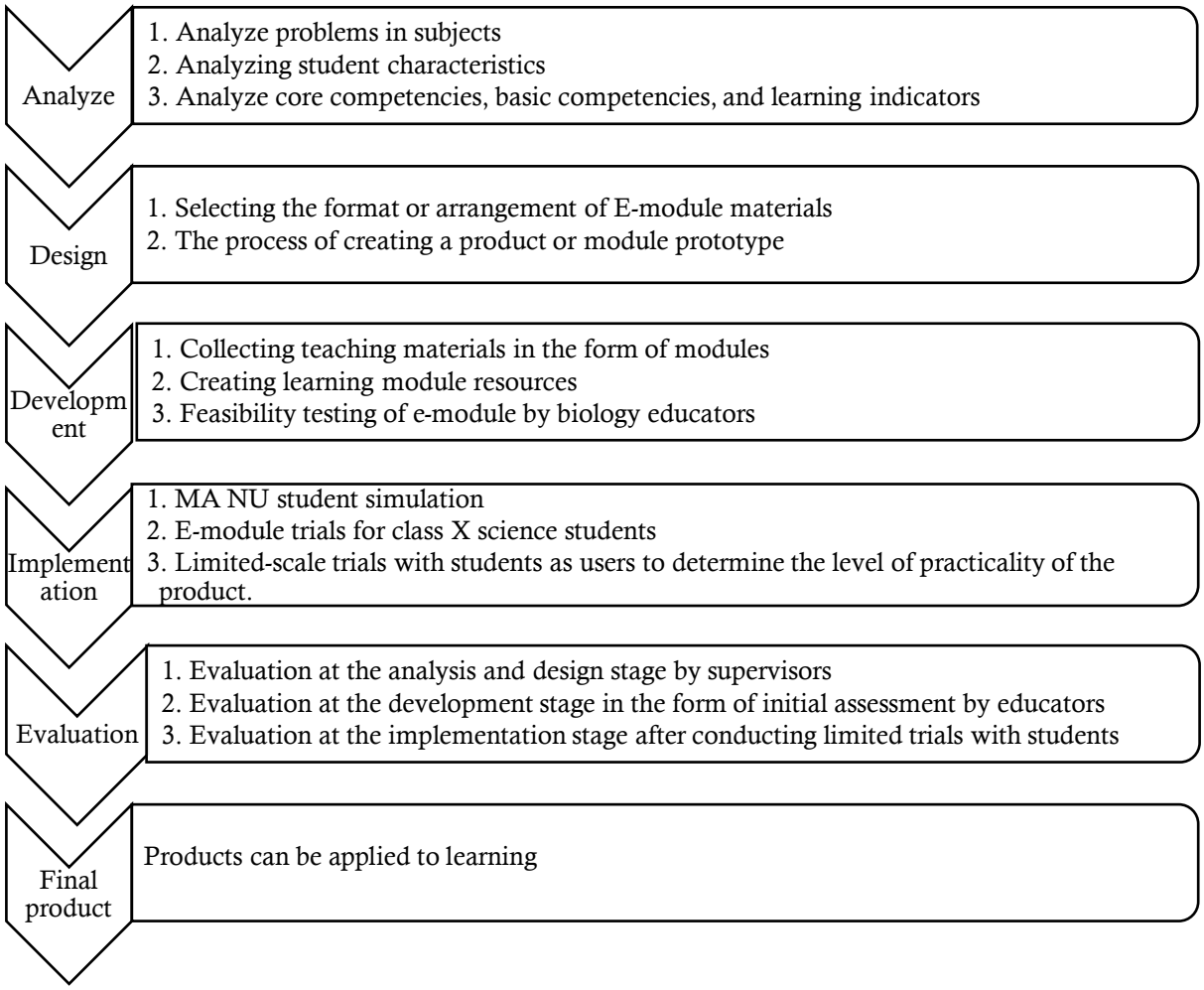

Figure 1. Research design

Data analysis aims to determine the level of validity of the e-module that has been developed. Data analysis was obtained from the results of validation by material experts, material experts and

Biology educators on the validation instrument sheet that had been made. Table 1 shows the tasks of the e-module validator.

Table 1. Cucurbitaceae Family Based e-module Validator

No.	Validator Name	Institution	Expertise	Information
1.	Validator 1	IAIN Kudus	Lecturer in Plant Morphology Course	Validator I material expert
2.	Validator 2	IAIN Kudus	Lecturer in Biology Learning Subjects	Validator II material expert
3.	Validator 3	MA NU Raudlatus Shibyan	Biology Educator	Validator III material expert
4.	Validator 4	IAIN Kudus	Lecturer in Biology Learning Media Courses	Media expert I validator
5.	Validator 5	IAIN Kudus	Lecturer in Learning Media Courses	Media expert II validator
6.	Validator 6.	UIN KHAS Jember	Lecturer in Biology Learning Media Courses	Media expert III validator
7.	Validator 7	MA NU Raudlatus Shibyan	Biology Educator	Biology Educator as user validator/facilitator

The validation instrument sheet uses answer choices with a likert scale with a range of 1-5. This indicator is taken from a book entitled methods and techniques for compiling a thesis (Riduwan, 2010). The description of the criteria for the assessment using the Likert scale. Its criteria was Very good (5), Good (4), Pretty good (3), Not good (2), Very not good (1). Results of the assessment with a Likert scale are then summed up as a whole and the percentage valu. Based on the percentage score of the validation results obtained, it is then interpreted as in Table 2.

Table 2. e-module Validity Criteria (Hodiyanto et al., 2020)

Percentage (%)	Validity Criteria
80,00 < value ≤ 100	Very Valid
60,00 < value ≤ 80,00	Valid
40,00 < value ≤ 60,00	Valid Enough
20,00 < value ≤ 40,00	Invalid
0,00 < value ≤ 20,00	really Invalid

E-module practicality data was obtained from the results of testing on a limited scale in Class X IPA MA NU Raudlatus Shibyan Kudus. The practicality test sheet uses answer choices with a Likert scale. Interpretation of the Practicality Score on the Likert Scale is score 5 (strongly agree), score 4 (agree), score 3 (only agree), score 2 (disagree), and 1 (strongly disagree). The results of the practicality assessment are then summed up, and the percentage. Based on the practicality value obtained, it is then converted in accordance with the provisions of the criteria in score 81,00 – 100 (Very Practical), score 61,00 - 80,00 (Practical), score 41,00 - 60,00 (Pretty Practical), score 21,00 - 40,00 (Less Practical), and score 0,00 - 20,00 (Impractical).

3. Result and Discussion

A product is said to be good or suitable for use if it has previously been tested on experts in accordance with their field. Likewise with the Cucurbitaceae Family-based e-module, which has been tested or validated before being used in learning. The results of the validation analysis carried out by material experts, media experts, and Biology educators are presented in two data, namely

quantitative and qualitative data. The quantitative data validation results by material experts and media experts can be seen in the following table.

Validation is carried out at the development stage. The results of the validation by material experts are in accordance with Table 3. Get the percentage that falls into the very valid or feasible category and the media expert's validation results are in accordance with Table 4. Get the percentage of scores that fall into the very valid or feasible category. The validity of the product is also assessed by Biology educators before being tested in the field or in learning. The validity value by Biology educators is in accordance with Table 5. getting a score with a percentage that is included in the valid or feasible category. The categories mentioned above are in accordance with the criteria according to the validation results (Hodiyanto et al., 2020) in his research.

Table 3. Results of Validation by Material Experts

No.	Aspect	Persentase			Average Percentage	Criteria
		Material Expert I	Material Expert II	Material Expert III		
1.	Curriculum	90%	100%	80%	90%	Very Valid
2.	Material Presentation	92,5%	97,5%	80%	90%	Very Valid
3.	Material Completeness	97,14%	97,1%	88,57%	94,27%	Very Valid
4.	Language	92,5%	100%	72,5%	88,3%	Very Valid
5.	Local Wisdom	100%	100%	90%	96,7%	Very Valid
	Average	94,42%	98,92%	82,21%	91,85%	Very Valid

In more detail, the results of the validation by material experts are in accordance with Table 3. The lowest score was obtained on the language aspect and the highest score was on the wisdom aspect. The language aspect is the most important point because students can absorb the knowledge contained in the e-module, one of which is the ease of understanding the language contained in it. The linguistic aspects in the e-module must be communicative and relevant to the level of ability and language development of students (Safitri & Hartati, 2016). However, with a value that is still in the very decent category, the language aspect in the e-module is still understandable. As for students who have difficulty understanding foreign languages, the researcher has provided a glossary that can help students digest the foreign languages in the e-module. The glossary itself helps someone in finding the meaning of difficult words because it contains concepts that are relevant to a particular field of knowledge (Susanti, 2016).

Table 4. Results of Validation by Media Experts

No.	Aspect	Percentage			Average Percentage	Criteria
		Media Expert I	Ahli Media II	Media Expert III		
1.	Appearance	96%	94,7%	93.3%	94,7%	Very Valid
2.	Desain	96,7%	93,3%	93,3%	94,43%	Very Valid
3.	Ease of Use	97,5%	87,5%	97,5%	94,17%	Very Valid
	Average	96,73%	91,83%	94,7%	94,42%	Very Valid

The aspect of local wisdom gets the highest score because the contents of the e-module contain a diversity of plants in Kudus Regency, namely the Cucurbitaceae Family. This is the most important point by researchers in developing e-module. It is very natural that the aspect of local wisdom gets the highest score. Another reason is that photos and morphological characteristics were also taken, observed, and analyzed directly from where species from the Cucurbitaceae family

were found. In contrast to the results of the material expert's validation, the results of the media expert's assessment in accordance with Table 4. actually get almost the same value for each aspect. However, there is something that is slightly higher than the other aspects, namely in the design aspect. The validators may assume that the e-module that has been made is in accordance with the design that follows technological developments. In the learning process, it is impossible to avoid learning problems. So one solution to overcome problems in learning is to develop e-module with instructional designs and integrate them according to technological developments (Herawati & Muhtadi, 2018).

Table 5. Validation Results by Biology Educators

No.	Aspect	Percentage	Kriteria
1.	Material	80%	Valid
2.	Language	73,3%	Valid
3.	E-module view	86,7%	Very Valid
4.	Ease of Use	80%	Valid
5.	Benefits	72%	Valid
6.	Efficiency	80%	Valid
	Average	78,7%	Valid

The results of the next validation are by Biology educators where there are two aspects of the assessment that get the lowest scores according to Table 5, namely aspects of usability and language. The benefits of the e-module get at least a score because in fact the e-module has not been applied to students so that educators do not dare to rate it higher. In the aspect of language also get quite a bit of value. This is due to the possibility that the sentence structure is not perfect or is still not in accordance with indonesian grammar. However, both aspects are still in the valid category, which means they can still be used by students. The highest value is the aspect of the e-module display. In this case the researchers agree because the display aspect has been adjusted so that it attracts students to read and understand the contents of the e-module. Aspects of the display here include proportional layout (layout of text and images), suitability for color selection, font type selection, font size, and clarity of writing on each topic. The display aspect will also have a good effect on the learning experience of students (Puspita et al., 2021). The stage that must be carried out after development is implementation.

In the implementation phase, a limited scale product trial was carried out for all students of class X IPA MA NU Raudlatus Shibyan. As a result, responses and assessments by students are in accordance with Table 6.

Table 6. Results of Student Responses to Field Trials

No.	Assessment Aspects	Indicator	Percentage	Average	Criteria
1.	Appropriateness	Material	79%		
		Language	76%	79%	Practical
		Graphics	82%		
2.	Practicality	Ease of Use	80%		
		Usefulness of e-module as teaching materials	77%	78%	Practical
		Efficiency of e-module teaching materials.Praktis	77%		
	Average		78%	78,5%	Practical

As a result, responses and assessments by students according to Table 6. get an average score that falls into the practical category. This category refers to the criteria according to practicality test

results (Wijayanti et al., 2022) in his research. In this assessment both aspects get almost the same value, namely for the feasibility aspect and the practicality aspect. However, there is an indicator that gets the lowest score in accordance with Table 6. namely the language indicator. This is because students have only read the e-module once so they think the language is difficult to understand. Reading is not just understanding symbols and writing, but understanding, accepting, rejecting, comparing, and believing in the opinions and content contained in the reading. So, if there is someone who after doing reading activities but has not been able to catch the message contained in the reading then the reading process has not been successful and needs to repeat the reading (Tantri, 2016). One way for students to understand the content of the material is to understand the concept first. Optimal understanding of the concept will have an impact on maximum learning outcomes (Sari et al., 2015)

The highest value is in accordance with Table 6, namely in the graphical aspect. This is because students like the appearance of the e-module that is made. So that later there will be interest in studying the contents of the e-module. This is in line with the research conducted by Ardianthi and Wanabuliandari in whose research concluded that students will increase their interest in reading when they get learning resources that are equipped with pictures or interactive activities in them. (Ardianti & Wanabuliandari, 2021). This agrees with the statement (Waryanto et al., 2017), which reveals that students will increase their interest in reading when they read texts that are designed in book form.

The development of e-module based on the Cucurbitaceae Family on the Spermatophyta sub-material contains Spermatophyta material which is integrated with local wisdom and potential that exists in Kudus Regency. In this case the researcher utilized the diversity of the Cucurbitaceae family as a learning resource which was packaged into a valid and practical teaching material. A similar research was conducted by previous researcher was declared valid (Hilmiyah, 2022). Similar research was also conducted by Yusrina Risky on Spermatophyta material obtained valid (Amalini, 2021). Based on the explanation above, it shows that the development of e-module with the results of identification and characterization of the Cucurbitaceae family is suitable for use as teaching materials for students and also as a place to introduce the potential and local wisdom of plant diversity in Kudus Regency.

The advantage of this e-module is that there is a diversity of species from the Cucurbitaceae family so that students can add insight into the local potential around them and can utilize and maintain its sustainability. The majority of the images in the e-module are personal documents taken directly on location. There are tasks in the e-module that can train students to observe or go directly to the field to identify the morphological characters of the Cucurbitaceae family around them. Providing opportunities for students to dive directly into nature or what is commonly called (JAS), namely exploring the natural surroundings, will train students' sensitivity to the environment.n (Kose et al., 2011). The existence of direct learning in the surrounding environment can provide opportunities for students to be able to think openly and flexibly so that it will stimulate and improve students' thinking skills. Learning by direct observation according to Kosvota in (Basaroh et al., 2021) Expressing can make it easier to remember and re-understand the material being studied. Another advantage is efficiency in utilizing learning time which in the e-module contains the Cucurbitaceae family which must be observed directly and requires a lot of time, here students know about the diversity of the Cucurbitaceae family accompanied by their distribution and morphological characters.

Based on the research that has been done, the final result of this research is in the form of an e-module based on the Cucurbitaceae family which is obtained by direct identification in all parts of the Kudus District. This e-module has passed the validity and practicality stages by obtaining

grades in the very feasible and feasible categories, so that this e-module can be used in the learning process.

4. Conclusion

Based on the results and discussion, it can be concluded that the e-module based on the Cucurbitaceae family obtained a value from the results of validation by material experts in the category of very valid or suitable for use. The results of the validation assessment by media experts obtained a percentage in the category of very valid or suitable for use in terms of appearance, design and ease of use. Validation carried out by Biology educators obtained values in the category of very valid or suitable for use in terms of material, language, e-module appearance, ease of use, usefulness, and efficiency.The results of the analysis of the Cucurbitaceae Family-Based e-module on Spermatophyta class X IPA material obtained a score in the practical or feasible category. Based on the results of the validation test and practicality test, and can be used in the learning process. Development of Cucurbitaceae Family-Based e-module in Kudus Regency for Learning Spermatophyta

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