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The effectiveness of local wisdom-based interactive digital module on students' critical thinking disposition

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ABSTRACT

Local wisdom-based interactive digital module are alternative teaching materials to facilitate meaningful learning and experience, to stimulate the use of thinking skills including critical thinking dispositions. This study applied quasi-experimental design with pretest and posttest control group. Respondents involved in this study were 109 students from senior high school in Bengkulu, Indonesia. The class selection was carried out randomly to determine the interactive digital module class (X1), the e-module class (X2), and the control class (K). Students' critical thinking dispositions were measured through the Critical Thinking Disposition in Biology Test (CTDBT) instrument which included 10 questions for each of the seven disposition indicators. The data were analyzed using the Kolmogorov-Smirnov test, Levene test, one-way ANOVA test, and LSD. After the data were known to be normally distributed and homogeneous, an ANOVA test was carried out with the result that there was a significant difference in the experimental class and the control class on students' critical thinking disposition scores, namely 0.008<0.05. This showed that interactive module improve students' critical thinking dispositions, compared to e-module and control classes. The critical thinking disposition which increased significantly was shown in the truth-seeking indicator. However, the e-module class did not differ significantly from the control class in improving students' critical thinking dispositions. Therefore, teachers can use local wisdom-based interactive digital module in biology learning.

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1. INTRODUCTION

Local wisdom which contains life habits and beliefs becomes a learning medium in instilling values in every individual in society. This explains that one of the forms of the character of society in Indonesia is sourced from local wisdom, so it is hoped that local wisdom can be included in the education curriculum [1]. Education that contains local wisdom will teach students to always be attached to the concrete situations they face [2]. Learning modules are several learning media in the form of teaching materials which are arranged as a whole and systematically according to the stages of student development, considering what will be learned with long-term learning objectives and to help students achieve learning goals [3]. The introduction of local wisdom through teaching materials can be applied to biology learning, an example of the material that can be

related to Bengkulu local wisdom is ecosystem and diversity material. Some examples of local wisdom in Bengkulu Province, Indonesia, include the *tabot festival* [4], *rintis* and *masang bubu* [5], *mengeges* and *sakea* [6], *repung*, and not only that Bengkulu Province has local wisdom which has become a regional icon, namely *the rafflesia flower* [7].

The learning module previously developed was a learning module that integrates local wisdom from several regions in Bengkulu Province into biological material [8]–[11]. Some of the local wisdom raised and integrated into ecosystem material are i) from the South Bengkulu area: *rintis*, *ngelapun*, *masang bubu*, *ngahah*, *nangguak*, and *kasam*; ii) from the Rejang area: *Mengeges* and *bio* or *Silo*; iii) from the Kepahiang area: *Bubuh Garam*. This digital module is equipped with interesting features and text material on biology and local wisdom which is further clarified with audio-visuals, pictures, and videos to emphasize the material presented. Apart from that, the digital module facilitates two-way discussions and students can also evaluate learning achievements through the available quiz feature. Realita *et al.* [12] stated that digital modules help students to learn independently and repeatedly because they are easy to use via smartphone or laptop online and offline. Dari and Sudatha [13] explained digital modules can help foster students' enthusiasm for independent learning. Research conducted by Sholikha *et al.* [14] showed that digital modules were effectively used independently by students in catching up on the subject matter. Several researchers [15], [16] adding digital modules makes it easier for students to access learning materials anywhere and anytime. Digital-assisted modules can help students understand content more quickly and increase interaction between students and teachers during the learning process. This is because digital modules allow students to manage study time effectively, besides that the content of the material presented in the form of text, images, audio, and video will make it easier for students to understand the material, foster interest or interest, increase interaction, develop skills, and provide learning which is fun.

As a result of the development of technology, teachers have started to recognize modules that have transformed into digital-based modules, but the implementation of learning is still minimal. This was proven by 67% of students not understanding digital-based modules and 96% of students admitting they need them as an alternative learning resource [17]. This data confirms that the application of digital-based modules is still rarely used in learning. This is contrary to the opinion [18] that in responding to technological developments, learning should be demanded to be more innovative, varied, creative, and following with the current needs of students. Syahfitri and Muntahanah [19] stated that the application of biology learning that has been going on so far still uses learning resources in the form of worksheets and textbooks printed by publishers. Supariadi [20] stated that the availability of learning resources in schools is still limited which includes a variety of learning resources, access, quality, and quantity of learning resources. Several researchers [21]–[23] explained that in the biology learning process the learning resources used are still dominant in the form of textbooks, not yet using modules, especially local wisdom-based digital module.

Digital-assisted modules have the advantage that they can be designed as attractively as possible so that they differentiate from printed modules in general, which are usually colorless and less clear [24]. In addition, the existence of digital-based learning media can create an interesting learning atmosphere both carried out in class and outside the classroom (online and offline learning) [25]. When compared to other teaching materials, digital modules are easier for students to access independently [26]. This media can also assist in delivering abstract or difficult-to-understand biological material [27]. Digital-based modules are alternative teaching materials that can increase students' interest and understanding [28].

The availability and use of innovative and varied teaching materials such as digital teaching modules are believed to be able to grow and increase student learning motivation. Study by Zaharah and Susilowati [29] revealed that digital modules that have attractive features and can concretize abstract material can foster student motivation to learn. Erniwati *et al.* [30] also explained that the use of digital modules can significantly increase learning motivation. Lufiah *et al.* [31] explained that digital modules can stimulate students in learning. Researchers argue that if students have been stimulated, and have a high interest and motivation to learn, then students will tend to develop and practice their critical thinking skills through analysis, evaluation, and interpretation. Saputra *et al.* [32] explained that students' tendency to think critically is shown by their curiosity, enthusiasm, and high interest. Miswari *et al.* [33] revealed that the tendency of critical thinking disposition is not innate, but requires stimulation in its development, for example through innovative modules that can facilitate students according to their needs, namely being close to technology.

Several studies related to measuring critical thinking dispositions, such as research conducted by Syahfitri and Firman [34] which measured students' critical thinking dispositions based on gender and measured using the Critical Thinking Disposition in Biology Test (CTDBT) instrument with the result that only analytical indicators had a significant influence with p-value<.05. Another research measured students' critical thinking dispositions using the critical thinking disposition (CTD) instrument on a Likert scale with the result that the highest critical thinking disposition score was found in the open-mindedness indicator (score=71.16) [35]. Boonsathirakul and Kerdsomboon [36] measured critical thinking dispositions using the CTD instrument in the form of a Likert scale with the result that there was no significant difference in

students' critical thinking disposition scores based on gender. Based on this information, it is known that measuring critical thinking dispositions is still dominated by using Likert scale instruments and there is no measurement of students' critical thinking dispositions in biology learning that specifically applies learning assisted by local wisdom-based digital interactive module.

Reviewing the facts that happened causes learning to be monotonous, students still refer to the old method, namely teacher-centered [37]. The learning process has not facilitated students to gain experience and direct learning, so they are less actively involved in problem-solving and tend not to use critical thinking optimally [38]. Therefore, one of the efforts that can be made to realize meaningful learning is to ensure the availability of interactive digital modules that have been previously developed to be effective and proven to be able to increase students' critical thinking disposition. Thus, the research question is how effective local wisdom-based interactive digital modules are on students' critical thinking dispositions.

2. RESEARCH METHOD

Previous studies have developed products in the form of valid and reliable local wisdom-based interactive digital module, so this research examines the level of effectiveness of modules in biology learning to improve students' critical thinking disposition. This study used a quasi-experimental design in the form of a nonequivalent control group design [39]. The research design is in the form of a pretest and posttest control group design. The study involved two experimental groups and one control group. The research was started by giving an initial test (pretest), then a final test (posttest) after the treatment (treatment) in the three groups. The research design is presented in Table 1.

Table 1. Research design [40]

Class	Pretest	Treatment	Posttest
E1	Y_1	X_1 (learning applied local wisdom-based interactive digital module)	Y_2
E2	Y_1	X_2 (learning applied e-module flipbook)	Y_2
K	Y_1	(Conventional teaching materials such as printed books from publishers)	Y_2

E: Experimental class; K: Control class; X1: Use of local wisdom-based interactive digital module; X2: Use of e-module; Y1: Pretest; Y2: Post-test

The population of this study was three high schools and each school was represented by one class as the research sample with a total of 109 students from tenth grade. The selection of schools was carried out by considering the equality of school abilities, where the three schools used as data collection sites were schools with an accreditation rating of A. Sampling was carried out using a random sampling technique, where two groups served as the experimental class and one class as the control class. Experimental class X1 (the first school) was a class whose learning applied a local wisdom-based interactive digital module, while experimental class X2 (the second school) was a class that used e-modules. Furthermore, the learning media used in the control class (the third school) was conventional teaching materials such as printed books from publishers. Each class used the problem-based learning model with the number of respondents namely 38 students for experimental class 1, 35 students for experimental class 2, and 36 students for the control class.

The data collected technique includes two stages, namely the test distribution technique. The test was given before (pretest) and at the end (posttest) learning. The instrument used was a critical thinking disposition test called Critical Thinking Disposition in Biology Test (CTDBT). CTDBT is a test of critical thinking disposition in biology [40]. CTDBT includes seven indicators of critical thinking dispositions (truth-seeking, open-mindedness, analyticity, systematicity, self-confidence, inquisitiveness, and maturity), where each indicator consists of 10 questions in a multiple-choice format that leads to biology learning [41]. The validity and reliability of the CTDBT have been confirmed through average variance extract (AVE) and composite reliability (CR) values of more than 0.5, namely truth-seeking (AVE=0.72, CR=0.96), open mind (AVE=0.61, CR=0.94), analyticity (AVE=0.76, CR=0.97), systematicity (AVE=0.69, CR=0.96), self-confidence (AVE=0.83, CR=0.98), inquisitiveness (AVE=0.56, CR=0.93), and maturity (AVE=0.75, CR=0.97) [42].

The data analysis was carried out through prerequisite tests and hypothesis testing. The prerequisite test is done through the normality test (Kolmogorov-Smirnov test) and homogeneity test (Levene statistical test), while hypothesis testing is done by the one-way ANOVA test. If the results of the analysis show that there is a significant difference, then a further test is carried out with the Least Significance Different Test.

3. RESULTS AND DISCUSSION

3.1. Result of student's critical thinking disposition

The critical thinking disposition score of class X1 (the class that used a local wisdom-based interactive digital module) is significantly higher than class X2 (a class that uses e-modules) and control class (a class that uses conventional teaching materials in the form of printed books), namely on the truth indicator -seeking, analyticity, systematicity, self-confidence, and inquisitiveness, while the open-mindedness and maturity indicators have lower scores than the other two classes. The thinking disposition scores in class X2 were higher than the control class, namely on the indicators of truth-seeking, analyticity, systematicity, and self-confidence. Meanwhile, the indicators for open-mindedness, inquisitiveness, and maturity have the same scores, namely 38, 42, 35.

Figure 1 describes that the use of local wisdom-based interactive digital module is effective in increasing students' critical thinking disposition scores compared to the other two classes. Students who use local wisdom-based interactive digital module are seen to have a high truth-seeking tendency. This shows that students do not immediately receive the information provided, but first find out the truth. Through the presentation of local wisdom in the module, it can foster curiosity, so that students practice analyzing every phenomenon they find. In other words, students will be trained to develop thinking skills. This is in line with the statement of Damayanti [43] that the application of scientific concepts to local wisdom will facilitate students to develop higher-order thinking skills. Before testing the hypothesis, the researcher carried out prerequisite tests through the normality test and homogeneity test which are shown in Table 2.

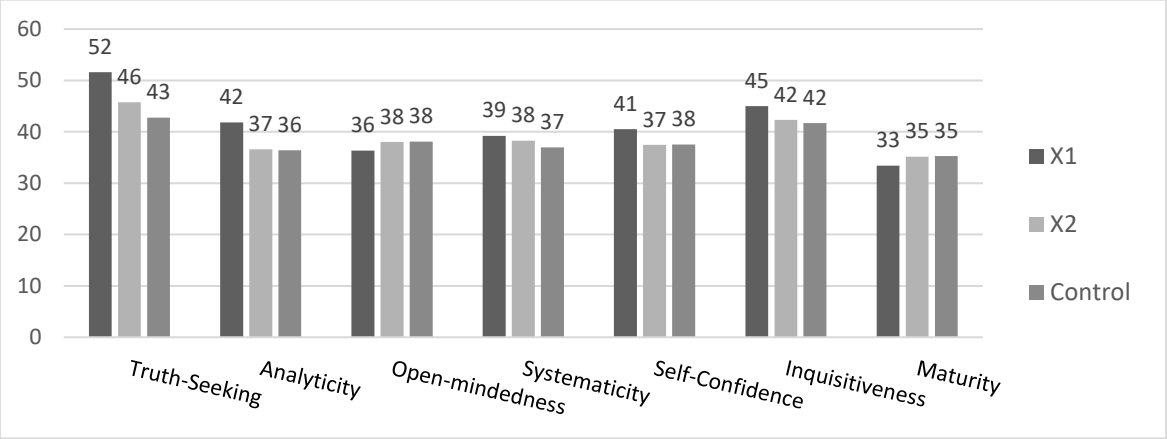

Figure 1. Students' critical thinking disposition scores

Table 2. Prerequisite test results: normality and homogeneity of critical thinking disposition data

Class	Kolmogorov-Smirnov[a]		Levene statistic
	Df	Sig.	Sig.
X1	38	0.200	0.430
X2	35	0.968	
Control	36	0.111	

The normality test presented in Table 2 showed that the data was normally distributed with a significance value of more than 0.05, namely (X1=0.200), (X2=0.968), and (control class=0.111). While the Levene test results also show a significance value of more than 0.05, namely 0.430. If the prerequisite test has been carried out and fulfilled, then the analysis is continued with the one-way ANOVA test as presented in Table 3. The results of the ANOVA test showed that students' critical thinking disposition scores had a significant difference value of less than 0.05 namely 0.008.

Table 3. The results of the ANOVA test on students' critical thinking dispositions

	Sum of Squares	Df	Mean Square	F	Sig.
Between groups	154.642	2	77.321	5.002	0.008
Within groups	1638.550	106	15.458		
Total	1973.193	108			

Several researchers [44]–[47] have examined the effectiveness of modules based on local wisdom in biology learning. Most of the research results show that local wisdom-based modules have proven effective in improving students' thinking skills, activity, motivation, interest in learning, and learning outcomes. Besides, Lestari [48] added that the use of local wisdom-based module was effective in developing three components of student competence namely attitudes, skills, and knowledge. Lestari *et al.* [49] explained that local wisdom-based digital module are proven to be able to create fun, meaningful, creative, dynamic, and dialogic learning. Next, to find out which treatments were significantly different, the LSD test was carried out which is presented in Table 4.

Table 4 describes that there is a significant difference between classes using local wisdom-based interactive digital module and classes using e-modules and conventional teaching materials in increasing students' critical thinking dispositions. Furthermore, there is no significant difference between the e-module class and the control class in increasing students' critical thinking disposition scores.

Table 4. Least significance different test results on students' critical thinking dispositions

(I) Class	(J) Class	Mean difference (I-J)	Std. Error	Sig.	95 % Confidence interval	
					Lower bound	Upper bound
X1	X2	2.07669*	.92111	.026	.2505	3.9029
	Control	2.77193*	.91443	.003	.9590	4.5849
X2	X1	-2.07669*	.92111	.026	-3.9029	-.2505
	Control	.69524	.93330	.458	-1.1551	2.5456
Control	X1	-2.77193*	.91443	.003	-4.5849	-.9590
	X2	-.69524	.93330	.458	-2.5456	1.1551

3.2. Discussion

In contrast to the control class and the e-module class, classes that use local wisdom-based interactive digital module are considered more significant in increasing students' critical thinking dispositions. During the learning process, students look happy and enthusiastic about using local wisdom-based interactive digital module as learning resources. Local wisdom-based interactive digital module facilitate students to learn biological material and local wisdom comprehensively through images, audio, and video so that they can stimulate students to use their critical thinking tendencies. Learning through images, audio, and video seems to provide a real experience for students. This causes students to be automatically trained to construct knowledge and analyze problems found, not just understand concepts. This kind of learning experience is rarely felt by students in learning that use regular e-modules and textbooks printed by publishers.

Technological advances often cause the erosion of the culture or traditions of an area, it is not uncommon for the current younger generation to not understand the traditions that exist in their surroundings. Therefore, digital modules that integrate local wisdom, can provide meaningful learning and experiences. Through this module students not only understand biology material but are also given examples of local wisdom related to biology content, so they can hone students' tendencies and thinking skills. In their research, Widyawati *et al.* [50] stated that the application of local wisdom-based learning in the Industrial Revolution 4.0 era could facilitate meaningful learning. Students can construct their knowledge by studying culture scientifically so that they can improve higher-order thinking skills. Atmaja [51] added that digital modules based on local wisdom can increase students' knowledge of culture or traditions in the area around them through biology material. Abidinsyah *et al.* [52] explained that elevating local wisdom in learning can help students learn biological concepts through real phenomena that occur in nature.

The previous research results [53], [54] showed that learning that elevates local wisdom is effective in improving students' dispositions and critical thinking skills. Syahidi *et al.* [55] added that local wisdom-based learning can help students in discovering the concepts they are learning, students not only gain knowledge but can also instill an active attitude in solving problems found in everyday life. This is relevant to the previous statements [56], [57] that students do not just have thinking skills but need to be trained through problem-solving from the phenomena of everyday life in the surrounding environment.

Another factor that causes local wisdom-based interactive digital module to be more effective in increasing critical thinking dispositions is the characteristics of interactive modules. The module not only presents biological material but also examples of local wisdom related to this material which is presented through pictures, videos, and audiovisuals. In addition, the module is also equipped with quizzes, and exercises that are two-way in nature, where the teacher can immediately provide feedback on assignments or quizzes that have been done by students. Several other advantages of this module are that it is based on Android, and students can install modules and use them online or offline. The characteristics of the module

that are easy to access anywhere and anytime can foster student interest and motivation in using it. Research by Ridho *et al.* [58] showed that technology-assisted teaching materials make learning more innovative, not boring, and able to increase student enthusiasm and activity in learning so that it can support their thinking abilities. Several researchers [59], [60] explained that students currently prefer digital-based learning, especially if it is available in the form of interactive learning applications that are easy to access and use anywhere and anytime. In contrast to e-modules, which, although they are electronically based, are not yet two-way interactive, and do not yet concretize environmental phenomena through local wisdom videos.

4. CONCLUSION

The research findings show that local wisdom-based interactive digital module are effective in increasing students' critical thinking dispositions compared to learning using e-module media and conventional media such as printed textbooks. The results of this research have the opportunity to become a reference for educators in improving the quality of learning. The implementation of interactive digital modules that integrate local wisdom in biology learning is one alternative that can be used to train students to actively use their thinking skills such as critical thinking dispositions so that they can develop high-level thinking skills (critical and creative thinking skills). Students will be accustomed to analyzing, evaluating, constructing knowledge, and connecting it to solving problems. Therefore, teachers need to be able to provide more innovative learning media that are relevant to the needs of students who are very close to technological advances. The existence of teaching media which was originally limited to printed textbooks and switched to e-modules which have now transformed into interactive digital modules is very effective in assisting teachers in delivering more concrete learning. For future researchers, it is suggested to examine more deeply the influence of this local wisdom-based interactive digital module on critical thinking dispositions which include educational level and student demographic aspects such as gender and age. This research has implications for teachers, namely one alternative solution in conveying and concretizing abstract biology material can be through interactive and fun teaching materials, to increase students' understanding and skills in learning.

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