

Use of e-module based on local potential projects to provide creative thinking abilities for high school students

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Article Information	Abstract
Keywords: E-module; Local potential; Creative thinking skills; Project-based learning; Student responses Kata Kunci: E-modul; Potensi lokal; Kemampuan berpikir kreatif; Pembelajaran berbasis proyek; Respon siswa History: Received : 15/01/2025 Revised : 19/05/2025 Accepted : 03/06/2025 Published : 13/06/2025	Students have the ability to create solutions to problems based on local, national or global issues related to understanding biodiversity according to the demands at the end of learning. The solution to meet these demands is to conduct learning using e-modules based on local potential utilization projects. This study aims to obtain information on the use of e-modules based on local potential utilization projects to equip students with creative thinking skills. This learning is carried out using e-modules related to the syntax of project-based learning (PjBL). Pre-experimental with one group pretest-posttest design. Participants in this study were 10th grade students consisting of 64 students. Data on students' creative thinking skills were obtained from the results of the pretest and posttest. The results of the study on students' creative thinking skills obtained an average N-gain value of 0.56 which is included in the moderate category. Student responses related to the use of e-modules based on local potential utilization projects were obtained that 83.88% meant that almost all students said that e-modules could be used in learning. Based on the results of the study, the use of e-modules can be an alternative to improve students' creative thinking skills. Creative thinking skills possessed by students will increase students' creative abilities to innovate in order to utilize existing local potential. <i>Abstrak. Siswa memiliki kemampuan menciptakan solusi atas permasalahan-permasalahan berdasarkan isu lokal, nasional atau global terkait pemahaman keanekaragaman hayati sesuai dengan tuntutan diakhir pembelajaran. Solusi untuk memenuhi tuntutan tersebut dengan melakukan pembelajaran menggunakan e-modul berbasis proyek pemanfaatan potensi lokal. Penelitian ini bertujuan untuk memperoleh informasi mengenai penggunaan e-modul berbasis proyek pemanfaatan potensi lokal untuk membekalkan kemampuan berpikir kreatif siswa. Pembelajaran ini dilakukan dengan penggunaan e-modul yang terkait dengan sintaks project based learning (PjBL). Pre-experimental dengan desain one group pretest-posttest. Partisipan dalam penelitian ini adalah siswa kelas 10 yang terdiri dari 64 siswa. Data kemampuan berpikir kreatif siswa diperoleh dari hasil pretest dan posttest. Hasil penelitian kemampuan berpikir kreatif siswa didapatkan nilai rata-rata N-gain yaitu 0.56 yang termasuk kategori sedang. Respons siswa terkait dengan penggunaan e-modul berbasis proyek pemanfaatan potensi lokal didapatkan bahwa 83.88 % berarti hampir seluruh siswa mengatakan bahwa e-modul dapat digunakan dalam pembelajaran. Berdasarkan hasil penelitian penggunaan e-modul dapat menjadi alternatif untuk meningkatkan kemampuan berpikir kreatif siswa. Kemampuan berpikir kreatif yang dimiliki siswa akan meningkatkan kemampuan kreativitas siswa untuk melakukan inovasi untuk memanfaatkan potensi lokal yang ada.</i>

A. Introduction

The rapid development of technology in the 21st century has resulted in changes in the environment, especially the school environment. One of the 21st century skills that students must have is the ability to think creatively. Creative thinking skills are the abilities that students have to be able to bring out the power of thought and creativity to create something that is beyond the thinking of most people (Choirunnisa, 2023). Based on the results of PISA (Program for International Student Assessment), 31% of Indonesian students achieve at least basic skills in creative thinking (Level 3), but this is much lower than the average in other countries, which is around 78%. In addition, an international survey conducted by TIMSS (Trends in International Mathematics and Science Study) released by the Ministry of Education and Culture in 2015 said that in Indonesia the level of creative thinking skills is very low (Pradiarti et al., 2024). This states that students' creative thinking skills in schools have not been trained optimally. There are aspects of creative thinking, namely fluency, flexibility, originality, elaboration (Torrance, 1968). The use of electronic modules can make students learn independently and can access materials wherever they are, it will also change students' views on reading and consuming interactively and make them comfortable, where printed modules have images, narration, and graphics but e-modules can contain various features such as audio, music, animation, and video (Prasetya, 2021).

The problem currently faced in biology learning is the weakness in the learning process, where students are less able to develop their creativity (Neliwati et al., 2022). Biodiversity learning materials have different meanings depending on students' understanding, biodiversity materials cannot be separated from the types and natural resources that exist, so that this understanding can improve the development of concepts when students must be applied in various situations. Explaining learning strategies that allow students to have a conceptualization of the meaning of biodiversity (van Weelie & Boersma, 2018).

Local potential can be used as a learning resource, as we know that the changes that occur in life when this society has developed very rapidly (Susilo, 2018). Tupas (2019) said that local potential such as biodiversity can be used as an effective learning resource. By utilizing local potential, students can better understand biodiversity directly. Several areas have been identified as learning resources that can be used in local excellence-based education, this shows that local potential can be integrated into the curriculum to improve students' understanding of biodiversity (Hastuti et al., 2020)

The potential for mango plantations in Indramayu Regency is very abundant. On average, it produces around 685,000 tons per year produced by

the community's mango trees. However, of the many mangoes produced by the community, only about 20% can be processed into modern food products. With this, students need to utilize the local potential they have for the learning process (Sinoniayu, 2022).

Efforts that can be made to improve creative thinking skills are by implementing effective learning models (Sugandi et al., 2023). Project-based learning aims to achieve competencies in attitudes, knowledge, and skills (Hardjo et al., 2020). The project-based learning (PjBL) model is a model that is suitable for providing students with creative thinking skills (Duke et al., 2021), this is related to one of the 21st-century skills that students must have and also the profile of Pancasila students in the independent curriculum. The suitability between student needs, curriculum, and subject matter must be considered by educators, considering that students have different characteristics related to the environment, social, and culture in society. In biology learning there is great potential in utilizing the surrounding environment. Utilization of the surrounding environment can be in the form of utilizing local potential from the area where students live (Aripin & Yulianti, 2018).

This study aims to improve students' creative thinking skills and creativity to be able to utilize the potential of mangoes around students. The existing local potential needs to be utilized as well as possible to produce good results, and students can learn to be able to make creative products to utilize local potential that is not yet maximized. The use of this e-module can help students to provide directed guidelines for the creation of a creative product produced by students, so that students' creative thinking skills and creativity will increase.

B. Material and method

This is study experimental. The research method used is pre-experimental. This study uses a research design one group pretest-posttest (Creswell, 2008). The use of one group pretest-posttest research design through pretest and posttest activities aims to determine data on students' creative thinking abilities before and after the use of local potential-based e-modules Table 1.

Table 1 One group pretest-posttest research design

O ₁	X	O ₂
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(Source: Creswell, 2008)

Description:

O₁ = Pretest of students' creative thinking abilities

O₂ = Posttest of students' creative thinking abilities

X = Learning using e-modules based on local potential utilization projects.

The population in this study were 10th grade students from one of the high schools in Indramayu Regency, using a sample of 64 students. The sample is

a part or representative of the population studied. The sample in this research is one class that will be used as an experimental class. The sample selection method uses a sampling technique, namely purposive sampling. The sample criteria selected were students who had not received biodiversity material and had a smartphone. This research was conducted in three meetings with each meeting lasting three hours of class

The instrument used in this study was using a written test according to the indicators of Creative Thinking Skills, thoughts produced (fluency), novelty of each response (originality), thoughts that show various possibilities (Flexibility) and detailed thinking about their ideas (elaboration) (Torrance, 1968).

The indicators of creative thinking skills refer to Table 2. The data analysis used in this study was

descriptive statistical analysis, normality test, hypothesis test, N-gain test.

Creative thinking ability data comes from pretest and posttest score data in the form of an assessment of students' creative thinking abilities. The N-gain value is explained by Hake (1998) equation with Formula 1. The N-gain value obtained was then converted according to Hake's (1998) categories. The conversion of N-gain values is shown in Table 3.

$$(N - \text{gain}) = \frac{\text{posttest} - \text{pretest}}{\text{Maximum score} - \text{pretest}} \dots \dots \text{Formula 1}$$

Description:

N-gain = Normalized N-gain for each student

Pretest = Obtain a pretest score for creative thinking ability

Posttest = Posttest score obtained for creative thinking ability

Table 2 Indicators of creative thinking

Indicator	Criteria
Fluency	- Answer with a number of answers if there are questions, - Have many ideas about a problem
Flexibility	- Provide various interpretations of a picture, story, or problem - Provide alternatives or different ways to solve a problem
Original	- Giving an answer that is unusual, different from others, and rarely found by most people - Making an unusual combination of parts or elements
Elaboration)	- Develop and enrich a product or idea - Be able to explain in detail about objects, ideas, or situations so that they become more interesting

Table 3 Classification of pretest and posttest gain index values

Skor (g)	Classification
(g) > 0,7	High
0,7 > (g) > 0,3	Moderate
(g) < 0,3	Low

C. Results and discussion

The e-module used in this study uses the 4D development model. The 4D research model is a model used to develop and test learning products, such as media, learning devices, or learning models. The 4D model consists of four stages according to Thiagarajan (1974) namely: Define, Design, Develop, and Disseminate.



Figure 1
E-module view (in Indonesian)

The e-module developed by the researcher in this study resulted in an e-module containing material on biodiversity based on local potential utilization projects and training creative thinking skills (see Figure 1). The integration of PjBL and creative thinking used to form content in the e-module can be seen in Table 4. In the Let's think creatively section, the content in the e-module presents discourse from articles and students are asked to ask questions, find solutions, and create ideas to be used as project topics to be carried out. Joint project content is content that contains guidelines for students to work in groups to create product design, product creation timeline, and reporting the results of creative product creation. Reflection content contains questions about evaluating the results of what students do and what students can get during the series of project work.

Data on students' creative thinking skills were obtained from the results of the pretest and posttest scores of creative thinking skills questions consisting of 16 descriptive questions. The research instrument was in the form of a creative thinking test in the form of essay questions and a creative product assessment rubric. Before the research instrument was used, the

validation and instrument testing process were carried out first. The trial of the research instrument was carried out on grade XI students who had studied the biodiversity material. After the trial was carried out on

grade XI students, an analysis was carried out. Analysis of creative thinking questions was used as a measuring tool for creative thinking. The questions used to assess creative thinking skills can be seen in Table 5.

Table 4 Contents of the e-module

No.	PjBL syntax	Indicator thinking creative	Content
1.	Determining project topics	Fluency and flexibility	Let's think creatively
2.	Designing project completion steps	Elaboration	Let's think creatively
3.	Preparing project implementation schedule	Originality	Joint project
4.	Completing projects with teacher guidance	Originality	Joint project
5.	Evaluating project processes and results		Reflection

Table 5 The questions used

No.	Indicator	Question description	Many questions
1.	Fluency	Asking lots of questions	2
			2
		Having lots of ideas about a problem	2
			2
2.	Flexibility	Giving interpretations of a picture or story, or problem	2
			2
		Giving alternatives or different ways to solve a problem	2
			2
3.	Original	Giving answers that are unusual, different from others, and rarely found by most people	2
			2
		Making unusual combinations of parts or elements	2
			2
4.	Elaboration	Developing a product or idea	2
			2
		Being able to explain in detail about ideas, or situations so that they become more interesting	2
			2

Table 6 Pretest posttest score analysis

Data type		Pretest	Posttest
Data source		Creative thinking questions	
N		64 students	
Class average		38.84	71.25
Standard deviation		15.36	14.28
Normality test	Sig. value	0.200	0.200
(Kolmogorov-Smirnova)	Description	Normally distributed	Normally distributed
Homogeneity test	Sig. value	0.485	
	Description	Homogeneous	
Hypothesis test	Sig. value	0.000	
(Paired samples T-test)	Description	There is a significant difference	
N-gain		0.56	
Description		Quite effective	

Table 7 Recapitulation results of N-gain values for each indicator

No.	Indicator	Average N-gain	Category
1.	Fluency	0.79	High
2.	Flexibility	0.62	Moderate
3.	Original	0.84	High
4.	Elaboration	0.84	High

The pretest and posttest data obtained by students were converted and interpreted to determine the effect of using e-modules based on local mango potential utilization projects on students' creative

thinking skills, then the data was tested statistically including the normality test and the N-gain test. The results of the analysis of creative thinking skills are shown in Table 6.

The results of the N-gain data analysis found 0.55 which is included in the moderate category. This shows that there is an influence from the use of e-modules based on local mango potential utilization projects that are quite capable of providing students with creative thinking skills. E-modules based on local potential utilization projects can provide students with creative thinking skills; by involving students in projects and being relevant to the conditions of the student's environment, students are able to be invited to think creatively and utilize local potential around the student's environment. This is in line with the results of research by Sutrisno et al. (2022) which states that students who are involved in local utilization-based projects have a higher level of creative thinking in designing solutions. The use of project-based e-modules that utilize local potential as a learning context has been shown to stimulate students' creativity in finding innovative solutions to problems faced by the surrounding community (Azzahra et al., 2023).

The recapitulation results of the N-gain values for each indicator can be seen in Table 7. The N-gain value of all indicators is included in the moderate and high categories; only flexible thinking is included in the medium category. This means that the three categories have an increase between the pretest and posttest, and the use of e-modules based on local potential utilization projects is able to equip students with creative thinking skills.

Fluency thinking indicator This indicator is by asking students to create questions and ideas related to the illustrations provided. Based on the results of the N-gain which are included in the high category, it shows that students have been able to express the ideas and ideas they have for an illustration given. This is also in line with the results of research conducted by Aflah et al., (2023) that students have been able to find answer ideas or think of more than one answer to solve a problem. With the ability to think fluently (fluency), students can see more options and solutions that may be very necessary in solving a problem or providing a new innovation that arises from ideas and ideas (Handayani et al., 2021).

Fluent thinking will also be trained when students reflect at the end of learning. An example of the content "Let's Think Creatively" can be seen in Figure 2. The e-module used contains the content "let's think creatively" in the content that trains students to convey their ideas related to the existing reading. Before students answer the questions in the e-module, students are asked to first read and understand the contents of the existing materials so that students have an idea related to the situation. By integrating with PjBL (Project Based Learning) learning, creative thinking skills related to fluent thinking (Fluency) will be provided. This is also related to the learning method used, namely project-based learning, which has been proven effective in improving students' creative

thinking fluency (Wibowo et al., 2021). This is clearly seen in science education, where the emphasis is often more on understanding principles than on developing creative skills (Trisnayanti et al., 2020).



Figure 2
Contents of e-module related to fluent thinking (in Indonesian)

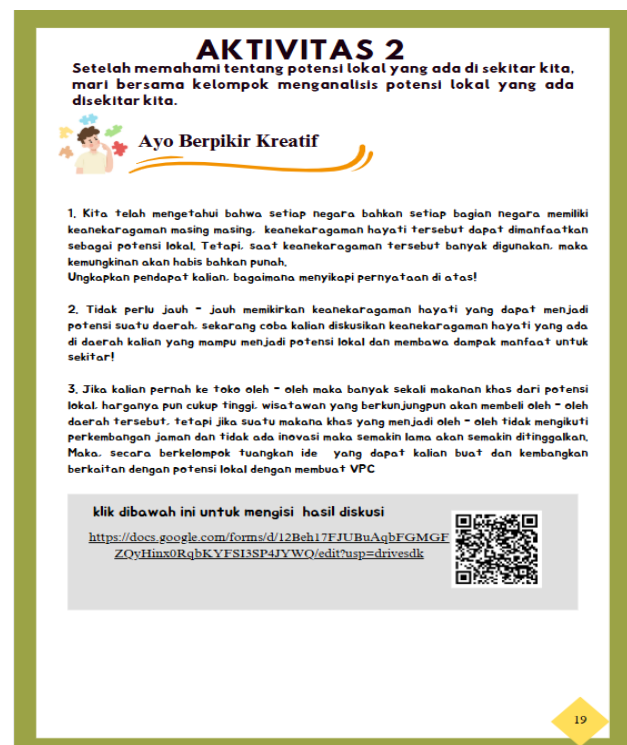


Figure 3
Let's think creatively content related to flexibility (in Indonesian)



Figure 4
Utilization of local potential (in Indonesian)

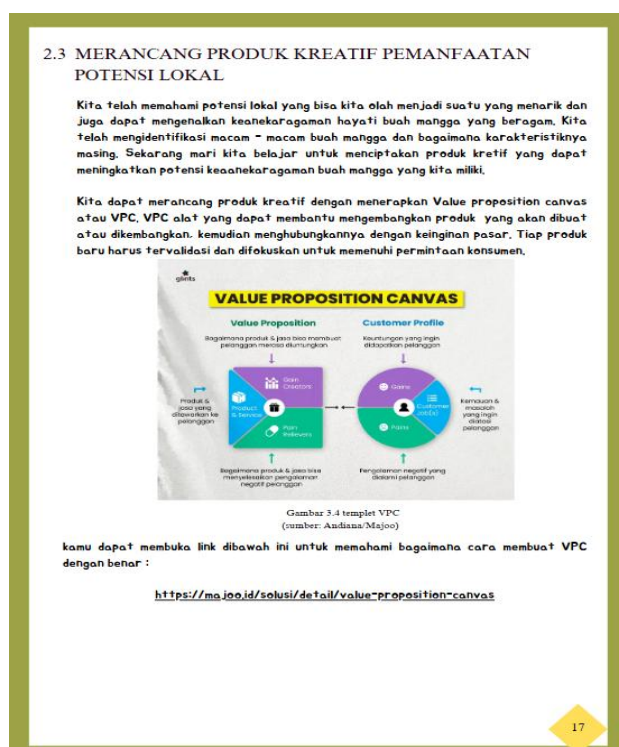


Figure 5
Utilization of local potential (in Indonesian)

In the flexible thinking indicator, the flexible thinking indicator is around interpretation (see Figure 3). The illustration of the student's story provides an interpretation related to the infographic and

illustration of the story, so that the ability to think flexibly (flexibility) can be fully possessed by students. In line with the opinion of Fajriah & Asiskawati (2015) that the indicator of flexibility in creative thinking is related to the number of ideas that can be generated by students and the answers must vary. Flexibility in students' creative thinking abilities, namely the ability to generate ideas by switching between different concepts, is the main focus (Grajzel et al., 2023). In addition, cognitive flexibility is very important in the creative process, because it allows individuals to switch adaptively between various problem-solving strategies (Rodríguez-Martínez, 2023).

In the original thinking indicator about putting forward the right way to solve a problem with one's own thoughts. Originality is specifically emphasized as the ability to produce unique ideas and not derived from existing concepts (Ritter et al., 2020). Based on Figure 4, the use of e-modules based on local potential utilization projects can provide students with original thinking skills. The ideas that are developed do not only look at one aspect, but many aspects must be seen. In this indicator, each student is able to produce answers that are presented in their own language (Aflah et al., 2023) and originality is the student's skill in solving problems in their own way or in other words that are not generally thought of by people.

In the elaboration thinking indicator, an idea that can be developed and realized to utilize the local potential of mango (see Figure 5). The use of VPC (Value Proposition Canvas) can equip students to think creatively about how students can meet their needs and achieve their goals in innovative ways. Students are faced with the challenge of designing appropriate solutions or approaches based on an in-depth analysis of their needs, which supports the development of creative and analytical thinking skills (Osterwalder & Pigneur, 2010).

The use of interactive learning methods can improve students' creative abilities by deepening theoretical approaches and connecting creative abilities with intellectual abilities (Gajda et al., 2017). Using Canva in learning has been proven to increase student interest and understanding. In schools, this application is used to create multimedia-based learning media which can increase the interest and sympathy of teachers and students towards the learning process (Saputra et al., 2022). Apart from that, Canva can help students understand the material better and motivate teachers to be more creative, and in the learning process using Canva increases students' interest in learning through interactive and interesting media (Ilham et al., 2023).

Student responses to learning using project-based e-modules on the utilization of local mango potential were measured using a four-point scale. There were 15 student response questionnaires on a scale of 1-4 that had to be answered by students after implementing learning using project-based e-modules

on the utilization of local mango potential. The statements contained in the student response questionnaires concerned the scope of the material, presentation of the e-module, language, and design.

In the learning process using project-based e-modules on the utilization of local mango potential, students provide responses related to the learning media they use. This response aims to determine how

influential a learning media is on the abilities being developed. In general, students have a positive perception of e-modules. Students provide positive perceptions of the e-modules used with an emphasis on clarity, usefulness, and ease of access (Satriani et al., 2024). Students show high self-confidence when using e-modules, which shows a positive impact on student academic satisfaction (Rahmawati et al., 2024).

Table 8 Percentage of student response results

No.	Assessment criteria	Percentage (%)	Interpretation
A. Coverage of material			
1.	The coverage of the material in the e-module is easy for me to understand.	86.72	Almost all respondents
2.	The content/material in this e-module can increase knowledge and insight.	80.08	Almost all respondents
3.	Additional material/information increases understanding regarding the utilization of local mango potential.	85.16	Almost all respondents
4.	This e-module is useful in helping learning besides textbooks.	81.25	Almost all respondents
B. Presentation			
5.	The material presented uses simple language so it is easy to understand.	88.67	Almost all respondents
6.	The presence of illustrations and images that help understand the biodiversity material	83.20	Almost all respondents
7.	E-modules provide students with motivation and creativity	91.02	Almost all respondents
C. Linguistics			
8.	Easy to understand explanation of terms	86.33	Almost all respondents
9.	The language used in the e-module is communicative so it is easy to understand	85.55	Almost all respondents
D. Design			
10.	Interesting cover display, images and writing	79.69	Almost all respondents
11.	The layout and font size in the e-module are attractive and quite easy to read.	83.20	Almost all respondents
12.	The appearance of each page attracts attention	81.64	Almost all respondents
13.	E-module is easy to access	81.64	Almost all respondents
14.	The balance of images and text is interesting and not boring to read.	81.25	Almost all respondents
15.	The overall appearance of the e-module is attractive and can increase student creativity.	82.81	Almost all respondents
Average value		83.88	Almost all respondents

Based on Table 8, overall student responses regarding the use of e-modules based on local potential utilization projects are very good, this is related to the average value of all student response results which is 83.88%, which means that almost all respondents said that e-modules based on local potential utilization projects can be used in learning. Digital learning media has proven to be effective in engaging students by adapting to students' learning styles and preferences. These digital tools encourage active learning and facilitate two-way communication between students and teachers, which improves the overall learning experience (Nurmalisa et al., 2023). The application of technology has also been received positively, as it makes learning more interesting and helps improve students' technological literacy. However, challenges such as reduced use of textbooks and potential eye fatigue due to long screen time have also been noted (Lu'Luilmaknun et al., 2021).

Based on student responses, the use of e-modules which are digital media can improve learning,

this media requires careful consideration of students' learning styles to maximize its effectiveness. Different types of media can elicit varying responses, and educators need to pay attention to these differences when designing learning experiences (Sengkey et al., 2019). In addition, students show high self-confidence when using e-modules, which shows a positive impact on student academic satisfaction (Rahmawati et al., 2024). Research conducted by (Dilekçi & Karatay, 2023) students' creative thinking skills can increase students' desire to learn, innovation skills, and creativity. According to Saeed & Ramdane (2022) the application of creative thinking models in educational institutions results in the development and improvement of creative thinking skills in high school students if used together with traditional teaching methods.

Based on the results of student responses about the use of project-based e-modules on the utilization of local mango potential in the diversity material to equip students with critical thinking skills, it can attract

students to be motivated to learn so that with the new learning media students will be enthusiastic in learning. Thus, this e-module equips students to be able to have creative thinking skills.

D. Conclusion

The use of project-based e-modules on the utilization of local mango potential on biodiversity material to equip high school students with creative thinking skills has the characteristics of e-modules that must be in accordance with the analysis of student and teacher needs, connecting the learning methods used with the expected achievements, having appropriate material coverage, interviews, displays, and language. Project-based e-modules utilizing local potential can equip students with creative thinking skills, namely by increasing students' creative thinking skills. The N-gain value from the results of the pretest and posttest of students' creative thinking skills is 0.56, which means that project-based e-modules utilizing local potential are quite effective in equipping students with creative abilities. Student responses to project-based e-modules utilizing local potential include student responses to material coverage, e-module presentation, language, and design, which is interpreted that almost all respondents said that e-modules based on local utilization are very good for equipping students with creative thinking skills. This study has implications as one of the references for the use of e-modules based on the local mango fruit potential utilization project to equip high school students with creative thinking skills and creativity. This study can equip students to have the skills needed now and, in the future, namely creative thinking skills and creativity. The creative thinking skills possessed by students are the basis for students to be able to create new ideas and ideas that can be applied in everyday life. Experiments in making creative products utilizing the potential of mango fruit are one way for students to find out what the local potentials of their area are that must be utilized properly and wisely. In addition, making creative products can encourage students' abilities to open up employment opportunities while maintaining the diversity they have.

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